

Assessment of Patients Learning Needs for Prevention of Diabetic Foot

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DOI: <https://doi.org/10.5281/zenodo.8036756>

Published Date: 14-June-2023

Abstract: Background: A diabetic foot is a foot that exhibits any pathology that results directly from diabetes mellitus or any long-term (or "chronic") complication of diabetes mellitus.

Significance of the Study:

In Saudi Arabia, Prevalence of diabetic ulcer is ranging from 2%-10%. High rate of lower limb amputation in DFD (More than 15%) and survival rate for undertaken amputation patient are short. Ninety diabetic amputations are performed monthly in Saudi Arabia capital of Riyadh. DFD and diabetic patients' awareness of DFD and how to take care of it will reduce the incidence of more complications like amputation.

Purpose of the Study:

The aim of this study is to assess the patient's learning needs for prevention of diabetic foot. This aim will be achieved through the following objectives: (1) To assess of the patient's knowledge for prevention of diabetic foot. (2) what are the factors affecting levels of knowledge of diabetic patients for prevention of diabetic foot?

Methodology: The research study design was a descriptive and exploratory study. The study was conducted in the diabetic outpatient clinic, Prince Sultan Medical Military City (PSMMC), Riyadh, Saudi Arabia. Convenience samplings, a total of 400 samples were collected for this study. Research tools: The semi-structured interview questionnaire is divided into two parts, Socio-demographic characteristics, and patient health history. A patient's self-assessment of knowledge.

Results And Conclusion: The overall score of knowledge about foot health significantly associated marital status, living arrangement, HbA1c and FBS.

Keywords: Diabetic foot ulcer, Knowledge about Diabetes, Severity of Diabetic Foot, Ulcer Based on Wagner's Classification, Neuropathy, Peripheral Vascular Disease.

1. INTRODUCTION

Foot health should be a major consideration for people with diabetes and for those who care for them. Foot complications in this high-risk population can lead to a cascade of negative complications, potentially resulting in loss of limb and life. The lifetime risk for foot ulceration in people with diabetes is 15 to 25%. According to the International Diabetes Federation, persons with diabetes are 15 to 40 times more likely to require lower-leg amputation compared to the general population. Approximately 85% of amputations are preceded by the development of a neuropathic foot ulcer. (Armstrong, Holtz-Neiderer et al. 2007). Following a lower-limb amputation, people with diabetes not only suffer the clinical and psychological consequences of limb loss, but also have a five-year mortality rate of 50%. This is a higher mortality rate than is seen in breast cancer in females, prostate cancer in males or lymphoma. Diabetic foot complications have also been reported to be the major contributing factors for mortality and morbidity among the diabetic population as a consequence

of substantial physical, physiological, and financial impacts of the disease for the patients and the community at large. It has been reported that 24.4% of the total healthcare expenditure in cases of DM is related to foot complications (Sargen, Hoffstad et al. 2013, Al-Ayed, Ababneh et al. 2018).

The International Diabetes Federation (IDF) MENA region (2017) reported that globally, 425 million people have been estimated to have diabetes, among which more than 39 million reside in the MENA region; by 2045, this number is anticipated to escalate to 67 million. The Kingdom of Saudi Arabia (KSA) is not exempt from this worldwide epidemic and diabetes is clearly recognized as the most daunting health issue it faces. The disturbing rise of diabetes in Saudi Arabia is referred to as an epidemic in many research works. (Al Dawish, Robert et al. 2016, Al Hayek, Robert et al. 2017, Alotaibi, Perry et al. 2017, Robert, Al-Dawish et al. 2018) Recently, the IDF also reported that there were 3.852.000 cases of diabetes in Saudi Arabia. It is well demonstrated that poorly managed diabetes leads to serious diabetes-related vascular complications, reduced quality of life and early death, (Gioacchini, Albera et al. 2018).

The Middle East and North Africa (MENA) have been projected to register the highest prevalence of diabetes, overall, in the wake of the meteoric rise in economic development, urbanization and lifestyle pattern changes in these regions. (Alotaibi, Perry et al. 2017).

Diabetes mellitus, besides disrupting the carbohydrate metabolism process, also induces vascular disease and impacts nearly all the types and sizes of blood vessels. In fact, vascular complications cause majority of the morbidity, hospitalizations, and mortality of patients with diabetes mellitus. Retinopathy, nephropathy, and neuropathy (microvascular complications) impact hundreds of millions of diabetics and normally target those having long-term or uncontrolled forms of the disease; however, these disorders can also exist at the time of diagnosis or in those yet to be diagnosed (Alwin Robert and Al Dawish 2019). These complications all contribute to an increased risk of foot ulcer, infection, delayed ulcer healing and amputation. However, in Saudi Arabia, the prevalence and risk factors of micro and macrovascular complications in patients with diabetes mellitus (DM) has not yet been clearly documented. There is sufficient evidence to show that individuals with DM are more susceptible to various types of short- and long-term impediments, which frequently result in early demise. (Aldukhayel 2017, Al-Rubeaan, Siddiqui et al. 2018).

Implementation of changes in lifestyle patterns, like maintaining a robust body weight, staying on a healthy diet, being physically active, avoiding smoking and consuming moderate amounts of alcohol can prevent the onset and complications of diabetes in many instances, (Bulum, Blaslov et al. 2016, Zheng, Ley et al. 2018).

Prevention is extremely important, but for the million people presently suffering from diabetic foot ulcer, paying attention to their disease is of utmost priority. To minimize diabetic foot complications in the diabetic population it is imperative to recognize high-risk individuals, contemplating efficient, evidence-based intrusions, develop nationally agreed clinical guidelines, upgrade the self-management, ameliorate affordable access to medicines and devices, provide knowledge regarding diabetes to the current generalist health workforce, and bring into effect diabetes safe preschool, school, and childcare (2009, Al Dawish, Robert et al. 2016, Al Hayek, Robert et al. 2017).

Significance of the Study

Diabetic foot disease (DFD) is diabetic patient's foot affection by ulcers, which are accompanied by peripheral vascular disease and/or diabetic neuropathy of the lower limb. Prevalence of diabetic ulcer is ranging from 2%-10%. High rate of lower limb amputation in DFD (More than 15%) and survival rate for undertaken amputation patient are short. Ninety diabetic amputations are performed monthly in Saudi Arabia capital of Riyadh. Identification of DFD and diabetic patient's awareness of DFD and how to take care of it will reduce the incidence of more complications like amputation. Diabetic foot ulceration is preventable, and the incidence of foot ulceration may be reduced through giving the right guidance about podiatric care (Ren et al., 2014). The ADA (2017) and the MOH (2013) emphasize the importance of having a continuous and comprehensive foot examination for people with diabetes at every visit. Adherence to self-care activities is important, as failure to adhere to self-care activities increases the risk of developing DFU.

Problem statement

In the diabetic foot, ulcer, and amputation result from a combination of risk factors coming together over time resulting in sequences called "causal pathways." The most common pathway to ulceration is deformity or neuropathy, minor trauma,

poor circulation and infection, gangrene, and amputation. Assessing the patient learning needs that supports the patient to take an active role in their foot care has been associated with improved outcomes in a wide variety of settings. Protecting the high-risk foot from injury is a primary objective in the high-risk patient. The patient learning needs as, foot inspection, nail care, footwear selection and utilization, environmental modifications to prevent minor foot trauma, knowing when and whom to call for problems.

Purpose of the Study

The aim of this study is to assess of the patient's learning needs for prevention of diabetic foot. This aim will be achieved through the following objective: To assess of the patient's knowledge for prevention of diabetic foot.

Research Questions:

1. Are the patients with diabetes mellitus having the adequate knowledge, for prevention of diabetic foot?
2. What are the factors affecting levels of knowledge of diabetic patients for prevention of diabetic foot?

Conceptual /Theoretical framework

Dorothea E. Orem's theories of self-care and self-care deficit were used as the theoretical framework of this study. The theory about self-care is based on the fact that every adult has more or less full capacity to act in order to maintain their health and treat themselves in case of sickness or injury (National encyklopedin, 2010). This capacity may vary depending on the individual knowledge, education, age, experience of life, economy, culture, and health status. The patient needs mental and practical skills and also education and motivation to be able to organize and perform their self-care. These skills can develop through instructions from health care professionals and also spontaneous by practicing self-care. The nursing goals are as far as possible to help the patient to become independent in his or her self-care. Nursing care is according to Dorothea needed when the patient is affected from limitations that do not allow them to practice or meet their self-care needs. These limitations can occur because of conditions, as for example diabetes. The care should be conducted in such way that the individual or his relatives can get help as far as possible to regain the patient's self-care capacity. Therefore, this theoretical framework was used to investigate if the patients had capacity to control their diabetes and maintain their health.

2. REVIEW OF LITERATURE

Diabetes with the coexistence of diabetic retinopathy and foot problems complicating diabetes not only represents a personal disaster, but also becomes a serious burden to public health in China. A foot self-care educational intervention is both cost-effective and feasible even in a health resource-limited setting, which should be developed and evaluated. The educational intervention can facilitate positive foot self-care behaviors among the diabetic retinopathy patients with visual disability and their primary caregivers in China (Li, Gu et al. 2019).

❖ Prevalence of diabetic foot ulcers

On the 10th of March 2009, Dr Abdulaziz Al-Gannass, a foot and ankle surgeon at the National Guard King Abdulaziz Medical City in Riyadh, KSA, reported that the AFP (Agence-France-Presse) news agency that the number of diabetes-linked amputations is rising quickly and beginning to occur at younger ages. He added that some 90 diabetic amputations are performed monthly, i.e., three per day were performed in the KSA capital of Riyadh. Further a study carried out to estimate the magnitude and pattern of foot lesions seen in diabetics living in Saudi Arabia.

Diabetic foot ulcer (DFU) is a major source of morbidity and a leading cause of hospitalization in patients with diabetes. (Kasiya, Mang'anda et al. 2017). These ulcers are usually in the areas of the foot which encounters repetitive trauma and pressure sensations. (Singer, Tassiopoulos et al. 2018) It is estimated that 50% of diabetes related hospital admissions are due to DFU and diabetes is the main cause of more than half of nontraumatic lower limb amputations DFU can lead to infection, gangrene, amputation, and even death, if necessary, care is not provided. Overall, the rate of lower limb amputation in patients with DM is 15 times higher than patients without diabetes. It is estimated that approximately 50%–70% of all lower limb amputations are due to DFU. In addition, it is reported that every 30 seconds one leg is amputated due to DFU worldwide and it goes without saying that these amputations increase mortality rate (Yazdanpanah and Shahbazian 2018).

About 15–25% of patients with diabetes may develop foot ulcer during their lifetime (Yazdanpanah and Shahbazian 2018). The annual risk of developing diabetic foot ulcer in patients with diabetes is estimated to be about 2%, but this risk in patients with previous history of foot ulceration is expected to increase to 17–60% over the next three years (Yazdanpanah and Shahbazian 2018). The prevalence of diabetic foot ulcer is reported to be 1.3–12% in different studies (Dubsky, Jirkovska et al. 2013).

The prevalence of active foot ulceration varies between developed and developing countries depending on the definitions of lower limb lesions used, the population studied, and the health care system and settings (Apelqvist and Larsson 2000). In most European countries, the prevalence of diabetic foot ulcers, reported from community-based studies, ranges from approximately 1.0% to more than 4.0% (Kumar, Ashe et al. 1994, Abbott, Carrington et al. 2002). Whereas in developing countries the prevalence is as high as 11.0% in some nations of the African horn, studies from Arab countries showed a varying prevalence of diabetic foot ulcers ranging between 5.0% in Jordan to 11.9% in Algeria (Benotmane, Mohammedi et al. 2000, Jbour, Jarrah et al. 2003). DFD causes approximately 40-60% of all non-traumatic lower extremity amputations and, in some regions in the USA, the percentage is as high as 70-90%. The age-adjusted annual incidence of diabetes-related lower limb amputations varies markedly between geographical areas and ethnic groups, ranging from 2.1 to 13.7 per 1000 persons with diabetes (Sambamoorthi, Tseng et al. 2006).

A study reported that the annual incidence of diabetic foot ulcer worldwide is between 9.1 to 26.1 million, (Armstrong, Boulton et al. 2017) Furthermore, DFU is responsible for substantial emotional and physical distress as well as productivity and financial losses that lower the quality of life. In the USA it was calculated that DFU accounted for \$38.7 billion of health expenditure in 2007, (Boulton, Vileikyte et al. 2005).

❖ The risk factors of diabetic foot ulcers

The risk factors associated with foot ulcers in patients with type 2 diabetes mellitus (T2DM). A total of 81 T2DM patients (age range: 40-80 years) registered at the Diabetes Treatment Center, Prince Sultan Military Medical City (PSMMC), Riyadh, Saudi Arabia between April and September 2015 were included in this cross-sectional study after purposive selection and assigning of patient numbers. The most common footwear reported to be used by the patients was sandals shoes (46%). The issues of loss of protective sensation, vascular insufficiency, deformity, previous amputations, and dermatological abnormalities of the lower limbs were found to be most common among the foot ulceration patients. The study findings thus recommend regular foot examination, following of basic hygiene habits, encouragement of the use of appropriate footwear, patient education about foot ulcers, and prompt treatment for minor injuries to prevent further ulceration in DM patients (Al-Ayed, Ababneh et al. 2018).

The prevalence and risk factors for diabetic foot infection (DFI), and to identify factors associated with delayed wound healing of diabetic foot ulcer (DFU). The median healing time for patients with DFUs was three months. There were six variables identified as significantly associated with prolonged healing time of DFU, namely presence of infection ($p < 0.001$), poor glycaemic control with fasting blood glucose ≥ 7 mmol/l ($p < 0.001$), high blood pressure $\geq 140/90$ mmHg ($p < 0.001$), large DFU size ≥ 2 cm² ($p < 0.001$), history of amputation ($p < 0.005$) and plantar location of the DFU ($p < 0.05$). In conclusion a large DFU size, poor glycaemic and blood pressure control are common risk factors for both DFU and DFI. Unexpected high prevalence and ethnicity risk factor for DFI urge more comprehensive primary and secondary preventative strategies to reduce its incidence (Kee, Nair et al. 2019).

The factors associated with diabetic foot (DF) among T2DM patients are identifying the extent of this problem and the associated factors will enable the health providers to imply early preventive measurements. In univariate analysis, older age, long duration of diabetes and poor glycemic control reflected in high levels of HbA1c were significant factors associated with DF. The current results could highlight the importance of epidemiological studies to raise the awareness of this important health care problem around the country (Fawzy, Alshammari et al. 2019).

The prevalence of diabetic foot ulcers (DFU) and its association with age, gender, duration of diabetes, peripheral neuropathy (PN), peripheral arterial disease (PAD) and HbA1c. Body weight, height, body mass index (BMI), HbA1c and duration of diabetes were recorded. The prevalence of DFU was 7.02%, of which 4.5% of the ulcers were on the planter and 2.6% on the dorsal surface of the foot; 8.5% of the persons had bilateral foot ulcers and 0.4% subjects had Charcot deformity. There was significant association of foot ulcers with age, duration of diabetes, HbA1c, PN and PAD, whereas

no association was observed with gender and BMI. Peripheral neuropathy is the commonest cause of foot ulcers. An optimum control of blood glucose to prevent neuropathy and regular feet examination of every person with diabetes may go a long way in preventing foot ulceration (Younis, Shahid et al. 2018).

The risk factors of major lower extremity amputations in type 2 diabetic patients referred for hospital care with diabetic foot syndrome. The following predictors were found to be associated with the higher incidence of major lower limb amputations: duration of diabetes ≥ 15 years, HbA1c $\geq 8\%$, patients on insulin, with hypertension, cardiac diseases, chronic renal impairment, stroke, having gangrene, higher number of components, higher Wagner classification, and ischemia. However, the rate did not differ significantly between men and women. Presentation with gangrenous tissue and poor glycemic control are the important risks and significant predictive factors for type 2 diabetes-related major lower limb amputations (Shatnawi, Al-Zoubi et al. 2018).

The risks of diabetic patients getting DFU were estimated through a hospital-based survey. This survey collected information from hospitalized diabetic patients in Wuhan City, Hubei Province, China, using a questionnaire. The findings of this study can potentially be utilized to develop an early DFU diagnostic method in diabetic patients and can provide objective evidence for suggesting that patients who are suffering from foot problems should seek professional help (Zhong, Li et al. 2017). The prevalence of DFU and its associated risk factors in Sudanese individuals with diabetes study reported that living with diabetes for more than 5 years had a non-significant adjusted effect on diabetic foot probability. Prevalence of diabetic foot ulcer was 18.1% and the risk of development of diabetic foot ulcer is increased with duration of diabetes more than 10 years (Almobarak, Awadalla et al. 2017).

The prevalence of diabetic foot disease by utilizing the retinal eye screening registers in the Waikato region of New Zealand. Understanding both the prevalence and the degree of foot disease across the general diabetes population will help to determine what podiatry services are required for people with diabetes. Factors identified as significant included age, type of diabetes, duration of diabetes, and smoking. These factors placed people at greater risk of diabetic foot disease. A significant number of people with diabetes are at risk of diabetic foot disease. This study has highlighted the need for targeted podiatry services to address diabetic foot disease (O'Shea, McClintock et al. 2017).

A sociodemographic and clinical characterization of patients with diabetic foot ulcer indicated for amputation surgery. This cross-sectional study with 206 patients with type 2 diabetes and a diabetic foot ulcer indicated for amputation surgery. Given that the neuropathic ulcers are more easily preventable, systematic monitoring of patients with neuropathy is important. In patients with neuroischemic foot, strategies to cope or manage more efficiently the pain are paramount. Intervention should be multidisciplinary and take into account sociodemographic and clinical factors, as well as the presence, intensity and interference of pain in the patient's daily life activities and whether the patient has family or caregiver support (Pedras, Carvalho et al. 2016).

Peripheral vascular disease (PVD) is an important prejudiced cause towards development of foot ulcers in about 50% of cases. It accounts for 70% death in Type 2 diabetes (Noor, Zubair et al. 2015).

❖ The characteristics of diabetic foot ulcer

The clinical and microbiological profile of diabetic foot ulcer patients admitted to a tertiary care hospital. Diabetic foot ulcer patient had poor blood glucose control with elevated HbA1C and fasting blood glucose level. Neuropathy and peripheral vascular disease, hypertension were major complications. Staphylococcus aureus, Pseudomonas aeruginosa were common infecting bacteria (Kateel, Augustine et al. 2018)

The incidence of diabetic foot ulceration, days to heal, healing rate and the risk factors influencing healing are in accordance with other multidisciplinary facilities with podiatry input (Messenger, Masoetsa et al. 2018). A study performed by Khalifa (2018). Demographic, diabetes related, comorbid and ulcer related variables were investigated as risk factors. The frequency rate of recurrent diabetic foot ulceration in patients with type 2 diabetes is high particularly in the first year despite regular follow-up and patient education.

The differences in diabetes patients with or without DFS stratified by type 1 (T1D) or type 2 diabetes (T2D). To compare HbA1C, neuropathy, nephropathy, cardiovascular disease risk factors, and macrovascular complications between patients with or without DFS, regression models were conducted. One third of the patients with DFS had an amputation of the lower

extremity. Especially neuropathy or peripheral vascular disease was more prevalent in patients with DFS. New concepts to prevent DFS-induced amputations and to reduce cardiovascular risk factors before the occurrence of DFS are necessary (Bohn, Grunerbel et al. 2018).

On a study was designed to assess the knowledge of the warning signs of diabetic foot ulcer deterioration and to determine the knowledge of these warning signs among patients with a history of diabetic foot ulcers. A cross-sectional study design was used. More than 30% of the participants were unaware of the warning signs of peripheral vascular insufficiency and severe infection. Of the participants, 75.8% felt that the time to seek medical treatment of diabetic foot ulcers was when they experienced wound deterioration. Those who held this opinion had significantly less knowledge regarding the warning signs of diabetic foot ulcer deterioration than did those who had not. Other factors that were significantly associated with less knowledge included being older, having less education, not having an existing foot ulcer, having no foot ulcer treatment history, and never having received education regarding foot ulcers. Patient education regarding the importance of timely treatment seeking and warning signs should be promoted (Chin, Yeh et al. 2018).

The predominance of monomicrobial growth and Gram-negative organisms in diabetic foot patients. With increase in the severity of DFI, there was increased rate of hospital readmissions, amputations (major and minor), and mortality. Dimensions of ulcer may have a bearing on rate of minor amputations (Seth, Attri et al. 2019).

The risk factors for major amputation in diabetic foot patients were bony invasions, dialysis, GI disorders, hind foot locations, low levels of haemoglobin and elevated fasting blood sugar levels (Namgoong, Jung et al. 2016).

Diabetic foot burn patients delay seeking medical attention, have a longer length of stay, more complications and more amputations than other burn patients (compared with our previous study on burn patients). Prevention and training programs are highly needed to prevent foot burns (Momeni, Jafarian et al. 2018).

The prevalence of risk factors observed in patients with diabetes without foot ulcers and to explore possible connections between the risk factors and high plantar pressure. Several potential risk factors for the onset of diabetic foot ulcers (DFU), Hallux valgus and hallux rigidus appeared to increase the PP under the medial forefoot and a high BMI appeared to increase the PP under the lateral forefoot. There is a need to construct a simple, valid, and reliable assessment routine to detect potential risk factors for the onset of DFU, (Tang, Zugner et al. 2015).

Foot ulcers are more likely to present on the plantar surface of the foot and largely affect overweight older males with a long standing history diabetes in our outpatient hospital in Western Sydney (Haji Zaine, Burns et al. 2014). Identification of relationship between diabetic foot and diabetes risk factors in appropriate groups may help clinicians to focus on certain factors in diabetic foot prevention (Nehring, Mrozikiewicz-Rakowska et al. 2014).

The risk factors and clinical biomarkers of prevalent diabetes foot complications, including foot ulcers, gangrene, and amputations among patients with diabetes in Jeddah, Saudi Arabia. Longer diabetes duration, insulin use, lower hemoglobin levels and non-Saudi nationality were associated with higher prevalence of foot complications. These associations were largely explained by the presence of DPN and PAD except for non-Saudi nationality. Diabetes patients with both DPN and PAD had nearly 10-fold increased risk of foot complications than those with neither condition (Hu, Bakhotmah et al. 2014).

❖ The effect of diabetic foot ulcers on the patients

The clinical characteristic of patients with diabetic foot ulcer treated in a Multidisciplinary Diabetic Foot Unit (MDFU) and analyzes the mortality and factors associated with its survival. Patients with diabetic foot ulcer are characterized by high morbidity and mortality, with cardiovascular disease being the most frequent cause of death. It is necessary to pay more attention to this risk group, tailoring objectives and treatments to their situation and life expectancy (Rubio, Jimenez et al. 2017).

The overall amputation rates and risk factors for amputation in patients with DFW are wound state according to Wagner classification, congestive heart failure, leukocytosis, dementia, and PAOD were the significant risk factors for major amputation. In DFW with PAOD, Wagner classification grades and leukocytosis were the predictors for major amputation. Only the presence of osteomyelitis (OM) showed significant difference for amputation in DFU. Systemic factors, such as CHF, leukocytosis, and dementia were identified as risk factors for major amputation. In terms of DFU, 38.4% underwent amputation and the presence of OM was a determinant for amputation (Kim, Kim et al. 2018).

The impact of diabetes mellitus (DM) on foot ulcer admissions in the United States, and to investigate potential explanations for rising hospital costs. Diabetes increases the incidence of foot ulcer admissions by 11-fold, accounting for more than 80% of all amputations and increasing hospital costs more than 10-fold over the 5 years. The majority of these costs are related to the treatment of infected foot ulcers. Education initiatives and early prevention strategies through outpatient multidisciplinary care targeted at high-risk populations are essential to preventing further increases in what is already a substantial economic burden (Hicks, Selvarajah et al. 2016).

Furthermore, the progression of DM to diabetic peripheral neuropathy is one of the critical complications of diabetic foot ulcers with serious social, psychological, and financial consequences that negatively affect the quality of life in diabetic patients (Armstrong, Holtz-Neiderer et al. 2007). The notable risk factors for foot ulcer include the male gender, smoking habits, long duration of suffering from diabetes, peripheral neuropathy, foot deformity, Peripheral Vascular Disease (PVD), history of prior ulcers or amputation, poor glycemic control, genetic and nutritional factors, diabetic retinopathy, and nephropathy; of these, the most important factor is peripheral neuropathy (Boulton, Armstrong et al. 2008).

DFU treatment is expensive. On an average, the treatment cost for wounds with Wagner grade I in five industrialized countries was \$3096 in 2010. However, if the wound becomes complicated and amputated, the cost will rise to almost \$107900 (Hunt, Liu et al. 2011, Iraj, Khorvash et al. 2013). Therefore, based on the noble quote in health care profession "prevention is better than the treatment of the disease," Diabetic patients and health care providers to diabetic patients should familiarize themselves with the principals of diabetic foot ulcer prevention. All the diabetic patients should undergo comprehensive foot exam once a year. The goal of this examination is to determine the risk factors that may result in foot ulcer and consequently amputation of the affected organ. The physical examination contains observation, palpation of the pulses in the lower extremities, including the posterior tibial and dorsalis pedis pulses. The physical examination also includes neurological tests. At least two neurologic tests are performed and one of the tests should measure the protective sensation in which a 10 g monofilament is used. Vibration sensation using a 128 Hz diapason, Pinprick sensation, ankle reflex and position are other neurologic test performed in comprehensive foot exam (Collier, Dowie et al. 2011, Iraj, Khorvash et al. 2013).

3. METHODOLOGY

Research Design

This research study design was a descriptive and exploratory study.

Setting

The study was conducted in the diabetic outpatient clinic, Prince Sultan Medical Military City (PSMMC), Riyadh, Saudi Arabia.

Study Population and Sampling

The research study is a convenience sampling, a non-probability/non-random sampling technique used for this study. In carrying out the study, the respondents were selected consciously and carefully, followed by the appellations of the selected suitable patients with specific identification numbers. Sample size is calculated using Cochran's formula, upon consultation of statistician, with confidence level of 95% and margin of error = 0.05. A total of 400 samples were collected for this study.

Inclusion Criteria: Adult patients above 18 years old who agreed to participate in the research study from both sex and patients with diabetes mellitus were included in this study.

Exclusion Criteria: The exclusion criterion was a history of major psychiatric disease, dementia, neurological disorders, immunocompromised patients, trauma and a history of foot surgery and refusal to sign the consent form or incapable of understanding the instructions necessary to carry out the present study.

Research Tools:

1. The semi-structured interview questionnaire is divided into 2 parts:

- Socio-demographic characteristics included age, gender, education, work status, and marital status, etc.

- Patient health history included past medical and surgical history and current health history includes recent health issues and treatment plans, etc.

2. Self-assessment of knowledge/practice

A structured questionnaire was used to collect the past history of condition foot, current patients self-assessment for condition of foot, kind of shoes wear, kind of socks wear, patient self-care practice, patients soak feet, test water temperature before putting foot in use medicated products for warts, corns or calluses, put moisturizing creams or lotions between toes, walk around in bare feet, wear shoes without wearing any socks, always inspect shoes for foreign objects or torn linings, use a hot water bottle or heating pad on feet, sit with legs crossed, smoking history, attended class on how to care for feet, read any handouts on foot care, read any handouts on proper footwear and like of a handout on how to care for your feet.

3. Biochemical measurement

The HbA1c test was the most appropriate measure of glycemic control and diagnostic test for diabetes. HbA1c < 7% was considered a good control value (ADA standards of medical care in diabetes). Readings were collected from the patients' records which are analyzed in the central lab at PSMC (COBAS INTEGRA 400 plus/800 analyzers). Total cholesterol level registers at 5.2 mmol/L and above consider as hypercholesterolemia and fasting blood glucose is greater than 6.1 mmol/L considered as high blood sugar level. Other biochemical parameters creatinine, RBC, albumin, hemoglobin, platelets, WBC, and urea were also collected from patient's medical report.

Data Collection Methods

The data was collected using self-Administer questionnaires, with verbal general questionnaire instructions. All the patients are interviewed were in the diabetic outpatient clinic, Prince Sultan Medical Military City (PSMMC), Riyadh, Saudi Arabia. They were interviewed in the waiting area with a self-administered questionnaire with me being available on the study site to answer all questions or clarifications. Also, read the questionnaires to persons with low education level or low vision and for those who were fatigued in order to ensure understanding. Additionally, the researcher offered to read the questionnaire to participants if they preferred. The researcher informed the participants to take breaks if they feel tired and encouraged them to ask questions if they did not understand the questionnaire items. The researcher responded to any questions the participants had about the questionnaires to ensure that the participants understood all of the questionnaire items. Patients with reading or writing difficulties were helped by the researcher.

Statistical Analysis

Data analysis was carried out using Microsoft Excel 2010 (Microsoft Corporation, Seattle, WA, United States) and Statistical Package for Social Sciences version 22 (SPSS Inc., Chicago, IL, United States). In addition to the descriptive analysis, independent t test (for continuous variables) were also performed to identify variables associated awareness and knowledge. Continuous variables are represented as mean values \pm SD, while categorical variables are expressed as frequencies and percentages. A P-value of < 0.05 was considered as statistically significant.

Ethical Consideration

- This study was conducted in accordance with the 1975 Declaration of Helsinki, as revised in 2000, and the protocol of this study was approved by the research ethics committee of Prince Sultan Military Medical City, Riyadh, Saudi Arabia.
- An approval of King Saud university, college of nursing, an ethical approval for research proposal and tools for data collection was obtained.
- Prior to the commencement of the study, the participants or their caregivers were instructed, regarding their roles in this study, as well as the signed informed consent was obtained from them.
 - The participation of patients will be voluntary, and the patients have the right to withdraw from the study at any time without affecting their rights.
 - All answers on the questionnaire will be kept and maintained confidential and for the purpose of the current study only.
 - No harm or conflict will affect the patients.

Compliance with Ethics Guidelines

This study was conducted in accordance with the 1975 Declaration of Helsinki, as revised in 2000, and the protocol of this study was approved by the research ethics committee of Prince Sultan Military Medical City, Riyadh, Saudi Arabia.

Measurements

At enrollment, patients were interviewed about general health, demographic characteristics.

A single trained examiner performed a standardized clinical examination on all participants who first measured height; weight with the patients barefoot and wearing light clothing, Calculation of the BMI was done by dividing the weight in kilograms by the square of the height in meters.

4. RESULTS

The study has highlighted the gaps in the knowledge of foot care in diabetes patients and underscores the need for an educational program to reduce of diabetic foot complication. The patients' demographic data, patients as regards to medical history, results of clinical and biochemical parameter, patient self-assessment of knowledge of their feet is presented in the results section.

The results of this research study are divided into 2 parts:

- Part (I) The diabetic patient's socio-demographic, medical history, and adherence for medication
- Part (II) Diabetic patient self-assessment of knowledge/practice to their feet.

Part (I) The diabetic patient's socio-demographic, medical history and adherence for medication

(1) Percentage distributions of the diabetic patient's socio-demographic characteristics as regards to age, marital status, and educational level

(2) Percentage distributions of patients as regards to diabetic medical history and adherence for medication

Table 1: Percentage distributions of the diabetic patient's socio-demographic characteristics as regards to age, marital status, and educational level

Parameter	n=400	(%)
Age –(Years)		
• 18-39	133	33.2
• 40-59	115	28.8
• ≥ 60	152	38
Gender		
• Male	186	46.5
• Female	214	53.5
Marital Status		
• Single	96	24
• Married	288	72
• Widowed/divorced	16	4
Education Level^[1]		
• Illiterate/Primary	83	20.8
• Intermediate/Secondary	265	66.2
• University	50	12.5
• Postgraduate	2	0.5
Body mass index		
• < 18.5 (Underweight)	8	2
• 18.5–24.9 (Normal weight)	75	18.8
• 25.0–29.9 (Overweight)	135	33.7
• 30.0–34.9 (Class I obesity)	182	45.5
Living arrangement		
• Alone	10	2.5

<ul style="list-style-type: none"> Family 	390	97.5
Employment status		
<ul style="list-style-type: none"> Yes No 	106 294	26.5 73.5
Income / Salary		
<ul style="list-style-type: none"> Enough expenses for treatment and family Insufficient for treatment and family 	247 153	61.7 38.3
Smoking		
<ul style="list-style-type: none"> Yes-(Cigarette,shisha,beib,Other), No 	59 341	14.7 85.3
Family who is a smoker		
<ul style="list-style-type: none"> Yes no 	126 274	31.5 68.5

Table (1) shows that more than one third (38%) of the patients were in the age group ≥ 60 years, one third (the percentage distributions of the diabetic patient's socio-demographic characteristics as regards to age, marital status, and educational level. Majority of the study population (38%) were under the age group of ≥ 60 followed by 18-39 (33. %) years and 40-59 (28.8%) years. More than half of the patient (53.5%) were female and while male (46.5%). Near to the three quarter of the patients were married (72%) followed by singles (24%) and widows (4%). Regarding the education level, approximately two third (66.2%) were completed intermediate/secondary education, followed by illiterate/primary (20.8%) university (12.5%) and postgraduate (0.5%). The patient body mass index were represented as the following. Less than half of the patients (45.5%) were class I obese, followed by overweight (33.7%) and (18.8%) were having normal BMI.

The majority of the patients (97.5%) were living with family and only (2.5%) patients living alone. Approximately 3 quarter of the patients (73.5%) were not employed and (26.5%) were employed. As regards to the diabetic patient income, (61.7%) reported have enough income for treatment expenses, while (38.3%) reported that they have insufficient funds for treatment.

Table (2): Percentage distributions of patients as regards to diabetic medical history and adherence for medication

Items	No.	(%)
Types of diabetes		
<ul style="list-style-type: none"> Type 1 Type 2 	136 264	34 66
Patient History of :		
<ul style="list-style-type: none"> an amputation of a toe, foot, or leg <ul style="list-style-type: none"> Yes No 	0 400	0 100
<ul style="list-style-type: none"> a sore or cut on foot or leg that took more than two weeks to heal <ul style="list-style-type: none"> Yes No 	128 272	32 68
<ul style="list-style-type: none"> a foot ulcer <ul style="list-style-type: none"> Yes No 	93 307	23.2 67.8
<ul style="list-style-type: none"> Patient history of pervious hospital admission <ul style="list-style-type: none"> Yes No 	390 10	97.5 2.5
<ul style="list-style-type: none"> Patient adherence to current mediation <ul style="list-style-type: none"> Yes No 	91 309	22.7 77.3
<ul style="list-style-type: none"> Patient adherence to regular medical follow up <ul style="list-style-type: none"> Yes No 	302 98	75.5 24.5

Table (2) shows that approximately two third of the patient (66%) were type 2 and (34%) type 1 diabetes. Near to one third of the patient (32%) reported that they had a sore or cut on foot or leg that took more than two weeks to heal. Less than one quarter of the patient (23.2%) reported that they had foot ulcer and among them none of the patient had an amputation of a toe, foot, or leg.

More than three quarters of the patients (77.3%) not adherence to current mediation, and (24.5 %) not adherence to regular medical follow up (24.5%). Approximately all the patients (97.5%) had a history of pervious hospital admission.

Part (II) Diabetic patient self-assessment of knowledge/practice to their foots.

(3) Percentage distributions of diabetic patient self-assessment of knowledge/practice to their foots

(4) Percentage distributions of diabetic patient self-care practice of to their foots

Table (3): Percentage distributions of diabetic patient self-assessment of knowledge/practice to their foots.

Presence of	Yes		No	
	N	%	n	%
• An ulcer, sore, or blister	81	20.2	319	79.8
• Blood or discharge on your socks	83	20.7	317	79.3
• Any calluses on your feet	143	35.7	257	64.3
• Any numbness, tingling, pins and needles, or itching sensation	157	39.2	243	60.8
• Any tightness, heaviness, pain, or cramps in your feet or legs	125	31.2	275	68.8
Kind of shoes wear				
• Pointed toes	192	48	309	77.2
• Broad, round toes	20	5	208	52
• High heels	39	9.8	380	95
• Sandals	4	1	361	90.2
• Flip flops/thongs	50	12.5	396	99
• Athletic/sneakers/runners	0	0	350	87.5
• Shoes made of leather or canvas	2	0.5	400	100
• Special/custom shoes	2	0.5	398	99.5
• Shoes with adjustable laces, buckles or Velcro	192	48	398	99.5
kind of socks wear				
• Cotton	267	66.8	133	33.2
• Wool	4	1	396	99
• Acrylic/synthetic	34	8.5	366	91.5
• Knee highs	2	0.5	398	99.5
• Elastic-free tops	0	0	400	100
• Seamless socks	80	20	320	80
• Nylons/pantyhose	1	0.3	399	99.7
• "Diabetes" socks	0	0	400	100
• Prescription/compression	12	3	388	97

Table (4): Percentage distributions of diabetic patient self-care practice of to their foots.

Patient self care practice:	Yes		No	
	n	%	n	%
• Can reach and see the bottoms of feet	268	67	132	(33)
• Examine his/her feet				
➤ No				
➤ Yes, (How often?)				
▪ Every day	101	25.3	299	74.7
▪ Once a week or less	121	30.3	279	69.7
▪ 2-6 times a week	20	5	380	95
▪ When I have a problem	158	39.5	242	60.5

• Wash feet every day	299	74.8	101	25.3
• Dry well between the toes	263	65.8	137	34.3
• Use a moisturizing cream on feet	263	65.8	137	34.3
• Cut his/her own toenails				
➤ Yes	275	68.8	125	27.5
➤ No	125	31.3		68.7
• Soak your feet	265	66.3	135	33.8
• Always test water temperature before putting foot in	274	68.5	126	31.5
• Use medicated products for warts, corns or calluses	118	29.5	282	70.5
• Put moisturizing creams or lotions between toes	258	64.5	142	35.5
• Walk around in bare feet	147	36.8	253	63.3
• Wear shoes without wearing any socks	186	46.5	214	53.5
• Always inspect your shoes for foreign objects or torn linings	208	52	192	48
• Use a hot water bottle or heating pad on your feet	95	23.8	305	76.3
• Sit with your legs crossed?	168	42	232	58
• Do you smoke?	43	10.8	357	89.3
• Attended a class on how to care for feet	78	19.5	322	80.5
• Read any handouts on foot care	81	20.3	319	79.8
• Read any handouts on proper footwear	80	20	320	80
• Would you like a handout on how to care for your feet?	225	56.3	175	43.8

Table (4) shows the diabetic patient self-assessment of knowledge/practice of their feet. On the subject of the patients self-assessment for condition of foot today, a total of (20.2%) patients reported that they had an ulcer, sore, or blister, (20.7%) reported that they had blood or discharge on your socks, (35.7%) reported that they had calluses on feet, (39.2%) reported that they had any kind of numbness, tingling, pins and needles, or itching sensation and (31.2%) reported that they had any tightness, heaviness, pain, or cramps in your feet or legs.

With reference to the kind of shoes wear, (22.8%) patients reported that they used pointed toes, followed by broad, round toes (48%), high heels (5%), sandals (9.8%) flip flops/thongs (1%), athletic/sneakers/runners (12.5%), special/custom shoes (0.5%) and Shoes with adjustable laces, buckles, or Velcro (0.5%). With regard to the kind of socks s wear, a total of (66.8%) patients reported that they used cotton socks, followed by wool (1%), acrylic/synthetic (8%), knee highs (0.5), seamless socks (20%), nylons/pantyhose (0.3%) and prescription/compression (3%).

Regarding patient self-care practice 268 patients reported that they can reach and see the bottoms of feet, (25.3%) examine their feet every day, (30.3%) examine once a week or less, (5%) examine their feet by 2-6 times a week and patients reported that they examine their feet every day. A total of (74.8%) reported that they wash their feet every day, (65.8%) dry well between the toes, 263 (65.8%) reported that they use a moisturizing cream on feet (68.8%) reported that they cut their own toenails.

A (66.3%) patients reported that they soak their feet, (68.5%) reported always test water temperature before putting foot in, (29.5%) use medicated products for warts, corns or calluses, (64.5%) put moisturizing creams or lotions between toes, (36.8%) walk around in bare feet, (46.5%) wear shoes without wearing any socks, (52%) always inspect your shoes for foreign objects or torn linings, (23.8%) use a hot water bottle or heating pad on your feet, (42%) sit with their legs crossed, (10.8%) smoker. In addition, (19.5%) attended a class on how to care for feet, (20.3%) read any handouts on foot care, (20%) read any handouts on proper footwear, and (56.3%) reported that they like a handout on how to care for your feet.

5. DISCUSSION

Foot ulcers are more likely to be of neuropathic origin, and therefore eminently preventable, in developing countries, which will experience the greatest rise in the prevalence of type 2 diabetes in the next 20 years (Al Dawish et al., 2016; Boulton, Vileikyte, Ragnarson-Tennvall, & Apelqvist, 2005; Robert & Al Dawish, 2019). Diabetic foot problems are common throughout the world, resulting in major economic consequences for the patients, their families, and society (Xia et al., 2019).

Diabetic foot is one of the most debilitating and expensive complications of diabetes. While simple preventative foot care measures can reduce the risk of lower limb ulcerations and subsequent amputations by up to 85%, they are not always implemented (Al-Busaidi, Abdulhadi, & Coppel, 2016).

Diabetic patient Demographic characteristics

The present finding reported that more than half of the study populations were female and the rest of the patient male. A recent systematic review and meta-analysis found that that global DFUs prevalence was (6.3%), which was higher in males than in females (3.5%), and higher in type 2 diabetic patients (6.4%) than in type 1 diabetics (5.5%).

In the current study we found that almost approximately two third of the diabetic patients were completed intermediate/secondary education, one fifth was illiterate/primary more than one tenth have university level of education. A study reported that illiteracy invoked significant challenges to diabetic attentiveness and imposed increased foot complications (Al-Kaabi, Al Maskari, Cragg, Afandi, & Souid, 2015).

A cross-sectional study was conducted in King Khalid University Hospital, King Abdulaziz University Hospital, King Fahad Medical City, National Guard Hospital, Military Hospital, and Prince Salman Hospital, Saudi Arabia stated that the majority of patients were less educated and patients are unaware of the risk factors for diabetes foot and practice poor foot care (Al Odhayani et al., 2017). An Indian study reported that only 12.5% had received previous foot care advice from healthcare professionals and among the study population, almost one-quarter of patients were uneducated (Kishore, Upadhyay, & V, 2015).

In the present study we found that less than of the diabetic patient were class I obese and one third were overweight and less than one fifth had a normal BMI. Similar research results a South African study (Goie & Naidoo, 2016) recorded that 91% of DFU participants were either overweight or obese. (Goie & Naidoo, 2016).

Diabetic patients past history of foot condition:

In the present study we found that the past history of condition foot, approximately one third of the patients reported that they had a sore or cut on foot or leg that took more than two weeks to heal. Regarding having foot ulcer the present study reported that about less than one quarter of the patient had foot ulcer and among them none of the patient had an amputation of a toe, foot, or leg. Also the patients self assessment for condition of foot today, the current study stated that one fifth of patients reported that they had an ulcer, sore, or blister or they had blood or discharge on your socks, and more than one third reported that they had calluses on feet, and another more than one third reported that they had any numbness, tingling, pins and needles, or itching sensation and one third reported that they did not had any tightness, heaviness, pain, or cramps in their feet or legs.

A study reported that chronic wounds, including pressure sores, leg ulcers, DFUs and other kinds of wounds, healing by secondary intention are common in both acute and community settings (O'Meara, Cullum, Majid, & Sheldon, 2000).

Diabetic patient self care knowledge and practice towards foot care

• The kind of shoes and socks wear

In results of the present study, less than one quarter of the patients reported that the kind of shoes wear used is pointed toes, and less than half of the patients wear high heels shoes and about one tens wear flip flops/thongs, or special/custom Also, regarding the kind of socks s wear, we found that approximately two third of the patients reported that they used cotton socks, and one fifth wear seamless socks and less than tenth wear a different of types as wool, acrylic/synthetic, knee highs, nylons/pantyhose and prescription/compression.

Previous studies confirmed that correct footwear fitting is acknowledged as being vitally important, as incorrectly fitted footwear has been linked to foot pathology (Buldt & Menz, 2018). A recent study also concluded that large proportion of the population wear incorrectly sized footwear, which is associated with foot pain and foot disorders. They further stated that greater emphasis should be placed on both footwear fitting education and the provision of an appropriately large selection of shoes that can accommodate the variation in foot morphology among the population, particularly in relation to foot width (Buldt & Menz, 2018). To support the perception a previous study also stated that the use of specially designed shoes is effective in preventing relapses in diabetic patients with previous ulceration (Uccioli et al., 1995).

- **Patient self care practice**

In the present study, regarding patient self care practice, approximately two third of the patients reported that they can reach and see the bottoms of feet, and one quarter examine their feet every day, near to one third examine once a week or less, and more than one third reported that they examine their feet every day. Further we also found that a total of three quarter of the patients reported that they wash their feet every day, and about two third of the diabetic patients dry well between the toes, they use a moisturizing cream on feet and reported that they cut their own toenails.

Moreover support to the above findings, by a study stated that after healing of a foot ulcer, the risk of recurrence is high. For the prevention of a recurrent foot ulcer, home monitoring of foot temperature, pressure-relieving therapeutic footwear, and certain surgical interventions prove to be effective (Bus & van Netten, 2016). It should be noted here that a study from Saudi Arabia reported that majority (71.7%) of patients received foot examinations every 6–12 months and 4% received an examination every 2 years, while 3.7% had not received an examination in more than 2 years. Half (50.3%) of the subjects were aware and knowledgeable about diabetes disease foot care. Further, they indicated that 42.6% will take regular care of their feet, 28.9% will find proper fitting footwear, and 28.3% will monitor their feet for minor injuries (Al Odhayani et al., 2017).

In the present study reported that less than half of the patients reported that their skin has no intact, less than one third reported that their skin were dry with fungus or light callus. Heavy callus buildups were found in less than one fifth and less than one tens reported that they had ulceration or history of previous ulcer.

Previous studies also reported that skin issues are common among the DFU patients (Mahmoud, Mohamed, Mahdi, & Ahmed, 2008). Also, studies reported that the risk of developing a foot ulcer is significantly increased when a patient presents with a callus. Callus develops due to various reasons, of which, the most important in people with diabetes is peripheral neuropathy. Motor neuropathy leads to deformity and sensory neuropathy causes lack of sensation, which results in persistent abnormal pressure on the foot. The cells of skin react to it by increasing keratinization and turns into a callus, which predisposes to foot ulceration (Arosi, Hiner, & Rajbhandari, 2016).

Earlier studies reported that DFU are typically caused by repetitive stresses (shear and pressure) on the foot in the presence of the diabetes-related complications of peripheral neuropathy or peripheral artery disease, and their healing is often complicated by the development of infection (Crawford et al., 2015; Monteiro-Soares, Boyko, Ribeiro, Ribeiro, & Dinis-Ribeiro, 2012; Schaper, Van Netten, Apelqvist, Lipsky, & Bakker, 2016; Waaijman et al., 2014). Use of inappropriate footwear or walking barefoot typically increases the magnitude of the local mechanical repetitive stresses on the foot that are leading causes of the development of DFU (Crawford et al., 2015; Monteiro-Soares et al., 2012; Schaper et al., 2016; Waaijman et al., 2014).

Thus, it is recommended that people with diabetes wear appropriate footwear designed to reduce repetitive stresses at all times, to help prevent DFU (Bus, Armstrong, et al., 2016; Bus, van Netten, et al., 2016). Loss of protective plantar foot sensation is the major cause of DFU and ultimate limb loss. Identification of patients without protective sensation can reduce the risk of unrecognized foot injury.

In this present study, subdomin attitudinal beliefs significantly associated with living arrangement and smoker and FBS. A previous study found that active smokers had a much lower mean age at amputation compared with non-smokers, and smoking cessation improved amputation-free survival in diabetes patients (Xia et al., 2019). There is a marked correlation between the level of the patient understand of the disease and the development of the foot lesions.

Although appropriate control of type 2 diabetes can potentially reduce the prevalence of DFUs, there is scarcity of literature that has quantified the correlation between fasting blood glucose levels and the risk of the development of DFUs, (Navicharern, 2012).

The DFU, that usually fail to heal, and leading to lower limb amputation. Early effective management of DFU as follows: education, blood sugar control, wound debridement, advanced dressing, offloading, advance therapies and in some cases surgery, can reduce the severity of complications, and also can improve overall quality of life of patients especially by using a multidisciplinary team approach (Yazdanpanah et al., 2015).

6. CONCLUSION

The finding of this present research study were concluded that:

In conclusion, the present study found that higher age, low education, living alone, higher BMI, smoking were the most common risk factor for DFU. Majority of the study population possess uncontrolled diabetes and hypercholesterolemia. Hence, this study has highlighted the gaps in the knowledge of foot care in DM patients and underscores the need for an educational program to reduce of diabetic foot complication for Saudi population.

7. RECOMMENDATIONS

The research study is recommended that patients with diabetes should have a detailed annual foot examination; those having risk factors for poor outcome require more frequent foot care, patient education, and early referral to tertiary care centers. It is important for diabetic patients to have at least a yearly review of foot ulcer risk factors, and they should have a corresponding risk classification agreed based on this assessment. It is important that the treatment of DFUs should be part of a comprehensive care plan that should also include treatment of infection, frequent debridement, biomechanical offloading, blood glucose control and treatment of comorbidities. As DFUs represents the sum of multiple etiologies, its treatment requires a multidisciplinary team, which can result in a significant reduction in the incidence of ulcers, infections, and amputations. The team should include a diabetologist, a podiatrist, an orthoptist, an educator, and a plaster technician, in close collaboration with a vascular surgeon, an orthopedic/podiatric surgeon and a dermatologist.

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 Vol. 10, Issue 2, pp: (88-106), Month: May - August 2023, Available at: www.noveltyjournals.com

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