

Foot Care Awareness Among Patients with Type 2 Diabetes in Primary Health Care of Muscat Governorate: A Survey Based Cross Sectional Study

Bushra N. Al Rashdi¹, Asiya M. Al Zadjali², Khulood G. Al Rashdi³,
Thuriya M. Al Harthi⁴

¹Registered Nurse, Directorate of Nursing, Directorate General of Health Services- Muscat

²Senior Specialist Nurse B, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak

³Senior Staff Nurse, Directorate of Nursing, Directorate General of Health Services- Muscat

⁴Epidemiologist, Directorate of Training and Research, Directorate General of Health Services- Muscat

Abstract

Background: People with type 2 diabetes are at increased risk for neuropathy and peripheral artery disease, leading to lower extremity disease. Emphasizing the importance of foot care to people with type 2 diabetes and encouraging self-care is a cost-effective approach to further prevent morbidity and mortality from amputation and disability.

Aim: to explore knowledge, practice, and attitude towards foot care among patients with type 2 diabetes who follow up in primary health care in Muscat Governorate.

Method: A cross-sectional survey of (500) patients diagnosed with type 2 diabetes in primary care centers in Muscat governorate were included. A validated self-administered questionnaire was used to measure level of knowledge, practice, and attitude. Those who were not able to self-fill in the questionnaire were excluded. Knowledge about preventive measures for loss of sensation and ulcers were examined. Patients' practice and attitude towards foot care and hygiene was evaluated. Descriptive analysis and chi square test were performed using STATA software.

Results: The response rate was 75% (375/500). 216 (57.50%) of patients were females and mean age was 53 (13.1). Most patients knew that diabetes reduces the flow of blood to the lower extremities, 265 (70.67%) and that compliance to hypoglycemic treatment prevents complication, 368 (98.13%). However, a considerable proportion did not know that diabetes reduces blood flow 92 (24.53%), 102 (27.20%) did not know that smoking restricts blood flow to the feet, and 29 (7.73%) disagreed with this fact. 335 (89.33%) avoid walking bare feet and 328 (87.47%) dry their feet after washing. Educational level and occupation were linked to awareness with p-value 0.004 and 0.000, respectively.

Key words: Knowledge, Practice, self-foot care, diabetes foot ulcer in Oman, Assess the knowledge and practice of patients with type II Diabetes with foot ulcer.

1. Introduction & Background

Diabetes, is a multi-system and multi-organ illness is currently regarded to be a wide spread illness affecting both developing as well as developed countries. It is a long term metabolic illness with increased blood sugar level. In the recent past years, it has been causing impairment to heart, kidneys, eyes and nerves (Saeedi et al 2019). Adult onset disease is a general type of diabetes among adults. About 422 million people in the world are affected with this illness and most of them live in low- and middle-income countries. Diabetes is the chief reason for illness and deaths (Verma et al, 2021). As stated by Saeedi et al, (2019), the incidence of Diabetes is increasing worldwide in 2019, it was predicted that 463 million adults were living with the disease. By 2030, it is estimated that 587 million people may get affected with Diabetes by 2030 and 700 million by 2045.

Diabetes is a life endangering disease which causes life endangering complications and also many complications arise from long term diabetes illness such as Hypertension, kidney damage, blindness, nerve defects and foot complications. Among the various complications, diabetic foot is one of the commonest and devastating micro vascular complication. There are many factors predisposes to diabetic foot syndrome which include outer sensual nerve damage, deficiency of patient's understanding about foot care, inappropriate foot wear, and diabetes that is not controlled (Verma et al,2021). Lower limb amputation (LLA) is one of the most stressful complication of Diabetic Foot Ulcer (DFU). Almost, 85% of the lower extremity limb removal give rise to DFU. The treatment and care of DFU and LEA needs long duration of hospitalization and increased cost (Verma et al, 2021)

Diabetic foot ulcers (DFUs) are skin lesions found on the feet that have been demonstrated to have harmful effects on progression of illness and quality of life for patients with type 2 diabetes (T2D). A study conducted by Nather et al (2018) stated that a substantial percentage of non- traumatic lower limb removals experienced by those with diabetes can be recognized to DFUs. The end results of DFUs lengthen beyond patient's health, and remain as a burden on healthcare systems. Explicitly, it is estimated that one third of the costs of DFUs is associated with amputations (Jodheea – Jutton 2022). In resource- limited countries for advanced healthcare, the shattering outcomes of DFUs may be more. A cross sectional study done in Ethiopia by Letta et al (2022) exemplifies that 13% of Ethiopian individuals with diabetes have foot ulcers, and that 30.4% of patients admitted to a healthcare facility in Ethiopia had undergone amputations. Nevertheless, these statistical data may not be the exact presentation of the existing problem as there may be many patients who are not diagnosed or they are not under medical care (Tolossa et al, 2020).

Personal care practices play a vital role in meticulously managing T2D and its related complications. Ahmad & Joshi (2023) defines self and personal care in diabetes as an innovative alteration in the development of education or being evaluated by studying to continue alive with diabetes. Diligent examinations have illustrated the efficacy of complying with specific elements of diabetic self –care (Degefa et al, 2020) and daily foot care practice is the prime of most of many other components. DFU is one of the simple and less expensive self-care component which is proved to be effective and if it is implemented appropriately it prevents complications.in preventing complications (Tuha et al, 2020). In low income countries and resource limited countries, self-care facilities may be very much limited and therefore, suitable preventive strategies need to be developed in these countries.

The level of patient's awareness about their long term illness and the possible dangers arising out of illness will enlighten them about the importance of adherence to self-care activities. The patient should be aware about the disease and its complications, so that it will help him to monitor the progress of the illness. By thoroughly knowing about the disease will enable him to actively participate in self-care.

1.1.Problem statement

Diabetes mellitus (DM) is a severe life- intimidating illness. It is characterized by insistently increased blood glucose levels. Foot ulcer is one of the most distressing complications that is commonly seen in patients with type II diabetes mellitus. Diabetic foot occurs as a result of many factors, containing blood vessel and nerve injury, due to increased blood glucose levels. These foot complications can be avoided through daily care of the foot (Saeedi et al, 2019). Patients' good understanding of foot care and willingness to practice it are considered essential factors that help avoid serious complications (Altoijri et al, 2021). Many people with diabetes do not know the importance of foot care and the complication of foot lesions. Due to this gap in knowledge, patients were at high risk for lesions and ulcers that frequently progress to amputations. Therefore, the investigator, felt an urgent need to assess the foot care awareness among patients with Type II diabetes mellitus, who attend the primary

1.2.Purpose Statement

The purpose of the study is designed to describe the level of awareness of Type II diabetic patients attending primary health center in Muscat governorate in the Sultanate of Oman, so that the knowledge deficit can be bridged. Furthermore, they will be able to identify their foot problems early and take the immediate measures to correct the problems and prevent different foot-related problems.

1.3.Primary research question

To which extent diabetic type 2 patients have awareness, knowledge, attitude and practicing foot care?

1.4.Secondary question: Determine factors associated with poor knowledge including Socio demographic characteristics of patients.

1.5.The main scientific hypothesis.

Awareness of diabetic foot care is poor among patients with type 2 diabetes in Muscat governorate primary care.

1.6.Aim of the study

The purpose of this study is to explore the knowledge and practice about foot care among diabetic patients type 2 in two health centers at wilayat Bousher.

1.7.Main objectives

1. Explore the knowledge regarding foot-care among diabetic patients type 2 in PHC.
2. Assess the diabetic patients practice about foot care in PHC.

1.8.Secondary objective: Determine factors associated with poor knowledge in patients with diabetes

1.9.Theoretical framework

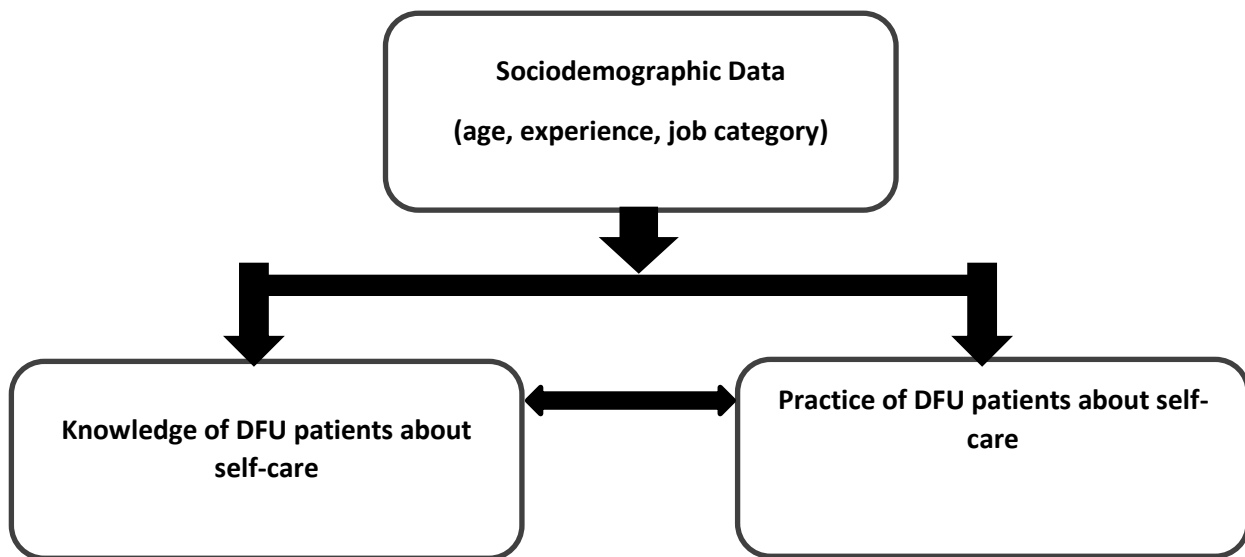
The viewpoint of health promotion and disease prevention will serve as the basis for this study. Nevertheless, many theories and models reinforce the practice of disease prevention and health promotion. The most appropriate theory for this study is the Knowledge, Attitude, and Practice (KAP) theory, which was developed by Kelman initiated in 2001 with the introduction of compulsory schooling in China (Shacho et al., 2024). This theory focus on the relationship between the three vital components which are knowledge (known), attitudes (believed), and practices (carried out) (Shacho et al., 2024). Moreover, the KAP theory was used to break down the procedure of changing human behavior into three stages: gaining knowledge, developing attitudes and beliefs, and building practices and behaviors (Wong et al., 2020). It is also possible to successfully alter human health behaviors during these stages. Theoretically, the hypothesis of KAP theory stresses that a deficit in knowledge influences patient's behaviors towards his illness (Wong et al., 2020). Subsequently, the KAP theory provides a direction for patients to strictly follow the foot care regularly. Therefore, it is essential to analyze the status of knowledge about proper

foot care among Type II DFU patients to examine the non-compliance and to determine the action that should be taken to implement foot care protocols and procedures in primary health center of the Muscat governorate.

1.10. Conceptual Framework

The research will only utilize the knowledge and practice component of the theory, the attitude component will omit as it will affect the visibility of the study. Research is performed on the management of biomedical waste. The conceptual framework of the study is designed and mentioned below.

Figure 1: Conceptual Framework



1.11. Conceptual definitions

Diabetic foot ulcers (DFUs) are skin lesions found on the feet that have been demonstrated to have harmful effects on progression of illness and quality of life for patients with type 2 diabetes (T2D).

Diabetes self-care: it is defined as an evolutionary, sustainable process of knowledge development in chronic medical conditions like Diabetes Mellitus.

Knowledge: Knowledge is expertise, cognizance, or understanding of objects like information, descriptions, facts, or expertise that are attained by learning or experience (Dictionary C., 2023b).

Practice: Defined as the intentional and recurrent application of abilities, behaviors, or knowledge to become an expert or master in a specific field or activity. It is important to change practices which are a key motivator to being change. It entails actively.

1.12. Significance of the study

This research will be used to subsidize upcoming recommendations for improving patient's self-care skills and knowledge with national diabetes guidelines and protocol. Therefore, this study will support in improving the quality of health care among diabetes patients and enhance foot care. Additionally, it will highlight the breaches between patients' practice whether in line with the national guidelines. All these points will support the improvement of the guidelines and methods to minimize foot infections. This study findings will help patients to follow evidence-based recommendations to prevent any infections.

2. Literature Review

This chapter outlines the literature review regarding the self-foot care of Diabetes type II. The purpose of

this detailed literature is to identify the gaps associated to the status of knowledge and practice and to what extent the knowledge and practice of self-foot care among diabetic patients are consistent with the study purpose. Hence, it will consists of the search strategy, evaluation of identified literature, and literature review related to key variables and concepts.

A literature review is an examination of theoretical writings and contextual knowledge about specific areas in background. The landscape of the review depends on critical development. Moreover, it is the procedure of carefully analyzing a huge quantity of studious information based on certain research questions or hypotheses.

2.2.Literature Search Strategy

Based on the analysis and viewing of selected articles, the themes that we figured out our knowledge, attitude, and practice of standard precaution among healthcare workers, availability of resources, and demographic factors that affect compliance toward standard precaution.

In order to ensure thorough coverage of relevant studies, the researcher employed a structured literature search technique for completion of research on foot care awareness among patients with type II diabetes in primary health care in Muscat Governorate. The researcher outlined the study question around the effects of patients with diabetes foot ulcer and self-foot care. Using Boolean operators to efficiently combine phrases, the researcher searched databases such as Scopus, Web of Science, PubMed, and CINAHL. Findings were further refined by employing filters for language, publication date, and study type. Furthermore, the researcher arranged the chosen papers using reference management software, performed full-text reviews after screening the titles and abstracts for relevance. This method allowed for a solid blending of results by reviewing existing practices and breaches in self-care among type II diabetes patients.

In the search strategy, valid, authentic databases and search engines were used, such as Cochrane Library, PubMed, CINAHL, iMedPub, and MOH Library. Moreover, websites of public health agencies and international organizations such as the World Health Organization (WHO), International Diabetes Federation (IDF), The American Diabetes Association (ADA) and nationally The Oman Diabetes Association (ODA) -Table 1- .

Table 1: Databases

Literature Search Databases			
	Databases	Search terms	Number of articles
1	PubMed	Self-care of	7
2	Cochrane Library	Diabetes Foot	1
3	CINAHL	Ulcer,	1
4	iMedPub	‘knowledge, and	1
5	MOH library	practice of type II Diabetes patients of self-care of foot ulcers	2

Additionally, Google Scholar has been used to find more articles and utilized them as secondary references. These databases were extremely reliable and recommended for easy searching and free access. The terms used for the search were “assess the knowledge and practice about diabetes foot ulcer self-

care”.

2.3. Inclusion and exclusion criteria

After the search process through different databases, about 45 studies were found appropriate and relevant to the topic. These studies went through a filtering process for inclusion and exclusion criteria. After applying inclusion and exclusion criteria, 12 studies were chosen. Each study evaluated the level of awareness about diabetes foot ulcer self-care and related barriers were included. Furthermore, articles in the English language highlighting diabetes patient’s awareness to self-care studies that were applied in primary health care clinics and at homes, and full-text articles within five years of age were the inclusion criteria of the search. On the other hand, all studies published before five years, studies among medical or nursing students, non-English languages, studies that did not conducted in the hospital, quantitative studies, and review-based studies such as systematic reviews of the articles were considered as the criteria for exclusion.

Finally, 12 studies were selected after searching different databases and applying appropriate tools according to the type of study. All 12 studies had credible and reliable results that were very significant, applicable to the population of type II diabetes patients and relevant to the research purpose.

After careful viewing of selected articles, themes were identified that were reflecting the knowledge and practice of diabetes foot ulcer self-care among type II diabetic patients, the availability of resources, and demographic factors that affected compliance to self-care management.

Analyzing these studies aims to alleviate information overload, ascertain the most suitable papers, and perceive their views, assumptions, false reporting, and beliefs from the evidence to define their validity.

2.4. Appraisal of identified literature

The appraisal of literature on DFU self-care management and patients’ focusing on studies published since 2019, features several key intuitions. Recent studies highlight the vital role of type II patient’s self-care management in minimizing /preventing infections and complications. ElKashif et al (2021) conducted a quasi-experimental study to evaluate the effect of developing guidelines for self-care practice of diabetic foot patients according to their needs, concerns, and medication use. in a comparison between pre and post intervention among 100 adult patients who were known diabetes type II for six months, the post intervention patients foot care knowledge and self-care practice scores were higher. The study suggests that developing protocol for self-care practice will enhance patient’s understanding about the disease and thus will prevent DFUs and foot amputation.

Another systemic review and meta-analysis were done by Ahmad & Joshi (2023) to highlight the significance of self-care practices and their role in controlling diabetes mellitus and preventing the complications associated with it. The analysis of selected articles revealed that self-care practices reduce complications, decrease further development of the disease and reduce any chronic side effects and complications.

To enhance patient awareness about self-care among patients with type II diabetes and to address on the gaps identified in recent literature, primary health care clinics should execute comprehensive, regular training programs for patients having type II Diabetes is imperative in primary health care clinics. The training programme of self-care should comprise of assessment of sugar levels in the blood, taking healthy foods, being physically active, taking medications regularly and on time, maintaining healthy behavior, and mitigating risk factors. These measures are vital for improving safety, reducing dangers and safeguarding the efficacy of Diabetes self-care practices among patients.

2.5. Overview of self-care practices of type II diabetes.

Diabetes mellitus (DM) is a long-standing, continuously growing metabolic ailment in which levels of glucose in the blood increase due to a total (DM of type 1) or incomplete (DM of type 2) decrease in the level of the hormone insulin. enacts a considerable burden on public health organizations worldwide, with its existence increasing from 463 million adults in 2019 to 700 million by 2045 (International Diabetes Federation, 2019). The requirements of people suffering from diabetes are not only confined to the control of blood glucose; there is also a need to prevent disabilities, side effects, and difficulties in rehabilitation. Self-care practice by diabetic people is key to achieving therapeutic goals. They involve set of behaviours such as healthy eating, being physically active, regular monitoring of blood sugar levels, good problem-solving skills, healthy coping skills, and risk-reduction behaviours. These are called self-care practices, defined as behaviours are undertaken by people with or at risk of diabetes to successfully manage the disease independently (Chittooru et al, 2022).

Self and personal care in this illness has been defined as an innovative change in the development of education. Self-management support is one of the fundamental components to improve the care of patients. Admitted diabetic patients in the hospital requires meticulous care delivery. In addition, diabetes and self-care management knowledge and behaviour must be assessed on admission and diabetes self-care management education and training should be offered whenever possible. Training about diabetic self-care must comprise medication dosing and administration, glucose monitoring, recognition and treatment of hypoglycemia (American Diabetes Association, (ADA), 2019). An ideal care of diabetic foot enquires an interdisciplinary team to attain the set goal objectives in treating diabetes and its complications (Yewande & Suliat, 2017).

Self-care practices includes intentional methods to take care of physical, emotional, and mental health. Any patient with a chronic illness may experience effects on their general health and their day to day life style changes in their choices and behaviors, which is the best part of personal self-care. These practices include varied things that need to be considered such as medicines, exercise, food, sleep, feelings, medical facilities, and care. The American Diabetes Association (ADA) mentions that keeping an eye on the intake of carbohydrates and fiber, experiencing weight loss, and minimizing the intake of lipids, saturated fat, trans fat, and salt are the fundamental things that need to be done for the management of this disease. As stated by Ahmed & Joshi (2023) patients also require additional practices to assess individual and social things for the improvement of the treatment of diabetes mellitus. Stoutness is one of the major concerns for individuals suffering from diabetes mellitus type 2. Dietary changes are the key factor in dealing with diabetes mellitus since they can lead to weight loss and finally help in the management of obesity, which further helps in the involvement of diabetes mellitus. According to the study done by Chittooru et al (2022) for the treatment of adolescent patients suffering from type 2 diabetes mellitus, has emphasized dietary control along with physical activities and alterations in the behaviour. The results from these studies suggests poor and doubtful results with respect to the impact of food on managing the end result, but autonomous results of diet modification were not counted. Personal care with physical activity is an interior part of managing this disease and helping with the movement of skeletal muscles (Ahmad & Joshi 2023). The aim of physical activities is to attain regulation blood sugar level regulation, improve the action of insulin, improve the metabolism of protein and fat, and avoid complications of diabetes, and increase life quality and expectancy. Adequate physical activities lead to lower levels of HbA1c. The only condition included is that it should be unified with counselling about diet. The present generations should know the necessities and importance of regular body activities, which helps them burn calories, reduce weight, and

maintain blood sugar levels. Additionally, the combined changes in diet and daily body exercises helps in harmonizing normal weight and increasing weight loss in individuals with stoutness.

2.6. Importance of Self-care management education for diabetes

Diabetes self-management education is necessary to improve patient outcomes and reduce diabetes-related complications. Patient focused diabetes self-care management training play an important part in decreasing the diabetes-associated problems by allowing the person with diabetes to manage the illness effectively and to enhance their eminence of life (Burke et al., 2014). Nevertheless, for providing general knowledge of diabetes care, it is vital to assimilate both the treatment and the education as per the needs of the individual (Newton et al., 2019).

Diabetes education could effectively improve the level of self-management, and glucose control in patients with diabetes mellitus (Zheng et al., 2019). Teaching related to diabetes is vital and it should be instructed through self-care activities for the betterment of individuals. Self-care includes activities related to diet control, increasing physical activities, avoiding high content fatty food, checking blood sugar level periodically and taking care of your feet. One of the main aim of self-care management is to reduce the level of glycosylated hemoglobin in blood. Certain alterations in personal care should be revised for progress and the development of a behavior change (Muhoma et al, 2020).

The individuals with diabetes need to undertake a plan and follow it strictly. The increasing occurrence of diabetes every year demonstrates the need to evaluate patients' learning requirements (Al Haik et al, 2019). The evaluation of learning needs is very important in producing reliable information about the gaps in patient's knowledge. Researches done by Kassahun et al & Muchiri et al (2016) reveals that that knowledge about diabetic medications, diet, exercise, glucose monitoring, and foot care is necessary to effectively self-care diabetes. Therefore, diabetes education is imperative to enhance knowledge on diabetes and meticulous self-care practices for a quality of life. In a cross sectional study done by Al haik et al (2019) to assess the level of diabetes self-care knowledge among 273 patients, it was found their knowledge was in the moderate level and there were many of the learning needs for each area of knowledge. Moreover, having adequate knowledge will help the patient to prevent complications. Therefore, it is obligatory for the healthcare professionals to develop appropriate educational programme for diabetes patients based on the learning needs of the patients and their characteristics.

2.7. Barriers associated with self-care of diabetes

Diabetes mellitus necessities a range of self-care practices, scientifically recommended to control the glycemic level and maintain the patient's health. However, there are many observed barriers that interrupt patients from fully implementing the diabetes self-care practices and obstacle (Letta et al,2021).In a qualitative exploratory study conducted by Letta et al(2021) among health care providers, it was identified that barriers to self-care practices are at system level, health care provider level and patient level. They were lack of organized diabetes care services, limited collaborative care practices and observed lack of knowledge on self-care practices. Furthermore, some of the prominent barriers were lack of multidisciplinary team care, lack of training of health care providers on diabetes self-care practices and availability of laboratory tests and diabetes medications.

Another qualitative exploratory study done by Adhikari (2021) identified more barriers for self-care management by patients. It includes lack of knowledge about diabetes self-management practices, cultural practices, insufficient counselling, lack of guidelines and protocols for counselling, lack of motivation from family members, peers and doctors and unavailability of resources in the community.

The above mentioned evidences suggest that the identified barriers could be overcome by implementing multifaceted educational strategies to raise the awareness among diabetes patients for executing self-care.

2.8. Recommendations

Some of the programmatic recommendations include, Firstly, building patient's knowledge and developing their skills will enable them to comply with and maintain recommended self-care practices (ADA, 2020). Moreover, programmes should be established with an emphasis to improve self-efficacy of the people with diabetes to comply with management recommendations. Individuals and families under financial difficulties and those who lack family support should be given special focus during design of future interventions..

Secondly, the health care providers must be fully knowledgeable to educate and counsel people with diabetes on diabetes self-management practices (ADA, 2020). Thirdly, understanding of issues for managing diabetes self-management from multiple actors is supreme as well as engaging multidisciplinary team for diabetes care and management. Fourthly, the low level health care workers must be provided with diabetes self-care management education. The community awareness programme must be arranged among general population to increase their knowledge.

Finally, self-help support groups can be introduced to provide counselling in diabetes self-management practices and emotional support to people with diabetes. Diabetes type II patients' crucial involvement in self-care management is covered in this research review. This emphasizes the significance of information and practice in self-care management in diabetes. The literature investigated studies from national and international countries to explain the knowledge awareness which is found only at the moderate level.

All studies targeted interventions and training. The acquired knowledge provides a solid foundation for the intended investigation in Oman, emphasizing the need for localized, longitudinal, and mixed-methods research on diabetes self-care management. The literature review provided background knowledge that is helpful to move forward to the next phase of the project to attain the aim of this study. The next chapter will focus on the methodology, which includes research design, population, sampling, sampling procedures, operational definition, instrumentation, data analysis, management, and ethical consideration.

3. Methodology

3.1. Introduction

This section is about the research design, and the ways and means by which information has been collected from the participants. The chapter covers the research methodology and different research techniques that are required to perform a quantitative study, such as methodology, research design, method, population, sampling technique and size, data collection tool, validity and reliability of instrument, data analysis plan, and ethical procedures.

3.2. Research Design and rationale

The study is based on primary research. It is a quantitative descriptive approach and a survey study design that will be used to evaluate the extent of knowledge and practices of Diabetic patients, type II, and to examine its association with socio- demographic data (age, gender, Educational level, occupation) in eight health centers at Muscat government. Survey design is one of the most common types of healthcare epidemiology research used for the study (Robb & Shellenbarger, 2020). Furthermore, characteristically, it is a more straightforward design to conduct with less budget than many other study designs. Also, it can be used for learning about the beliefs and behaviors of large groups of people. They can be either descriptive or used to test associations (Robb & Shellenbarger, 2020). According to the study purpose of

this proposal, the variables will be evaluated through a self-administrated questionnaire. Moreover, to collect the data, a cross-sectional descriptive research design will be used. A cross-sectional study gathers data from many sources at a single time, while a descriptive design helps to perceive and measure the variables. For the study, the variables are needed to be evaluated and therefore descriptive design is the most desirable choice because the data as an outcome will be generated in statistical form and the results can also be used for further studies (Doyle et al., 2019).

This approach was used to explore if there is a need for improvement with diabetic foot ulcer prevention practices of primary care providers for high risk patients. Descriptive studies yield data that simply describes situation and events. Descriptive statistics describes information and helps to simplify quantitative research findings by combining the data using percentages and averages, and can be useful in summarizing data set (Polit & Beck, 2012). Descriptive studies uses simple statistics such as central tendency – the mean, mode and median to describe data which helps in the understanding of quantitative research and are especially helpful in displaying practical information and describing information about the study sample (Polit & Beck, 2012).

3.3 Setting, Population, Sampling Technique and Sampling Procedure

The population in this study is composed of all diabetic patients type two who come for consultation and treatment in primary health care in Muscat. Patients will be randomly selected from diabetic clinic in health center in order to give equal chance for all study participants.

The research is related to the valuation of the knowledge and practice of self-care among type II Diabetic patients from eight selected health centers in Muscat governorate. All the patients diagnosed with type II diabetes patients who come for treatment and management to these eight health centers will be considered as study's population. The population is chosen randomly due to time and financial constraints.

The study was quantitative in nature. A systematic random sampling technique was used to select the participants per center. We determined the number of diabetic patients in each health center included in this study and then calculated the proportion of diabetic patients from the total number of diabetic patients in these centers. The study sample was distributed among the health centers based on the calculated proportion. The sample from each health center was then divided by the total diabetic patients to determine the patient sequence during participant selection.

Therefore, the sample frame will list all samples according to the staff number required for the randomization technique. Furthermore, inclusion criteria for sampling selection will involve patients with type II diabetes, both male and female with an age over 18 years, participants must be able to write and read and be able to fill in the questionnaire and the participants live in Muscat. On the other hand, the exclusion criteria for participants not to be included in the study comprises that patients with mental disease or dementia who face difficulties in communication.

3.4. Proposed sample size

The sample size was calculated to be 500 with relative precision (%) of 20, expected proportion of knowledge is 0.32, with desired confidence level (1-alpha) % of 95. A systematic sampling was used to randomly allocate the study participant per center. The researcher determined the number of diabetic patients in each health center included in this study and then calculated the proportion of diabetic patients from the total number of diabetic patients in these centers. The study sample was distributed among the health centers based on the calculated proportion. The sample from each health center was then divided by the total diabetic patients to determine the patient sequence during participant selection.

The inclusion and exclusion criteria are mainly used in cases of secondary based research. The inclusion criteria organize the population in a reliable, consistent, constant, and unbiased way. Despite the current quantitative research, the inclusion criteria of sampling cover all the patients diagnosed with type II diabetes registered in primary health clinics. The exclusion criteria comprises patients with mental disease or dementia who face difficulties in communication.

3.5. Operational Definitions of Study Variables/Constructs

The operational definition defines the concise and clear detail of a measure. Operational definitions of the elements are mentioned below:

Knowledge: Knowledge is defined as how much the patients with type II Diabetes are acquainted with the implication of adherence to self-care guidelines to protect themselves and prevent complications. It will be measured by the respondent's reply to the questionnaire through multiple choice questions (Knowledge, 2023).

Practice: Practice is the compliance of diabetic patients (the participants of the study) adhering to follow the guidelines and protocols of self-care policy that specified for known, diabetic patients type II who are registered in the clinics of the Muscat governorate.

Attitude: "It is an important factor in self-care practice for patients with diabetes II and is associated positively with preventive behaviors" (Abalkhail et al., 2021).

3.6. Data collection instrument

All eligible patients, after written informed consent, were administered a questionnaire by the principal investigator which had 16 self-administered agree, disagree and I don't know, questions regarding knowledge of foot care, attitude, and awareness of methods used to screen for foot problems and whether such methods are practiced by them. Nottingham Assessment of Functional Foot Care Revised 2015 questionnaire was administered

For the validity and reliability of the tool, several measures will be applied. Validity refers to how well the instrument measures the elements that it is intended to measure (Oktavia et al., 2018). Face and content validity will be performed by giving the tool to experts from field to assess the content of the tool and the extent of the tool to measure and meet the required aim. Expert feedback was used to adjust the tool if any. Then, the questionnaire was piloted with 15 subjects of the targeted sample to examine the feasibility and content clarity. Other than validity, reliability is an important aspect in quantitative instruments. Reliability refers to the same results from the instruments if the test is repeated. To perform the reliability test, the coefficient values for the excellent internal consistency should be ≥ 0.90 , while between 0.6-0.9 are considered good (Oktavia et al., 2018). Response was analyzed using the Cronbach's alpha coefficient the result was 78% which is mean its good .

3.7. Ethical consideration

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval for this study was obtained from the Research and Ethical Review and Approval Committee of the Directorate General of Health Services (DGHS), Muscat Governorate, Oman (Approval No.: MH/DGHS/DPT/87/2022).

Permission to conduct the study at the selected primary health centers in Muscat Governorate was obtained from the Directorate General of Health Services after ethical approval was granted.

All participants received a study information sheet explaining the purpose, procedures, and significance of the study. Written informed consent was obtained from all participants prior to their participation.

Participants were informed that their participation was voluntary and that they had the right to withdraw from the study at any time without any consequences.

All questionnaires were anonymized to ensure participant confidentiality. The collected data were securely stored and accessible only to the research team and were used solely for research purposes.

3.8. Threat to validity

Validity covers the concepts being investigated, the subjects being looked at, the procedures used to get the data, the conclusions drawn, and the degree to which data and outcomes accurately represent reality. Several validity threats make it difficult for the researcher to say that the independent variable influences the dependent variable confidently.

An internal validity threat that might occur in this study is mortality. Therefore, the researcher can recruit a large sample to account for dropouts or compare those who drop out with those who continue regarding the outcome. Furthermore, participants can be selected due to certain characteristics predisposing them to have specific outcomes. To overcome this threat, the researcher can select participants randomly so that characteristics have the probability of being equally distributed among the experimental groups.

On the other hand, the external validity threat in this study appears in conducting the study in all primary care centers in Muscat Governorate which can lead to difficulty in the finding being generalized. Moreover, using only a survey to study the impact of variables might be another external threat to the validity of the proposed research. To overcome this threat, the researcher can use interviews with participants and surveys to get more accurate results.

Statistical Analysis of the data

The data were collected and double-entered, validated, and analyzed using EpiData version 3.1 for entry and version 2.2.2.182 for analysis (EpiData Association, Odense, Denmark). Data were analyzed using descriptive statistics such as mean and standard deviation for the continuous variables and for the categorical variables, frequencies, and percentages. The knowledge score was calculated and summary measure was reported. The decision of choosing independent t-test, Mann–Whitney U-test, or Kruskal–Wallis test is done on the basis of the assumption of normality which was assessed by plotting QQ plot and histogram along with the Shapiro–Wilk test of significance for normality. Then, this knowledge score was categorized (scores: 8 high) groups). The data were entered in EpiData version 3.1 (EpiData Association Odense, Denmark) and were analyzed using R software. Pearson’s Chi-square test or Fisher’s exact test was used to test the categorical data to evaluate if the relationship between them arose by chance. The value is significant based on the P value within the significant range of less than or equal to 0.05.

4. Data Analysis & Data Interpretation

4.1. Demographic characteristics of the study population

In this section, the analysis of the survey is presented. This section also explains the interview questions that was conducted by the researcher. Total of 500 questionnaire was distributed and 375 (75%) of them submitted the complete questionnaire. The scrutiny of the demographic features comprised of gender, sex, marital status, work experience, literacy level and work position of the study subjects – Table 2-.

Table 2: Demographic distribution of the respondents (gender, age, Educational level, Occupational status)

	Category	Frequency	Percentage %
Total Respondents who participated in the study 375			

Gender status			
	Female	216	57.6
	Male	159	42.4
Age of Respondents			
	More than 20 years to 35 years	26	6.9
	More than 35 years to 45 years	95	25.3
	More than 45 years to 55 years	98	26.1
	More than 55 years to 65 years	94	25.07
	More than 65 years	62	16.5
Educational status			
	Illiterate	119	31.73
	Primary School	110	29.33
	Secondary School	54	14.4
	High school	89	23.73
	Diploma	1	0.27
	Post graduate	2	0.53
Occupational status			
	House wife	173	46.1
	Not working	1	0.3
	Retired	43	11.5
	Government	86	22.9
	Private	70	18.7
	Business man	1	0.27
	Others	1	0.27

Table 2 indicates that out of 375 study units, the highest participants are females forming 216 (57.6%) out of total participants and the rest of 159 (42.4%) were male subjects. It shows that females are more affected with diabetic foot ulcer than males which is supported also with evidences. In a cross sectional study done by Marshoudi et al (2021) in Al Dhahira region of the Sultanate of Oman reveals that females were more than men with diabetes foot ulcer. Poor glycemc control and long term neuropathy were the main reasons for women to be affected.

In considering the age distribution, 26 (6.9 %) of the respondents belong to more than 20-35 years of age, 95 (25.3%) of the participants fall into the age group of 35 to 45 years (4.32%), 98 (26.1%) participants were in the age group of 45 to 55 years, 94 of them were in the age of 55 to 65 years (25.1%) and 62(16.3%) of the subjects were found to be more than 65 years of age. Yao et al (2024) conducted a retrospective cohort investigation on the prevalence of DFU and amputation and they found that most of the DFU was at the age of 50 to 59 years and majority of deaths take place between 70 to 79 years of age. The main reason for this was due to narrowed of blood vessels and likelihood of amputation. Even in this

study, the researcher found that out of 375 participants 156 (41.6%) of them were in the age group of 55 and above. This may be due to some patients would have suffered the disease and diabetic neuropathy for a long time and also their low immunity.

With regards to the education status of 375 participants, 119 (31.7%) were found to be illiterate and 54(14.4%) of them had secondary school education and 92 (24.53%) of the participants were educated. The participants who were educated had a better knowledge and understanding about the self-foot care practices.

Out of 375 participants, majority of them (46.1%) were home makers, and 1 (0.3%) never went for work. On the other hand, 43 (11.5%) were retired from their work, 86 (22.9%) of them were working in the government, 70(18.7%) were working in the private sectors and 2 (0.53%) of them were engaged in some business. The study highlighted that 156 (41.6%) patients who were engaged in various jobs. It can be assumed that they must have been involved in long hours of working and standing for long hours. Their occupation would have been involving working in construction, farm workers or other high labored jobs where they must have been wearing the foot wear for a long time. This would have affected their lower limb blood supply. These factors are supported by a study done by Palmer et al, (2023) who identified that patients working for long hours have no time to give self-foot care, some had comorbidities who could not go for regular medical examination and some were wearing the foot wear for long hours.

Table 3: Response of Patient’s regarding knowledge about diabetic foot care

Variables (Knowledge)	Agree	Disagree	I do not know
Do you know DM patients take medication regularly to prevent the complication?	368 (98.13%)	4 (1.07%)	3 (0.8%)
Do you know DM patients may develop reduced blood flow in their feet?	265 (70.67%)	18 (51.4%)	92 (24.53%)
Do you know DM patients may lose their feet sensation?	301 (80.26%)	17 (4.53%)	55 (14.67%)
Do you know loss of sensation may develop ulcers and that may develop to gangrene?	292 (77.87%)	19 (5.07%)	64 (17.06%)
Do you know smoking can reduce the blood flow in your feet?	244 (65.07%)	29 (7.73%)	102 (27.2%)
DM patients should take care of their feet and take responsibility for self-examination?	339 (90.40)	11 (2.93)	25 (6.67)
Do you know DM patients can live abnormal life if they are taking appropriate measures to control their DM?	351 (93.60)	17 (4.5)	7 (1.87)
Have you ever received education about foot care from the health care workers?	268 (71.47)	52 (13.87)	55 (14.67)
Have you ever read a handout about foot care?	214 (57.07)	68 (18.13)	93 (24.80)

4.2. Frequencies of answers in Knowledge, attitude and practice questionnaire

Table 3 represents the findings relating to participants’ knowledge of T2DM. Most participants (98.1%)

agreed that taking regular medications is important to keep up their wellbeing. There was also an overwhelming agreement among 76.65% participants who said that they may develop reduced blood flow in their feet due to DM (80.91%) of them knew that they may lose sensation in their feet. 77.8% of them agreed that loss of sensation may result in ulceration of the feet which ultimately will result in gangrene of the foot. 65.07% of the participants were aware that smoking will reduce the blood flow in the feet. There was an enlightening response from 90.4% of the participants who confidently said that they know about caring their feet and about self-examination. Moreover, 93.6% of them were well aware that they can live a normal life if they comply to appropriate preventive measures. 71.4% of them had attended some education sessions about diabetes and self-care and 57.07% of them have read some related information about DM and self-care.

Table 4: Frequencies of answers towards practices and attitudes towards diabetic foot care

Variables	Agree	Disagree	I don't know
Daily washing the feet	354 (94.4%)	13 (3.4%)	8 (2.13%)
Checking temperature of water before washing and bath	305 (81.33%)	37 (9.87%)	33 (8.80%)
Drying the feet after washing.	328 (87.47%)	28 (7.47%)	19 (5.07%)
Applied a moisturizing cream on your feet is necessary.	320 (85.33%)	31 (8.27%)	24 (6.4%)
Lotion not to be applied between the feet	209 (55.73%)	71 (18.93%)	95 (25.33%)
Wearing comfortable shoes.	351 (93.60%)	15 (4.00%)	9 (2.40%)
Do not walking bare foot.	335 (89.33%)	30 (8.00%)	10 (2.67)
Examine your feet daily.	284 (75.73%)	50 (13.33)	41 (10.93)
Sit with your legs crossed wrong practice.	242 (64.53)	57 (15.2)	76 (20.27)

Table 4 represents the findings regarding practice and attitudes, as well as the total number of respondents and percentage in each question. The majority, 94.4% of the participants, washed their feet regularly and a vast number of the participants 305(81.33%) checked the temperature of the water before bath disease, and 328 (87.47%) responded that they would dry their feet after washing them.85.33% of the participants apply moisturizing cream on the feet but at least half of the participants (209/55.73%) only apply lotion to the feet. It is pleased to learn that 351 of them (93.6%) of them wear comfortable shoes and 335 (89.33%) of them do not walk in bare foot. However it is shocking to note that only 284 (75.73%) of them examine the feet regularly. Finally, they were questioned about the practice of crossing the legs while sitting and 242 (64.53%) of them agreed it is was a wrong practice.

Table 5: Factors associated with knowledge level towards diabetic foot among patients with diabetes

Items	Covariate	P- Value
Do you know DM patients may develop reduced blood flow in their feet?	Age Group	0.206
	Sex	0.627
	Educational level	0.287
	Occupation	0.000
Do you know smoking can reduce the blood flow in your feet?	Age Group	0.856
	Sex	0.599
	Educational level	0.521
	Occupation	0.004

*Knowledge items that had more than 20% response of “I don’t know”

Table 6: Factors associated with attitude towards diabetic foot among patients with diabetes

Items	Covariate	P- value
Lotion not to be applied between the fingers	Age Group	0.052
	Sex	0.609
	Educational level	0.000
	Occupation	0.757
Sit with your legs crossed is a wrong practice	Age Group	0.226
	Sex	0.352
	Occupation	0.521
	Sex	0.736

5. Discussion

The development of diabetic foot ulcers is basically driven by a combination of peripheral neuropathy, peripheral vascular disease (PVD), foot deformities, and reduced resistance to infection. Diabetic neuropathy leads to nerve damage that causes foot deformities, loss of sensation, and skin breakdown, all of which increase the danger of ulcers. PVD aggravates the problem by reducing blood flow, weakening wound healing, and contributing to ischemia. Other factors such as previous ulcers, poor glycemic control, and socioeconomic challenges also play significant roles in DFU development (Noor et al, 2015).

In this study, the researcher found that females are more affected by diabetic foot ulcers than males. This higher prevalence among women may be influenced by factors such as hormonal changes, a longer duration of diabetes, and potential delays in seeking medical care. The age group of 41 to 60, which is generally at higher risk for DFU, sees an even greater impact. This study results are relevant to those of Renuga et al (2016) particularly in terms of the higher prevalence of diabetic foot ulcers (DFUs) within the 41 to 60 age group.

Type 3 diabetes emerged as considerably more prevalent among patients with DFU s, combined with comorbidities such as obesity, hypertension, and dyslipidaemia, exacerbates the progression of conditions like peripheral neuropathy and PVD, both of which are key contributors to DFU development These findings highlight the importance of early detection and management of diabetic foot ulcers, as higher

Wagner grades are associated with more severe complications and a greater likelihood of amputation (Marshoudi et al, 2021).

While assessing the knowledge of the condition among participants, this study found that only 77.87% were aware of diabetic foot care and the risks associated with DFU. In contrast, a substantial 65-75% lacked sufficient awareness and understanding of these crucial aspects. This gap in knowledge mirrors the findings of Bhasker et al (2019) emphasizing the critical need for targeted education and awareness initiatives to improve foot care practices and reduce the incidence of DFUs among diabetic patients. An impressive 90.40% of individuals demonstrate a positive attitude towards foot care, reflecting a strong commitment to maintaining and enhancing their foot health through proactive practices and awareness. Similarly practice assessment reveals that participants regularly trim their toenails straight, reflecting a generally positive practice that helps prevent ingrown toenails and other foot-related issues. Specifically, 93.6% participants wear comfortable shoes and socks on their feet.

Healthcare providers play a crucial role in enhancing patient awareness and promoting effective foot care practices. Effective communication between healthcare professionals and patients is essential for fostering proper understanding and adherence to foot care protocols. Unfortunately, 71.47% [participants only had an exposure of educational results from suboptimal communication, which can be attributed to the limited time available due to the demanding schedules of healthcare workers. It stated by Yao et al (2024) that this time constraint, coupled with a lack of structured communication strategies, frequently hinders the comprehensive education of patients. These challenges need to solve by prioritizing patient education and executing organized communication can pointedly improve patient outcomes and promote better foot care practices.

Limitations

This study has a limitation of using a small sample size that may limit the generalizability of the findings to a broader population.

Conclusion

In conclusion, this study highlights the critical need for enhanced patient education and counselling in managing diabetic foot ulcers. Effective counselling plays a pivotal role in improving patient understanding, correcting misconceptions, and promoting better self-care practices. With physicians often constrained by heavy patient loads, the nurses are well-positioned to address gaps in foot care education. Ongoing support and counselling are essential to improve patient outcomes and reducing the overall healthcare burden associated with diabetic foot ulcers.

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Reference

1. Abalkhail, A., Al Imam, M. H., Elmosaad, Y. M., Jaber, M. F., Hosis, K. A., Alhumaydhi, F. A., Alslamah, T., Alamer, A., & Mahmud, I. (2021). Knowledge, attitude and practice of standard infection control precautions among health-care workers in a university hospital in Qassim, Saudi Arabia: A cross-sectional survey. *International Journal of Environmental Research and Public Health*, 18(22), 11831.
2. Abalkhali.,A, Al Imam.,MH,Elmosaad.,YM,Jaber.,ME, Al Hosis.,K,Alhumaydhi.,FA, Alslamah.,T,Alamet.,A,Mahmudi.,I (2021) Knowledge, Attitude and Practice of Standard Infection Control Precautions among Health-Care Workers in a University Hospital in Qassim, Saudi Arabia: A Cross-Sectional Survey. *Int J Environ Res Public Health*.11:18:11831
3. Adhikari. B (2021) Roles of Alkaloids from Medicinal Plants in the Management of Diabetes Mellitus. *Journal of Chemistry*.
4. Ahmed.,F, Joshi.,SH (2023) Self-Care Practices and Their Role in the Control of Diabetes: A Narrative Review. *Cureus*.5:15(7)
5. AlHaik.,S,Anshasi.,AH,Alkhalwaldeh.,J,Soh.,KL,Naji.,AM (2019) An assessment of self-care knowledge among patients with diabetes mellitus.*Diabetes & Metabolic Syndrome: Clinical Research & Reviews*.13.390-394
6. Altojiri.,AlGhofili.,H,Alanazi,SN,AlHindawi.,DA,AlAkeel.,NS,Bedoor,S,Julaidan.,AlHamzah.,M, Altuwajjiri (2021) Diabetic foot and peripheral arterial disease.*Saudi Medical Journal*.42(1) 49-55
7. American Diabetes Association. 6. Glycemic targets: standards of medical care in diabetes-2021. *Diabetes Care*. 2021;44:S73–S84.
8. Bhaskar A, Reddy K, Sagar K, Kishore K, Madhan Mohan Rao M, Krishna V (2019) Assessment of knowledge and patient counseling to the patient with diabetes on diabetic foot care in tertiary care hospital. *Int J Diabetol Vasc Dis Res*. 7(1):223-42.
9. Burke, S.D, D. Sherr, D., R.D. Lipman.,R.D (2014) Partnering with diabetes educators to improve patient outcomes.*Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 7 , p. 45
10. Chittooru., CS, Ananda, KG, Panati.,D, Chaudhuri.,S,Prahalad.,H (2022) Self-care practices and its determinants among diabetic population in rural Andhra Pradesh, India: A cross-sectional study. *Clinical Epidemiology and Global Health*.16.101102.
11. Degefa.,G,Wubshet.,K,Tesfaye.,S,Hirigo.,AT (2020)Predictors of Adherence Toward Specific Domains of Diabetic Self – Care Among Type -2 Diabetes Patients. *Clin Med Insights Endocrinol Diabetes*.20:13
12. Dictionary, C. (2023). Well-being. *Wellbeing*. <https://doi.org/10.1093/OED/2734155239>.
13. Doyle.,L, McCabe.,C, Keogh., B,Brady.,A, McCann.,M (2019) An overview of the qualitative descriptive design within nursing research.*J.Res Nurs*.18:@5 (5) 443-455
14. Elakashif.,MML, Mahdy.,AY,Elgazzar.,SE (2021) Evaluating The Effect of Establishing Protocol for Self- Care Practice of Diabetic Foot Patients Regarding Their Needs, Concerns and Medication Use: A quasi-experimental study. *Saudi Journal of Biological Sciences*.28(6) 3343-3350
15. IDF Diabetes Atlas 9th Edition; 2019. Available from: [https:// diabetesatlas.org/en/](https://diabetesatlas.org/en/).
16. Kassahun.,T,Gesesew.,H,Mwanri.,L,Eshetie.,T (2016) Diabetes related knowledge, self-care behaviours and adherence to medications among diabetic patients in Southwest Ethiopia: a cross-sectional survey. *BMC Endocr.Disord*.31:16(1):28

17. Letta.,S,Aga.,F,Yadeta.,TA,Geda.,B,Dessie.,Y (2021) Barriers to Diabetes Patients' Self-Care Practices in Eastern Ethiopia: A Qualitative Study from the Health Care Providers Perspective. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy. Dovepress.14: 4335-4349
18. Letta.,S,Aga.,F,Yadeta.,TA,Geda.,B,Dessie.,Y (2021) Barriers to Diabetes Patients' Self-Care Practices in Eastern Ethiopia: A Qualitative Study from the Health Care Providers Perspective. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy. Dovepress.14: 4335-4349
19. Marshoudi.,Sabroya.,AL,Ahmed,Fatma, Wali.,PS,AlBurji.,A, Al Khalbani.,K,Sabri.,MY (2021) Short Screening for Diabetic Foot Disease in an Omani Population at Al-Dahira, Sultanate of Oman. Dentistry and Medical Research.9(1)16-28
20. Muchiri, J. W., Gericke, G. J., Rheeder, P. (2016). Effect of a nutrition education programme on clinical status and dietary behaviours of adults with type 2 diabetes in a resource-limited setting in South Africa: a randomised controlled trial. Public Health Nutrition, 19(1), 142-155.
21. Muhammad-Lutfi AR, Zaraihah MR, Anuar Ramdhan IM(2014) Knowledge and practice of diabetic foot care in an in-patient setting at a tertiary medical center. Malays Orthop J. 8(3):22.
22. Muhoma.,T,Waruiru.,MW,Sanni.,Q,Knechi.,LD,McFarland.,M (2020) A quality improvement project to improve diabetes self-management and patient satisfaction in a low-resourced central Kenyan hospital.Afr HealthSci.20(3) 1322-1328
23. Nathan DM, Knowler WC, Edelstein S, (2019) Long-term effects of metformin on diabetes prevention: identification of subgroups that benefited most in the Diabetes Prevention Program and Diabetes Prevention Program Outcomes Study. Diabetes Care. ; 42:601–608.
24. Newton,P., Scambler, S., K. Asimakopoulou.,K (2019)A qualitative exploration of experiences of diagnosis amongst people living with type 2 diabetes.Journal of Diabetes Reports, 1 (1), pp. 1-11.
25. Noor S, Zubair M, Ahmad J(2015) Diabetic foot ulcer-a review on pathophysiology, classification and microbial etiology. Diabet Metabol Syndr: Clin Res Revi. 9(3):192-9.
26. Oktavia.,R, Irwandi.,I,Rajibussalim.,R(2018) Assessing the validity and reliability of questionnaires on the implementation of Indonesian curriculum K-13 in STEM education. Journal of Physics Conference Series. 1088:012014
27. Palmer.,KNB, Crocker.,RM,Marrero.,DG,Tan.,TW (2023) A vicious cycle: employment challenges associated with diabetes foot ulcers in an economically marginalized Southwest US sample.14:4.Front Clin Diabetes Health clinic.
28. Polit, D. F., & Beck, C. T. (2012). *Resource Manual for Nursing Research 10th Edition: Generating and Assessing Evidence for Nursing Practice*. Wolters Kluwer.
29. Renuga E, Ramakrishnan SR, Vanitha Rani N, Thennarasu P, Kannan G(2016) Impact of continuous patient counselling on knowledge, attitude, and practices and medication adherence of diabetic patients attending outpatient pharmacy services. Asian J Pharm Clin Res.9 (1):364-9.
30. Robb.,M, Shellenbarger.,T (2020) Mastering Survey Design and Questionnaire Development.J Contin Educ Nurse.1:51(6):248-249
31. Sabriya.,M, AL, Fatma.,A, Wali.,PS, Al Burj.,A,Al Khalbani.,K, Sabri.,MY (2021) Short Screening for Diabetic Foot Disease in an Omani Population at Al-Dahira, Sultanate of Oman.A cross sectional study. Dentistry and Medical Research.9 (1).16-28
32. Saeedi et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: results from the international Diabetes federation Diabetes atlas (2019), 9(th) edition. Diabetes Res Clin Pract. ;157:107843.

33. Shacho, E., Ambelu, A., & Yilma, D. (2024). Knowledge, attitude, and practice of healthcare workers towards healthcare-associated infections in Jimma University Medical Center, southwestern Ethiopia: using structural equation model. *BMC Health Services Research*, 24(1), 1611.
34. Tolossa.,T,Mengist.,B,Mulisa.,D, Fetensa.,G,Turi.,E,Abajobir.,A (2020) Prevalence and associated factors of foot ulcer among diabetic patients in Ethiopia: a systematic review and meta-analysis.*BMC Public Health*. 20, 41
35. Tuha.,A,Faris.,AG,Andualem.,A,Mohammed.,SA (2020) Knowledge and Practice on Diabetic Foot Self-Care and Associated Factors Among Diabetic Patients at Dessie Referral Hospital, Northeast Ethiopia: Mixed Method. *Diabetes Metab Syndr Obes*.17:14, 1203-1214.
36. Verma.,D Yogesh.,B,Ravi.,k,Mahendra.,S,Pradeep.,A,Vatika.,S (2021) Effect of mHealth Interventions on Glycemic Control and HbA1c Improvement among Type II Diabetes Patients in Asian Population: A Systematic Review and Meta-Analysis. *Indian Journal of Endocrinology and Metabolism*.25 (6):484-492.
37. Wong CL, Chen J, Chow KM, Law BM, Chan DN, So WK, Leung AW, Chan CW. Knowledge, attitudes and practices towards COVID-19 amongst ethnic minorities in Hong Kong. *Int J Environ Res Public Health*. 2020; 17(21):7878.
38. Yao.,Y,Chen.,L, Oian.,Y(2024) Age Characteristics of Patients With Type 2 Diabetic Foot Ulcers and Predictive Risk Factors for Lower Limb Amputation: A Population-Based Retrospective Study. *Journal of Diabetes Research*. Forward Series.
39. Yewande, O., & Suliat, A. (2017). Nursing interventions for the prevention of foot ulcers in adult diabetic inpatients. Unpublished bachelor's thesis. Laurea University of Applied Sciences, Uusimaa, Finland.
40. Zheng, F., Liu, S., Liu, Y., & Deng, L. (2019). Effects of an outpatient diabetes self-management education on patients with type 2 diabetes in China: a randomized controlled trial. *Journal of Diabetes Research*.