

Assessment of Knowledge and Patient Counseling to the Patient with Diabetes on Diabetic Foot Care in Tertiary Care Hospital

Research Article

Dr. Udaya Bhaskar A^{1*}, Dr. Venkata Sankar Reddy K^{1*}, Dr. Praneeth Sagar K¹, Dr. Kishore K¹, Dr. Madhan Mohan Rao M², Chinni Krishna V³

¹ Annamacharya College of Pharmacy, Rajampet, A.P, India. JNTU, Ananthapur, A.P, India.

² Associate Professor, Department of General Medicine, Rajiv Gandhi Institute of Medical Sciences, Kadapa, A.P, India. Dr. NTR University of Health Sciences. Vijayawada, A.P, India.

³ Associate Professor, Department of Pharmacology, Annamacharya College of Pharmacy, Rajampet, A.P, India. JNTU, Ananthapur, A.P, India.

Abstract

To measure the awareness among diabetes patient related to diabetic foot. To counsel diabetic patients who are lacking awareness about their disease, medications and Lifestyle modifications. To minimize the diabetic foot amputations and diabetes complications.

Abbreviations: HDL: High-Density Lipoprotein; GDM: Gestational Diabetes; WHO: World Health Organization; IDF: International Diabetes Federation; DM: Diabetes Mellitus; DFU: Diabetic Foot Ulcers; PVD: Peripheral Vascular Disease; PAD: Peripheral Arterial Disease; PN: Peripheral Neuropathy; PVD: Peripheral Vascular Disease.

Introduction

Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both [1]. Diabetes is a chronic disease that occurs when the pancreas does not produce enough insulin, or alternatively, when the body cannot effectively use the insulin it produces.

The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels. Several pathogenic processes are involved in the development of diabetes. These range from autoimmune destruction of the β -cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action. The basis of the abnormalities in carbohydrate, fat, and protein metabolism in diabetes is deficient action of insulin on target tissues. Deficient insulin action results from inadequate insulin secretion and/or diminished tissue responses to insulin at one or more points in

the complex pathways of hormone action [1, 2].

Impairment of insulin secretion and defects in insulin action frequently coexist in the same patient, and it is often unclear which abnormality, if either alone, is the primary cause of the hyperglycemia. Symptoms of marked hyperglycemia include polyuria, polydipsia, weight loss, sometimes with polyphagia, and blurred vision. Impairment of growth and susceptibility to certain infections may also accompany chronic hyperglycemia.

Acute, life-threatening consequences of uncontrolled diabetes are hyperglycemia with ketoacidosis or the nonketotic hyperosmolar syndrome. Long-term complications of diabetes include retinopathy with potential loss of vision; nephropathy leading to renal failure; peripheral neuropathy with risk of foot ulcers, amputations, and Charcot joints; and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction. Patients with diabetes have an increased incidence of atherosclerotic cardiovascular, peripheral arterial, and cerebrovascular disease. Hypertension

*Corresponding Author:

Dr. Annamaraju Udaya Bhaskar, Pharm D.
Annamacharya College of Pharmacy, Rajampet, A.P, India.
Tel: 7674044126
E-mail: udaybhaskar606@gmail.com

Dr. Venkata Sankar Reddy K, Pharm D.
Annamacharya College of Pharmacy, Rajampet, A.P, India.
Tel: 9908807084.
E-mail: venkatasankarreddyk@gmail.com

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and abnormalities of lipoprotein metabolism are often found in people with diabetes [1-3].

In some individuals with diabetes, adequate glycemic control can be achieved with weight reduction, exercise, and/or oral glucose lowering agents. These individuals therefore do not require insulin. Other individuals who have some residual insulin secretion but require exogenous insulin for adequate glycemic control can survive without it. Individuals with extensive β -cell destruction and therefore no residual insulin secretion require insulin for survival. The severity of the metabolic abnormality can progress, regress, or stay the same [1-3].

Classification Of Diabetes Mellitus

The disease states underlying the diagnosis of diabetes mellitus are classified into four categories: type 1, *insulin-dependent diabetes*; type 2, *noninsulin-dependent diabetes*; type 3, *other*; and type 4, *gestational diabetes mellitus* (Expert Committee, 2003).

Type 1 Diabetes Mellitus

The hallmark of type 1 diabetes is selective β -cell destruction and *severe* or *absolute* insulin deficiency. Administration of insulin is essential in patients with type 1 diabetes. Type 1 diabetes is further subdivided into immune and idiopathic causes. The immune form is the most common form of type 1 diabetes.

Although most patients are younger than 30 years of age at the time of diagnosis, the onset can occur at any age. Type 1 diabetes is found in all ethnic groups, but the highest incidence is in people from northern Europe and from Sardinia. Susceptibility appears to involve a multifactorial genetic linkage but only 10-15% of patients have a positive family history [1, 2].

Type 2 Diabetes Mellitus

Type 2 diabetes is characterized by tissue resistance to the action of insulin combined with a *relative* deficiency in insulin secretion. A given individual may have more resistance or more β -cell deficiency, and the abnormalities may be mild or severe. Although insulin is produced by the β -cells in these patients, it is inadequate to overcome the resistance, and the blood glucose rises. The impaired insulin action also affects fat metabolism, resulting in increased free fatty acid flux and triglyceride levels and reciprocally low levels of high-density lipoprotein (HDL).

Individuals with type 2 diabetes may not require insulin to survive, but 30% or more will benefit from insulin therapy to control the blood glucose. It is likely that 10-20% of individuals in whom type 2 diabetes was initially diagnosed actually have both type 1 and type 2 or a slowly progressing type 1, and ultimately will require full insulin replacement. Although persons with type 2 diabetes ordinarily do not develop ketosis, ketoacidosis may occur as the result of stress such as infection or use of medication that enhances resistance, eg, corticosteroids. Dehydration in untreated and poorly controlled individuals with type 2 diabetes can lead to a life-threatening condition called *nonketotic hyperosmolar coma*. In this condition, the blood glucose may rise to 6-20 times the normal range and an altered mental state develops or the person loses consciousness. Urgent medical care and rehydration is

required [1, 2].

Type 3 Diabetes Mellitus

The type 3 designation refers to multiple *other* specific causes of an elevated blood glucose: non-pancreatic diseases, drug therapy [1].

Type 4 Diabetes Mellitus

Gestational diabetes (GDM) is defined as any abnormality in glucose levels noted for the first time during pregnancy. Gestational diabetes is diagnosed in approximately 4% of all pregnancies in the USA. During pregnancy, the placenta and placental hormones create an insulin resistance that is most pronounced in the last trimester. Risk assessment for diabetes is suggested starting at the first prenatal visit. High-risk women should be screened immediately. Screening may be deferred in lower-risk women until the 24th to 28th week of gestation [3].

Epidemiology of Diabetes

Diabetes is a complex metabolic disease which can give rise to many circulatory and neurological disorders. According to the report of World Health Organization (WHO) the number of diabetic patients in 2000 reached to 171 million [4] and was predicted to increase 380 million by 2025. So, at now in most countries diabetes is becoming as an epidemic disorder.

Diabetic has become a problem of great magnitude recently. It is estimated that 10-12% of the urban and 4-6% of rural population of India are now diabetic. DM has emerged as a major health care problem in India. According to diabetes atlas published by international diabetic federation (IDF) there were estimated 40 million people with diabetes in 2007 and this number predicted to rise to almost 70 million people by 2025.

The countries with largest number of diabetes will be in India, China and USA by 2030. It is estimated that every 5th person with diabetes will be an Indian [5]. India is known as the "diabetes capital" of the world with more than 40 million people with diabetes [6].

A study was conducted to estimate the prevalence of diabetes and the number of all age which diabetes for year 2000 and 2030. The prevalence of diabetes for all age group world wide was estimated to be 2.8% in 2000 and 4.4% in 2030 the total number of people with diabetes project to rise from 171 million in 2000 to 366 million in 2030 [4].

The Even minor trauma can lead to infection of foot ulcers and amputation is major course of morbidity, disability and cost for people with diabetes mellitus. Ultimately, diabetes prevention needs "political will", societal and community support and behavioral change on the part of individual and their families. Now is the time for India to wake up to the imminent problem of diabetes mellitus and act - before it is too late [7].

Diabetic Foot

Diabetic foot is defined by WHO as foot in diabetics with

neurologic disorders, some degree of vascular involvement with or without metabolic complications of diabetes in lower extremity and prone to infection, scarring, with or without deep tissue damage [8].

One of the most important and disabling complications of diabetes mellitus (DM) is the diabetic foot ulcers (DFU). Development of DFU is traditionally believed to result from a combination of oxygen deficiency caused by peripheral vascular disease, peripheral neuropathy, minor foot traumas, foot deformities, and infection [32-35].

Epidemiology

Global Epidemiology of Diabetic Foot Disease

During the life span of a diabetic patient, the danger of ulcerations to the lower foot is as high as 25% [10]. In some studies saying that DFU, incidence of 1-4%, and prevalence of 5.3% to 10.5% [36, 37] in all diabetic patients, accounts for more than half of the non-traumatic lower-extremity amputations in the world [38-42]. Globally, one lower limb is lost every 30 seconds because of DFU [43]. The range of mortality following diabetic foot amputation is 39-80% after 5 years, which is worse than the mortality rate for most malignancies [36].

Indian Epidemiology of Diabetic foot Disease

One-third of all diabetic patients have significant peripheral neuropathy and/or peripheral vascular disease (PVD). Diabetic foot problems are the commonest reason for hospitalization of diabetic patients (about 30% of admissions) and absorb some 20% of the total health-care costs of the disease more than all other diabetic complication. [54, 55]. In India prevalence of foot ulcers in diabetic patients in clinic population is 3%, which is much lower than reported in the western world. A possible reasoning for the low prevalence in Indians is younger age and shorter duration of diabetes [56, 57]. PVD has been reported to be low among Asians [58-61] ranging between 3-6% as against 25-45% in Western patients [62-64].

The prevalence of PVD increases with advancing age and is 3.2% below 50 years of age and rises to 55% in those above 80 years of age [65]. Similarly it also increases with increased duration of diabetes, 15% at 10 years and 45% after 20 years [66].

Amputations and Mortality

Ulcers of the low foot are generally related to an increased danger of amputation due to loss of sensitivity and bad hemostasis; conditions that, if combined with long term bad control of the blood glucose, create the necessary substratum for trauma infection and gangrene [10].

Foot ulcers and their complications are an important cause of morbidity and mortality in patients with diabetes. Annual incidence of foot ulcers is 1% to 4% and prevalence 5% to 10% in patients with diabetes [11]. About 50% of patients undergoing non-traumatic lower limb amputations have diabetes [12]. These patients have a high mortality following amputation, ranging from 39% to 80% at 5 years [11].

Hospitalization

Diabetic foot ulcer is the most general cause of hospitalization in diabetic patients [21]. On the other hand, these ulcers can lead to infection, gangrene, amputation and even death if the necessary care is not provided [22]. In addition, lower extremity amputation is associated with prolonged hospitalization and rehabilitation and also is required to home care and social support [23]. Overall, the rate of lower limb amputation in diabetic patients is 10-30 times higher than non diabetics [24, 25]. The studies showed that every 30 seconds one leg is amputated due to diabetes in the world [26]. In the first two years after amputation, there is a 50 percent risk of re-amputation [27] and three years after lower limb amputation, 50% of patients may be dead [28]. The prevalence of diabetic foot in Iran was estimated at 3% in 2001 [29].

Approximately, 20% of hospital admissions among diabetic patients are in consequence of foot problems [44]. Furthermore, DFU is among the most prevalent causes of hospitalization and morbidity [41, 45] and is responsible for more days of hospital stay than any other chronic complication of DM [46, 47].

Foot ulcers can cause severe disability and hospitalization to patients and considerable economic burden to families and health systems [81, 82]. Infection, occurring in about half of the diabetic foot ulcers, is a further complication [48, 83]. About 85% of diabetes-related amputations are preceded by foot ulcers, and it accounts for more than half of non-traumatic lower limb amputations [83, 84]. Individuals who develop foot ulcers have a decreased health-related quality of life [16, 73].

Impact of Economic Burden on Quality of Life

Diabetic foot and also cause to impose heavy economic burden on the health system [19]. Among diabetes' complications, different types of foot problems such as ulcers and infections are common and it has shown an increasing trend in the past decade [20].

DFU lesions are significant health and socioeconomic problem as they exert adverse effects on patients' quality of life and impose heavy economic burden on the patient and the state due to rising the need for rehabilitative and home care services [48, 49]. Given the DFU's high prevalence, heavy burden, and severe impact on patients' life quality, it is advisable that sufficient heed be paid to prevention of this particular complication of DM. Furthermore, while effective treatment and formulation of prevention guidelines require a thorough understanding of characteristics of DFU patients and their ulcers.

The cost of care for amputation is financially great for both the patient and the healthcare provider with surgery, post-operative care followed by rehabilitation and the need for adaptations to home and prosthesis fitting. But the personal involvement to the patient in pain, loss of mobility, even life-long dependence on others and limitations imposed by the change of role is incalculable (ICDF) [80].

The treatment of diabetic foot is expensive all around the world. In developed countries, more than 5% of diabetics have foot ulcers and 20% of total health care resources spent on care of the diabetic foot in these countries.

High economic burden for solving this problem requires close collaboration among health system and people; develop national and international strategies and interaction with other health team members. By this approach, providing adequate and effective health services are necessary for patients and their families Also, improving the quality of clinical performance can lead to changes in client and patient societies [18].

Impact of Education

Most of the patients developed DFU in 5th and 6th decades of their life, with the mean age being 59.3 years. Other studies also have found the average age of developing DFU to be about 55-60 years [50-53].

Poor knowledge of foot care and poor foot care practices were identified as important risk factors for foot problems in diabetes [17]. Evidence suggests that consistent patient education with prophylactic foot care for those judged to be at highest risk may reduce foot ulceration and amputations [28].

The most important point is that 85% of diabetic foot amputations are preventable with appropriate care and education [30]. Ideal management for prevention and treatment of diabetic foot is as follow: regular perception of foot, determine at risk foot, education to patient and health staff, appropriate foot coverage, and early treatment of foot problems [31].

As a result, educating medical and nursing personnel, applying screening and prevention guidelines, and allocating more resources are of great importance in treatment of DFU patients.

Classification of Diabetic Foot Ulcers

Classification systems grade ulcers (Table-1.1) and wound (Table-1.2) according to the presence and extent of various physical characteristics, such as size, depth, appearance and location.

In most patients, peripheral neuropathy and peripheral arterial disease (PAD) (or both) play a central role and DFUs are therefore commonly classified as:

- Neuropathic
- Ischaemic
- Neuroischaemic (Figures 1.1–1.3).

Neuroischaemia is the combined effect of diabetic neuropathy and ischaemia, whereby macrovascular disease and, in some instances, microvascular dysfunction impair perfusion in a diabetic foot [77, 78].

Charcot joint is a form of neuroarthropathy that occurs most often in the foot and in people with diabetes. Nerve damage from diabetes causes decreased sensation, muscle atrophy and subsequent joint instability, which is made worse by walking on an insensitive joint. In the acute stage there is inflammation and bone reabsorption, which weakens the bone. In later stages, the arch falls and the foot may develop a ‘rocker bottom’ appearance (Figure: 1.4-1.6). Early treatment, particularly offloading pressure, can help stop bone destruction and promote healing [77].

Foot deformity; A combination of motor neuropathy, cheiroarthropathy and altered gait patterns are thought to result in the “high risk” neuropathic foot with clawing of the

Figure 1.1. Neuropathic DFU.



Figure 1.2. Ischaemic DFU.



Figure 1.3. Neuroischaemic DFU.



Figure 1.4. Charcot foot with plantar ulcer.



Figure 1.5. Charcot foot with sepsis.



Figure 1.6. Chronic Charcot foot.



Figure 1.7. Areas at risk for DFU.

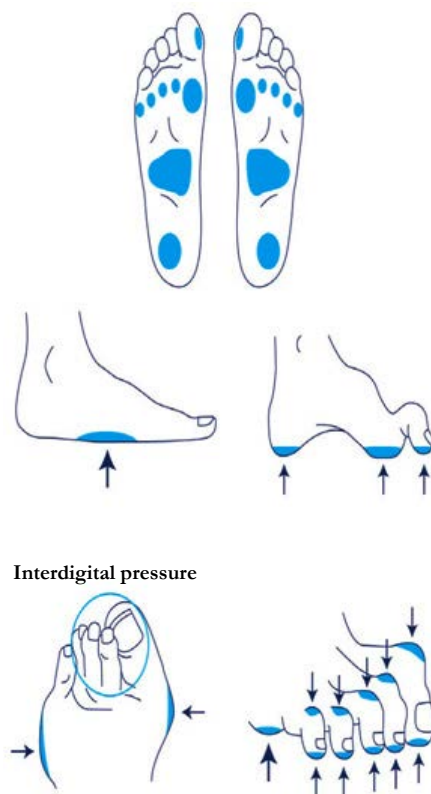


Table 1.1. Traditional Meggitt-Wagner Ulcer Classification System.

Grade	Lesion
0	No ulcer, but high-risk foot (bony prominences, callus, deformities, etc).
1	Superficial, full-thickness ulcer.
2	Deep ulcer, may involve tendons, but without bone involvement.
3	Deep ulcer with osteomyelitis.
4	Local gangrene (toes or forefoot).
5	Gangrene of whole foot.

Table 1.2. University of Texas wound classification system.

Grade 0: Pre- or post-ulcerative lesion, completely epithelialized	Grade 2: Wound penetrating to tendon or capsule
Stage A: without infection or ischemia	Stage A: without infection or ischemia
Stage B: with infection	Stage B: with infection
Stage C: with ischemia	Stage C: with ischemia
Stage D: with infection and ischemia	Stage D: with infection and ischemia
Grade 1: Superficial wound not involving tendon, capsule, or bone	Grade 3: Wound penetrating to bone or joint
Stage A: without infection or ischemia	Stage A: without infection or ischemia
Stage B: with infection	Stage B: with infection
Stage C: with ischemia	Stage C: with ischemia
Stage D: with infection and ischemia	Stage D: with infection and ischemia

toes, prominent metatarsal heads, high arch and small muscle wasting. Callus forms under weight-bearing areas (Figure: 1.7) as a consequence of dry skin (autonomic dysfunction), insensitivity and repetitive moderate stress from high foot pressure. It acts as a foreign body and cause ulceration [78].

Etiopathogenesis of Giabetic Foot Lesions

Pathogenesis of Ulceration

Diabetic foot ulcers result from the simultaneous action of multiple contributing causes [67, 68]. The major underlying causes are noted to be *peripheral neuropathy and ischemia from peripheral vascular disease* [69].

Neuropathy: More than 60% of diabetic foot ulcers are the result of underlying neuropathy [69, 70]. The development of neuropathy in affected patients has been shown in animal and *in vitro* models to be a result of hyperglycemia-induced metabolic abnormalities [71-73]. One of the more commonly described mechanisms of action is the polyol pathway [72]. In the development of neuropathy, the hyperglycemic state leads to an increase in action of the enzymes aldose reductase and sorbitol dehydrogenase. This results in the conversion of intracellular glucose to sorbitol and fructose. The accumulation of these sugar products results in a decrease in the synthesis of nerve cell myo inositol, required for normal neuron conduction.

Additionally, the chemical conversion of glucose results in a depletion of nicotinamide adenine dinucleotide phosphate stores, which are necessary for the detoxification of reactive oxygen species and for the synthesis of the vasodilator nitric oxide. There is a resultant increase in oxidative stress on the nerve cell and an increase in vasoconstriction leading to ischemia, which will promote nerve cell injury and death.

Hyperglycemia and oxidative stress also contribute to the abnormal glycation of nerve cell proteins and the inappropriate activation of protein kinase C, resulting in further nerve dysfunction and ischemia.

Neuropathy in diabetic patients is manifested in the motor, autonomic, and sensory components of the nervous system [69]. Damage to the innervations of the intrinsic foot muscles leads to an imbalance between flexion and extension of the affected foot. This produces anatomic foot deformities that create abnormal bony prominences and pressure points, which gradually cause skin breakdown and ulceration.

Autonomic neuropathy leads to a diminution in sweat and oil gland functionality. As a result, the foot loses its natural ability to moisturize the overlying skin and becomes dry and increasingly susceptible to tears and the subsequent development of infection.

The loss of sensation as a part of peripheral neuropathy exacerbates the development of ulcerations. As trauma occurs at the affected site, patients are often unable to detect the insult to their lower extremities. As a result, many wounds go unnoticed and progressively worsen as the affected area is continuously subjected to repetitive pressure and shear forces from ambulation

and weight bearing.

Vascular Disease: Peripheral arterial disease (PAD) is a contributing factor to the development of foot ulcers in up to 50% of cases [74, 75]. It commonly affects the tibial and peroneal arteries of the calf. Endothelial cell dysfunction and smooth cell abnormalities develop in peripheral arteries as a consequence of the persistent hyperglycaemic state [71]. There is a resultant decrease in endothelium-derived vasodilators leading to constriction. Further, the hyperglycemia in diabetes is associated with an increase in thromboxane A2, a vasoconstrictor and platelet aggregation agonist, which leads to an increased risk for plasma hypercoagulability [76]. There is also the potential for alterations in the vascular extracellular matrix leading to stenosis of the arterial lumen [76].

Moreover, smoking, hypertension, and hyperlipidemia are other factors that are common in diabetic patients and contribute to the development of PAD [67]. Cumulatively, this leads to occlusive arterial disease that results in ischemia in the lower extremity and an increased risk of ulceration in diabetic patients.

Diabetic peripheral neuropathy is one of the most common predisposing factors leading to foot ulceration and is the most common cause of hospital admissions in patients with diabetes. People with diabetes are 50 times more likely to develop a foot ulcer than non-diabetics (IWGDF 2007) [79].

Neuropathy, mechanical stresses, and angiopathy are the major etiopathological factors in the development of foot ulcers in people with diabetes [85]. Diabetic peripheral neuropathy is a heterogeneous disorder that includes mononeuropathies, polyneuropathies, plexopathies, and radiculopathies [86]. As diabetic neuropathy frequently leads to foot ulcer, it is recommended to screen all individuals with diabetes at least annually [87]. Of all the complications of diabetes, those that occur in the foot are considered the most preventable.

The Major challenges Relating to Diabetes Foot are

1. Foot ulceration is common, affecting up to 25% of patients with diabetes during their lifetime [49].
2. Over 85% of lower limb amputations are preceded by foot ulcers and Diabetes remains a major cause of non-traumatic amputation across the world with rates being as much as 15 times higher than in the non-diabetic population.
3. Strategies aimed at preventing foot ulcers are cost-effective and can even be cost saving if increase education and effort are focused on those patients with recognized risk factors for the development of foot problem [89].
4. Prevention is the first step towards solving diabetic foot problems. Although it was estimated that an ankle is lost to diabetes somewhere in the world every 30 seconds, a more important fact is that up to 85% of all amputations in diabetes should be preventable [88].
5. Diabetes is now the most common cause of Charcot neuroarthropathy in Western countries, another condition that should be generally preventable [90].

Factors increasing the Risk of Diabetic Foot Ulceration

The risk factors for each of the above mentioned complications are:

Peripheral Neuropathy

Unmodifiable risk factors:

1. Disease duration
2. Age
3. Heredity
4. Gender (most common in men)
5. Race (e.g. African Americans)
6. Height

Modifiable risk factors:

1. Hyperglycemia
2. High blood pressure (mainly diastolic)
3. Dyslipidemia
4. Abnormal microcirculation (modifiable with anticoagulant treatment)
5. Use of alcohol

Peripheral Vascular Disease

1. Smoking
2. Dyslipidemia
3. Hypertension
4. Atherosclerosis
5. Peripheral neuropathy
6. Gender (most common in men)
7. Obesity
8. Way of life
9. Hyperglycemia
10. Hyperinsulinemia
11. Homocysteine.

Successful diagnosis and treatment of patients with DFUs involves a holistic approach that includes:

- Optimal diabetes control
- Effective local wound care
- Infection control
- Pressure relieving strategies
- Restoring pulsatile blood flow

Treatment Goals of Diabetic Foot Wound

- To improve function and quality of life.
- To control infection.
- To maintain health status.
- To prevent amputation.
- To reduce costs.

Prevention Programmes of Diabetic Foot Ulcers

Most of the ulcerations heal, 70% of the cases recur, frequently progressing to unavoidable limb amputation. Several factors

are involved in the development of this process which include Peripheral Neuropathy (PN), Peripheral Vascular Disease (PVD), limited joint mobility and repeated trauma from abnormal load distribution on the foot [13, 14]. However, this unfavorable progression can be modified provided effective preventive measures are adopted such as adequate guidance regarding:

- 1) Lack of sensitivity and/or presence of peripheral vascular disease and its implications,
- 2) Hygiene and moisturizing practices,
- 3) Use of adequate footwear (when indicated),
- 4) Mandatory daily self-care (self-examination).

These guidelines should be extended to family members and caregivers as many diabetic patients at risk for complications such as obesity are frequently impaired for fulfilling self-examination. Therefore, preventive and care practices should provide guidance on the correct way to wash, dry and moisturize the feet as well as on how to cut nails and not trim cuticles, or use pumice stones and similar abrasive objects, use appropriate footwear, perform regular foot and footwear inspection and never walk barefoot [15-17].

Evidently, steps need to be taken towards two basic directions:

- A. Creation of Health Structures, Health Professionals Awareness.
- B. Training the patients.

The Diabetic Foot World Organization recommends: yearly examinations of the low foot for every diabetic and training in self care, every 3 months examination for patients with an ulcer, neuropathy or malformation history. In cases of ulcer relapse the patient needs to visit a specialized doctor within 2 weeks.

Studying the medical records one year before and three months after the seminar has shown improvement, as far as practical care of the diabetic foot is concerned, on matters of:

1. Patients' training by health professionals on care of the diabetic foot.
2. Diagnosis and record of the peripheral vascular disease.
3. Record of the practices of self care of the diabetic foot.
4. Reference to the appropriate special podiatrists and diabetologists whenever necessary.

The American "Orthopedic Foot and Ankle" Society has developed specific guidelines for the health professionals aiming at the prevention of diabetic foot ulcers.

Some of those are:

- A. Screening examinations for

- Evaluation of peripheral neuropathy
- Evaluation of skin integrity
- Evaluation of ulcers and wounds
- Malformations
- Vascular insufficiency
- Special shoes

- B. Training patients in order to self examine their low foot and for special practices of self care. Individual special care should be

taken for peripheral neuropathy patients.

C. Treatment: to be determined by the level of risk as defined by the presence of peripheral neuropathy, malformations and the history of ulcers. It combines:

- Training patients
- Orthoses
- Special shoes
- Charters of continuous care of nails and skin.

Ulcer care consists of:

1. Calluses care
2. Surgical cleaning of infected or dead tissues
3. Dressing
4. Member discharge.

Diabetic Foot Health Training Program

Basic steps to be taken by every patient:

1. Observing the blood glucose levels and maintaining it within the natural limit
2. Proper eating and exercising
3. Quit smoking [101].

Instructions for diabetic foot care:

1. Since you could not be able to feel minor injuries, check your feet every morning, before you put on your shoes. Do the same each night before you go to bed. Check for red spots, wounds, blisters, even for small ones. Do not forget to check between your toes and your sole. If you are unable to do so yourself, ask someone else to help you.
2. Keep your toe nails cut. If you can do so yourself, use a nail-clipper and polish the edges with a nail-file. Do not cut the nails in a round shape as this may lead the nail entering the skin. If you are unable to do so yourself, ask a specialist to do it.
3. Ask your doctor to examine your foot every 3 to 6 months, or more often if there are problems. Do not try to extract calluses on your own. Every time you visit your doctor take your shoes off in order to remind him to check your feet.
4. Take foot-baths every day using warm water (29–35°C). Do not use hot water as it can cause burns without you realising it. Dry your feet well when you finish, especially between your toes. Apply hydrating cream on the top and bottom of your feet, but not between your toes.
5. If you can, keep your feet up while seating. Do not cross your legs to your knees or ankles, since this obstructs blood circulation. Move your heel and toes up and down 2 or 3 times a day for 5 min. Do not use warm blankets, as they may cause burns without you realising it [101].

About shoes and socks:

1. Always wear comfortable shoes that fit your foot well. Make sure there is enough space for your toes. Avoid sandals, open-front shoes or shoes with laces between the toes. Never walk barefoot.
2. Wear clean cotton socks every day and make sure that they are not tight under your knee. If you wear panty hose make sure they

are not too tight and they do not have design or holes that could rub against your skin.

3. Every day you must inspect your shoes before wearing them to make sure there are not any other objects inside them that could hurt your feet.

4. If you observe an injury do not try to take care of it on your own. Seek your doctor's assistance. Remember that it is not just a simple wound and it therefore requires special care and attention [101].

Patient Foot Care Education

Patient education should be an integral part of management and prevention. Treatment outcomes will be directly influenced by patients' knowledge of their own medical status, their ability to care for their wound and concordance with their treatment [95, 96]. Patients with diabetes and high-risk foot conditions should be educated regarding their risk factors and appropriate management. A non-judgmental assessment of a person's current knowledge and care practices should be obtained first.

Patients at risk should understand the implications of the loss of protective sensation, the importance of foot monitoring on a daily basis, the proper care of the foot, including nail and skin care, and the selection of appropriate footwear. The patient's understanding of these issues and their physical ability to conduct proper foot surveillance and care should be assessed. Patients with neuropathy should be advised to break in new shoes gradually to minimize the formation of blisters and ulcers. Patients with visual difficulties, physical constraints preventing movement, or cognitive problems that impair their ability to assess the condition of the foot and to institute appropriate responses will need other people, such as family members, to assist in their care. Patients at low risk may benefit from education on foot care and footwear.

The development of an ulcer is a major event and a sign of progressive disease. It is important to discuss the impact of the ulcer on life expectancy with the patient. Education should be offered on ways in which patients can help to improve outcomes by making lifestyle changes (eg smoking cessation) and working with practitioners to reduce the risk of recurrence and life-threatening complications [95].

A Cochrane systematic review found that educating people with diabetes about the need to look after their feet improves their foot care knowledge and behaviour in the short term. There was insufficient evidence that education alone, without any additional preventive measures, effectively reduces the occurrence of ulcers and amputations [97].

Goals of Patient Education

Patient education should be a **planned life-long process**, starting from the point of diagnosis and remaining as an essential component of diabetes care.

For both Type 1 and Type 2 diabetes the aim of patient education should be to optimise:

1. Knowledge of diabetes and the aims of its management and the prevention of complications [91].

2. Motivation and attitudes to self-care - potential barriers to self-care need to be assessed and addressed.
3. Ability to define and agree personal health-care targets and develop strategies for meeting them.
4. Behaviours which interact with diabetes management.
5. Empowerment in self management and communicating with the professional members of the healthcare team effectively.

Improving Self-care Skills and Behaviour Change

Whilst medical treatments are important, long-term outcomes are also influenced by choices that people with diabetes make about diet, physical activity and other health-related behaviours. These choices will in part reflect knowledge about their condition and their ability to monitor it [98].

It is therefore necessary for patient education to incorporate both:

- Information giving/awareness raising, mainly to enable initial management of diabetes, but should also be on-going to meet the variable needs of the individual and match life events.
- Supporting behaviour change and self-care skills to ensure better outcomes in the long-term.

Maintaining behaviour change is essential in achieving positive longer-term benefit [105-107] and this is a challenging area which requires the use of appropriate skills, such as adult learning skills and a range of psychosocial methods. Interventions using enhanced methods including visual aids, behavioural learning and patient-centred techniques (eg patient participation) produce larger effects than those using didactic methods [107]. Acknowledging people's feelings and concerns and helping them to set achievable goals are achieved by using a patient-centred approach and motivating behavioural change.

Facilitating self-management involves helping individuals to find their own best combination of behaviours. It is suggested that educator skills and training should include motivation methods, psychology, peer review and working with groups [98].

Supportive Tools and Framework to Enable Effective Education and Self-Management

Information material: Patients and healthcare professionals need to have access to adequate information resources that are:

1. Accurate and consistent.
2. Timely.
3. In the appropriate format:
 - a. Diversity in preferences for information presentation needs to be recognised.
 - b. The education material has to be available in the appropriate language and needs to be acceptable in cultural terms.
 - c. Information should be in a suitable format to meet any cognitive or physical impairment needs.

Self-management plan: It would be ideal if an individualised plan can be prepared and filled in by both patient and 'educator' at different stages and it can be kept with the person's diabetes health-care record file for personal care plans to help empower people with diabetes and patient held/accessed records to

facilitate self-care.

Follow-up contact: eg: take-home material, brief follow-up calls, support groups or regular follow-up visits, will be critical to maintaining the success of any educational intervention. Obviously this will depend on adequate staffing and sufficient time assigned for education services.

Patient Counselling

Patient counseling refers to the process of providing information, advice and assistance to help patients use their medications appropriately.

Patient counselling is the part of educating the patient towards diseases and proper use of medication. In this part is also counsel awareness to diseases and preventive measures.

Counselling instructions for diabetes patients: At and shortly after diagnosis, basic facts are necessary for the initial management of diabetes and patient education should provide the minimum instruction to obtain control over the new situation and basic supportive information on:

1. The nature, symptoms and outcomes of diabetes and risks associated with the condition [91].
2. Identifying and addressing fears, anxieties and preconceived ideas of diabetes and answering questions [91].
3. Healthy eating.
4. Physical activity.
5. Initiating treatment whether tablets or insulin - with insulin, guidance with self-injecting.
6. Awareness of acute complications such as hypoglycaemia and to deal with them.
7. Self-monitoring.
8. Confidence building for self-management [91].

In the months following diagnosis, continuing education will expand on these topics covered initially and in addition will cover elements essential to living with diabetes such as:

1. Ensuring optimal and appropriate use of therapy, whether tablets or insulin.
2. Managing effectively nutrition and physical activity.
3. Being able to detect and manage acute complications of therapy such as hypoglycaemia.
4. Being aware of late complications preventing, detecting and treating them, and of the need for regular assessment.
5. Being able to monitor, record and act appropriately on the results of therapy.
6. Making appropriate responses to unpredicted and new problems.
7. Dealing with special situations, eg. travelling, illness.
8. Making appropriate lifestyle changes (eg. smoking, alcohol, drugs) and dealing adequately with stress.
9. Dealing with psychological aspects of living with diabetes.
10. Being aware of pre-conception care and implications of pregnancy.
11. Accessing healthcare professionals when needed.

Family members, partners and care takers should be included in the education process as appropriate. The nature and level

of information, as well as the timing of when provided, will ultimately be determined by the assessed needs of the individual and the format of the educational intervention [92-94].

Dietary advice:

1. Importance of diet in diabetes management and cardiovascular risk factor reduction, and role for achieving optimum metabolic control.
2. Recommendations for a healthy diet: guidance on recommended daily intakes of carbohydrate, fats, protein, fibre, nutritional labels etc.
3. Dietary assessment and addressing specific dietary needs.
4. Consideration and discussion of cultural/religious needs.
5. Discussion of dietary changes/ meal planning/cooking and recipe modification.
6. Benefits and strategies for weight management if appropriate.
7. Alcohol: drinking guidelines, risk of hypoglycaemia etc.

Incorporating physical activity into lifestyle:

1. Importance of physical activity in control of blood glucose and blood pressure, improving insulin sensitivity and general health.
2. Appropriate types of activity and personal goals.
3. Sport and leisure: safety and regulations, precautions, adjusting food and insulin, preventing and treating hypos, more frequent monitoring.

Literature Survey

1. *Bijoy et al.*, [102] 2012. Conducted a study on “knowledge assessment and patient counseling on diabetic foot care”. The study concludes that the well structured foot care education by a clinical pharmacist have a significant impact in the prevention of recurrent foot infections and complications which may lead to amputation due to the lack of diabetic foot care knowledge.
2. *Murtaza Gondal, et al.*, [103] 2007. Conducted a study on “evaluation of knowledge and practices of foot care in patients with chronic type 2 diabetes mellitus”. The results of this study demonstrate patients with diabetes who are at risk for the development of diabetic foot ulcers should receive ongoing foot-specific patient education.
3. *Hanu George, et al.*, [79] 2013. Conducted a study on “foot care knowledge and practices and the prevalence of peripheral neuropathy among people with diabetes attending a secondary care rural hospital in southern india” The study concludes that knowledge and practices regarding foot care. Male gender, low education, and lesser duration of diabetes are associated with poor knowledge scores. The prevalence of diabetic peripheral neuropathy is high.
4. *Nima Madanchi, et al.*, [104] 2013. Conducted a study on “Who are diabetic foot patients? A descriptive study on 873 patients” The study concludes that Number of patients with DFU is increasing. Recurrence of DFU is a major point of concern which underscores the importance of patient education to prevent secondary ulcers. As a result, educating medical and nursing personnel, applying screening and prevention guidelines, and allocating more resources are of great importance regarding treatment of DFU patients.
5. *Beverly Meaney*, [105] 2012. Demonstrated a study on “DIABETIC FOOT CARE: PREVENTION IS BETTER

THAN CURE” the study concludes that patient’s understanding, knowledge and awareness in relation to these problems which needs attention. Constant surveillance of their own feet is necessary for patients to help avoid complications and early detection of any problems will help maintain their independence and health.

6. *Maria I Anselmo, et al.*, [106] 2010. Conducted a study on “The effectiveness of educational practice in diabetic foot: a view from Brazil” The study concludes that the planned and multidisciplinary educational approach enabled high compliance of the ulcer prevention care needed in diabetic patients at risk for complications. the use of footwear provided was extremely low, demonstrating that the issue of its acceptability should be further and carefully addressed.
7. *Syed Fahd Shah, et al.*, [107] 2011. Conducted a study on “Evaluation and Management of Diabetic Foot: A Multicenter study conducted at Rawalpindi, Islamabad” The study concludes that Effective glycemic control, timely hospital admissions, appropriate surgical/medical treatment along with patient education in foot care, can decrease morbidity and mortality due to diabetic foot disease.
8. *Konstantikaki V. RN, MSc, PhD*, [108] 2008. Demonstrated a study on “The role of primary care in the prevention of diabetic foot amputations” the study concludes that the prevention of ulcers through the implementation of health education programs on the population and through training programs for the health professionals. It is estimated that 85% of low amputations of the diabetic foot could be prevented with the growth of the development health education programs.
9. *O.O. DESALU, et al.*, [109] 2011. Conducted a study on “diabetic foot care: self reported knowledge and practice among patients attending three tertiary hospital in nigeria” the study concludes that study has highlighted the gaps in the knowledge and practice of foot care in DM patients and underscores the need for an educational programme to reduce of diabetic foot complication.
10. *Nadia Saeed*, [110] 2010. Demonstrated a study on “Frequency of patients with diabetes taking proper foot care according to international guidelines and its impact on their foot health” this study concluded that This study demonstrated that very few patients with diabetes were practicing proper foot care according to the ADA Guidelines. High risk behaviours were common which could lead to preventable foot complications.
11. *Wipa Sae-Sia, et al.*, [111] 2013. Conducted A study on “effect of a self-management support program on diabetic foot care behaviors” The result indicates that a five-week SM program effectively enhanced DFCB. Thus, nurses are recommended to apply this program in improving DFCB in order to prevent diabetic foot ulcers or other foot complications.
12. *Nikhil P. Hawal, et al.*, [112] 2012. Conducted a study on “Knowledge, attitude and behaviour regarding self-care practices among type 2 diabetes mellitus patients residing in an urban area of South India” this Results revealed good attitude but poor knowledge and practices (behaviour) towards diabetes. We concluded that there is a need for structured programmes to improve attitude and practices of diabetic patients to promote better compliance towards diet, exercise and drug regimen.
13. *Thomas C, et al.*, [113] 2008. A study was to assess the “knowledge and practices among the diabetic patients regarding foot care”. This study conclude that About one third of diabetic patients had poor knowledge about foot care and only very few patients had good practices for foot care.

14. *Shaibi GQ, et al., [114]* 2008. A study was done to assess the disease “knowledge in patients attending a diabetic foot clinic”. This simple quality initiative reinforces the notion that patients with diabetes who are at risk for the development of diabetic foot ulcers should receive ongoing foot-specific patient education.

15. *Ray JG, et al., [115]* 2008. A study was done to determine knowledge and practice of foot care in people with diabetes. The results highlight areas where efforts to improve knowledge and practice may contribute to the prevention of foot ulcers and amputation.

16. *Maty SC, et al., [116]* 2008. The study was to “evaluate an intensive diabetes foot care education program at high risk for foot ulcer”. This study conclude that the patients also reported improved satisfaction with foot care; Intensive education program improved the foot care knowledge and behavior of high-risk patients.

17. *T. Haas, et al., [117]* 1994. The study was conducted to “assess the knowledge and practices regarding foot care”. Only one-third of the patients had received diabetic education. The best results were obtained in educated and younger patients. Our findings demonstrate that elderly diabetics can benefit from an education program and prove a real insufficiency in current education of elderly diabetics.

18. *Sayeed MA, et al., [118]* 2007. The study was conducted to “assessed the knowledge of the diabetic patient on foot care research”. This study conclude that could be taken is that the clients knew about the care that they must have with their feet to don't have complications, but the "own care" is not well done.

19. *Um HD, et al., [119]* 2008. A study was conducted to “assess the effectiveness of patient education on the prevention of foot ulcers in patients with diabetes mellitus”. this study conclude that Weak evidence suggests that patient education may reduce foot ulceration and amputations, especially in high-risk patients.

20. *Pnepet FH, et al., [120]* 2008. A study on “Identification of risk factors for the development of type 2 diabetes mellitus is a necessary step in planning prevention programmes for diabetes mellitus”. This study conclude that Inactivity alcohol usage and excess weight appear to be dominant risk factors for development of type 2 DM in this group.

21. *Weiss R, et al., [121]* 2008. This descriptive study was conducted in an Arab-Muslim town to assess the level of “knowledge, beliefs, and concerns about diabetes care”. This study conclude that there is a need for interventions focused on overcoming these barriers to improve diabetes treatment and self-care in this population.

22. *Wang J, et al., [122]* 2008. A study was conducted at a Veterans Administration Hospital to “evaluate patient capability for self-management” found that over 35 per cent of the patients interviewed lacked any formal training. The results indicate the need for systematic analysis of patient knowledge and the evaluation of training programs.

23. *Qi L, et al., [123]* 2008. The study was developed to explore the “psychological and behavioral factors that may influence both the incidence of chronic wounds and their progression”. This study conclude that patients may find it difficult understanding the rationale underlying prevention and treatment of foot ulcers; ulcerated patients may find it difficult to engage in the management of their foot ulcer outside consultations.

24. *Parichebr Kafaje, et al., [124]* 2012. A study conducted on ” Evaluation of Patients' Education on Foot Self-Care Status in Diabetic Patients” this study conclude that foot self-care education could improve knowledge and performance of patients about various foot problems, and was significantly important in

preventing ulcers.

25. *M. Riaz, et al., [125]* 2013. A study conducted on “Health related quality of life in patients with diabetes using SF-12 questionnaire” this study conclude that diabetes is associated with decreased levels of both physical and emotional wellbeing. The deterioration in quality of life was more evident in the physical than in the emotional wellbeing. Diabetes education results in improved quality of life.

Experimental Work

Study Design and Study Period

It is a prospective cohort study and the study would be conducted over a period of 6 Months.

Source of Data

Diabetic patients attending Medical Outpatient and inpatient Departments in Rajiv Gandhi institute of medical sciences (RIMS) Government Hospital, Kadapa.

Sample Size

Diabetic patients who fulfill the inclusive criteria will be considered as the sample and the sample size is 150-200.

Inclusion Criteria

The study includes,

Male and female patients who were diagnosed with type I and type II diabetes mellitus aged between 31 to 75 years.
Diabetic patients able to understand Telugu or English.
Diabetic patients who are willing to participate.

Exclusion Criteria

The study excludes,

Diabetic patients who are not willing to participate.
Patient with cognitive impairment, visual or hearing loss.
Pregnancy, planned pregnancy, or lactation.

Method of Collection of Data

Patients will be selected from department of general medicine wards (I.P/O.P). The required baseline will be collected from diabetes I.P/O.P in the patients or their relatives. Data collection proforma by chart review method with a well-suited to assess the results. Selection of patients will be identified by seeing their diagnosis which is conformed by the physician.

Informed consent is obtained from the each patient before participating the study (ANNEXUE-4). Data collection from the patients will include 4 parts.

PART - 1: In this part we are taking the information about case history from the patient or from their case sheet. This will includes the Demographic data, If he/she is a known case of diabetes and duration of diabetes, habits (Smoker/Alcoholic/

food habits/physical activity), family history, and the treatment. (ANNEXURE-1)

PART - 2: In this part we are going to list out the responses of patients to our questionnaire form about the knowledge of patient towards the disease and drugs.

It contains the questions up to 20 and give them score and divided in to poor, fair and good categories based on their scores. (ANNEXURE-2)

PART - 3: Here we are going to know the knowledge about

patient's disease through obtaining the questionnaire responses.

The questionnaire forms are prepared based on the patients mentality, attitudes, locality and that would be prepared by the researchers. The questionnaire had questions which were of the close ended type and comprised of yes/no/don't know variety of answers. The structured questionnaires were administered to the parents who completed them on the spot. Those who could not read and write were assisted by the researchers.

PART - 4: After completing the information we will give the standard patient counseling regarding disease condition,

Table 5.1. Patients demographics distribution.

S.NO	Characteristic	Total number of patients <i>n</i> = 198(100%)
1	Gender	
	Male	112 (57%)
	Female	86 (43%)
2	Age group in (years)	
	31-45	74(37%)
	46-60	89(45%)
	61-75	35(18%)
3	Marital status	
	Single	8(4%)
	Married	164(83%)
	Widowed	26(13%)
4	Religion	
	Hindu	137(69%)
	Muslim	44(22%)
	Others	17(9%)
5	Level of education	
	Illiterate	87(44%)
	Primary	43(22%)
	Secondary	28(14%)
	Graduate	40(20%)
6	Income	
	<5000	72(37%)
	5000-10000	61(31%)
	>10000	65(32%)
7	Smoking	
	Yes	40(20%)
	No	158(80%)
8	Duration of diabetes	
	<1 yr	44(22%)
	1-5yrs	103(52%)
	5-10yrs	32(16%)
	10+yrs	19(10%)
9	Physical activity	
	Yes	93(47%)
	No	105(53%)
10	Family history of diabetes	
	Yes	107(54%)
	No	91(46%)

Figure 5.1. Distribution of knowledge among patients.

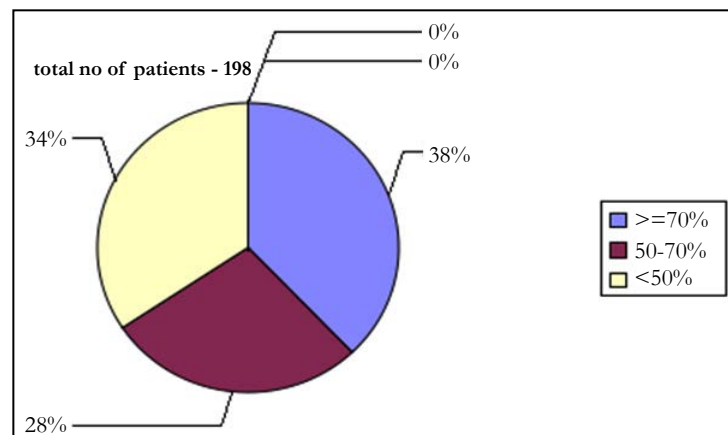


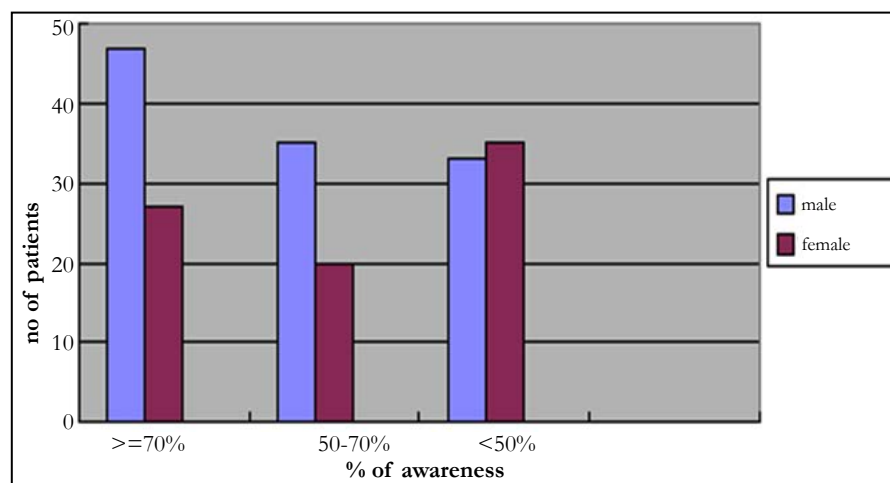
Table 5.2. Distribution of knowledge among patients.

Scoring (Out of 20)	Knowledge
>=70% (Good) (14 - 20)	75(38%)
50-69% (Satisfactory) (10 -13)	55(28%)
<50% (Poor) (<10)	68 (34%)
Total 198	100

Table 5.3. Patients socio-demographics with knowledge distribution.

S.NO	SOCIODEMOGRAPHIC FACTORS	Percentage of knowledge			P-value
		>=70%	50-70%	<50%	
		N=75(38%)	N=55(28%)	N=68(34%)	
Gender					
1	Male	44 (22%)	35(18%)	33 (17%)	0.2186
	Female	31(15%)	20 (10%)	35(18%)	
Age group (years)					
2	31-45	35(17%)	24(12%)	15(7%)	0.0237
	46-60	27(14%)	22(11%)	40(20%)	
	61-75	13(7%)	9(5%)	13(7%)	
Marital status					
3	Single	5(3%)	-	3(1%)	0.4174
	Married	61(31%)	48(24%)	55(28%)	
	Widowed	9(5%)	7(3%)	10(5%)	
Level of education					
4	illiterate	11(6%)	19(10%)	56(28%)	<0.0001
	Primary	16(8%)	20(10%)	7(4%)	
	Secondary	17(9%)	10(5%)	1(0.5%)	
	graduate	31(16%)	6(2.5%)	3(1%)	
Religion					
5	hindu	56(29%)	40(20%)	41(21%)	0.3459
	muslim	13(7%)	12(6%)	19(10%)	
	others	6(2%)	3(1%)	8(4%)	
Smoking					
6	Yes	16(8%)	11(6%)	13(7%)	0.9462
	No	59(30%)	44(22%)	55(27%)	
Duration of diabetes					
7	<1 yr	20(10%)	12(6%)	12(6%)	0.6509
	1-5yrs	33(17%)	31(16%)	39(20%)	
	5-10yrs	13(6%)	7(3%)	12(6%)	
	10+yrs	9(5%)	5(2.5%)	5(2.5%)	
Physical activity					
8	Yes	45(22.5%)	25(13%)	23(12%)	0.0072
	No	30(15%)	30 (15%)	45(22.5%)	
Income					
9	<5000	11(6%)	17(9%)	44(22%)	<0.0001
	5000-10000	23(12%)	21(11%)	17(9%)	
	>10000	41(20%)	17 (9%)	7(2%)	
Family history of diabetes					
10	Yes	43(22%)	28(14%)	36(18%)	0.7491
	No	32(16%)	27(14%)	32(16%)	

Figure 5.2. Distribution of knowledge with gender.



complications, smoking, foot wear, nail care, foot care, food habits and exercises were given to the selected patient with poor and satisfactory knowledge and this is very useful to patients and practitioners for better patient care. Patient information leaflets about patient counseling brochures are distributed to the patient for better understand and further beneficials (ANNEXURE-3).

Statistical Analysis

1. Graph Pad Prism 5.04 software. Simple frequency distribution has to be generated for dependent and independent variables.
2. Chi-square test was applied to find out statistical significance of socio-economic factors on knowledge regarding foot care in diabetic patients.

Experimental Results

A total of 198 diabetic patients were included in our study during a period of six months. The demographic detail among the subjects reveals that 112(57%) were males while 86(43%) were females.

Among the subjects 72(37%) had an income of <5000, 61(31%) had 5000-10000 per month and 65(32%) had their income more than 10000 per month. Based on the literacy status 87(44%) of subjects were illiterates, 43(22%) were primary education level and 28(14%) were secondary education level and 40(20%) were graduation level. Patients were asked about their smoking habits 158(80%) were non-smokers and 40(20%) were smokers. Patients' demographic details are shown in Table 5.1.

Among the patients 75(38%) had good knowledge, 55(28%) had satisfactory and 68(34%) had poor knowledge regarding diabetic foot care (Table 5.2).

Effect of Gender on Patient Awareness

The association between demographic variables and foot care knowledge was found out by using chi-square test. In association with sex and knowledge, 44(22%) male patients had good, 35(18%) had satisfactory and 33(17%) had poor knowledge. In females 31(15%) had good, 20(10%) had satisfactory and 35(18%) had poor knowledge. The chi-square value obtained was 3.014.

Sex was not significantly associated in relation to knowledge ($p=0.2186$) regarding foot care.

Effect of Age on Patient Awareness

Subjects under the age group 31-45 years, 35(17%) had good, 24(12%) had satisfactory and 15(7%) had poor knowledge. The age group of 46-60 years shows that 27(14%) had good, 22 (11%) had satisfactory and 40(20%) had poor knowledge. Under the age group 61-75 years, 13(7%) of them had good, 9(5%) had satisfactory and 13 (7%) had poor knowledge. The chi-square value obtained was 3.199 ($p=0.0237$) which has statistically no association with knowledge regarding foot care.

Effect of Income on Patient Awareness

Regarding income and knowledge on those subjects with a monthly income of <5000, 11(6%) had good, 17(9%) had satisfactory and 44(22%) had poor knowledge. Those with monthly income 5000-10000, 23(12%) of them had good, 21(11%) had satisfactory and 17(9 %) had poor knowledge. On patients with income >10000, 41(20%) of them had good, 17(9%) had satisfactory and 7(2%) had poor knowledge. The chi-square value obtained was 49.55 ($p<0.0001$) which is highly significant. Income per month has shown statistical association with the knowledge regarding foot care.

Effect of Literacy Status on Patient Awareness

Among the subjects who are illiterates, 11(6%) had good, 19(10%) had satisfactory and 56(28%) had poor knowledge. In primary education level subjects 16(8%) had good knowledge, 20(10%) had satisfactory and 7(4%) had poor knowledge. In secondary level subjects 17(9%) had good knowledge, 10(5%) had satisfactory and 1(0.5%) had poor knowledge. It was found that 31(16%) of graduation level subjects had good, 6(2.5%) had satisfactory and 3(1%) had poor knowledge. It shows a chi-square value of 91.05., the role of education has shown an impact on the knowledge ($p<0.0001$) regarding foot care.

Effect of Family History of Diabetes on Patient Awareness

Subjects with a family history of foot diabetes 43(22%) had good

Figure 5.3. Distribution of knowledge with age.

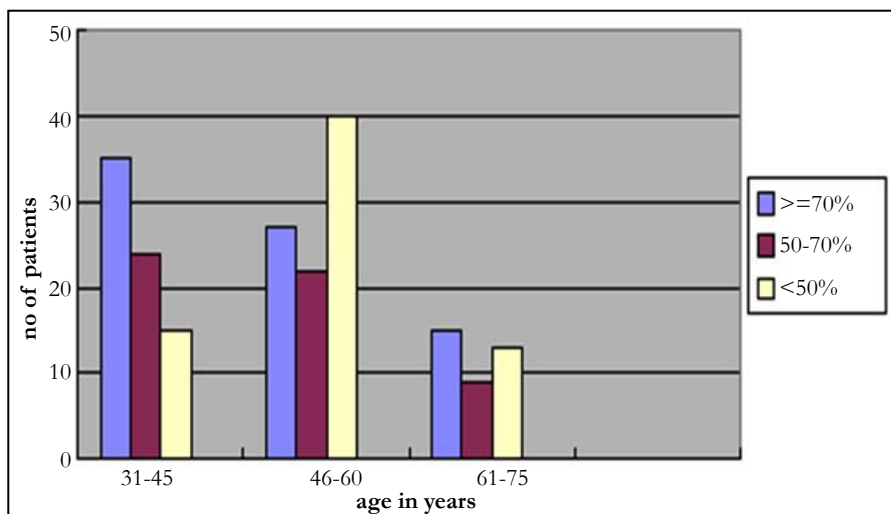


Figure 5.4. Distribution of knowledge with income.

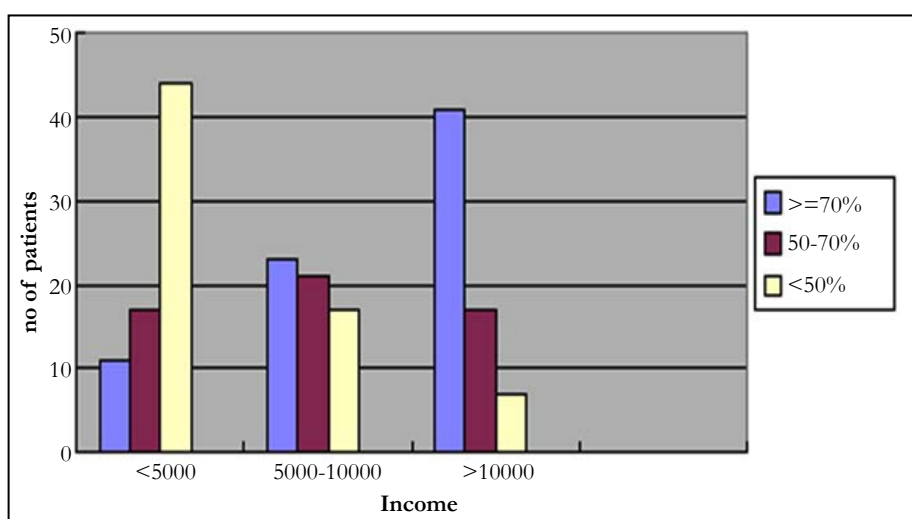
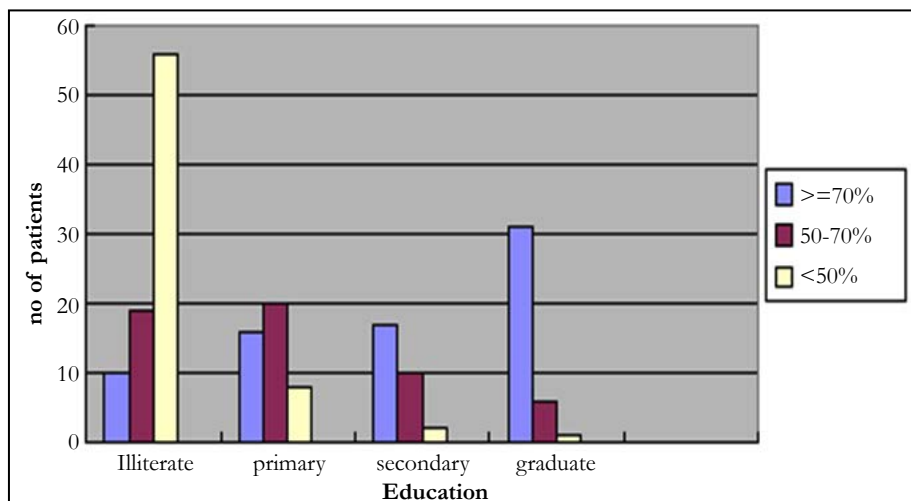


Figure 5.5. Distribution of knowledge with education.



knowledge, 28(14%) had satisfactory knowledge and 36(18%) had poor knowledge. In subjects without family history of diabetes 32(22%) had good knowledge, 28(14%) had satisfactory knowledge and 32(16%) had poor knowledge. History of foot infection has shown statistically no association with the knowledge ($p= 0.646$) regarding foot care.

Effect of Religion on Patient Awareness

In association with Religion and knowledge, 56(29%) hindu patients had good, 40(20%) had satisfactory and 4(2%) had poor knowledge. In muslims 13(7%) had good, 12(6%) had satisfactory and 19(10%) had poor knowledge. In others 6(2%) had good, 3(1%) had satisfactory and 8(4%) had poor knowledge. The chi-

Figure 5.6. Distribution of knowledge with family history of diabetes.

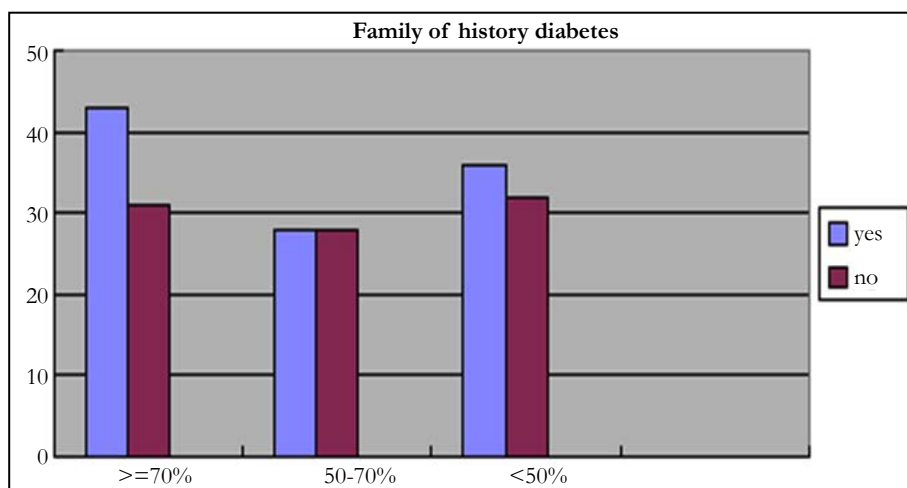


Figure 5.7. Distribution of knowledge with religion.

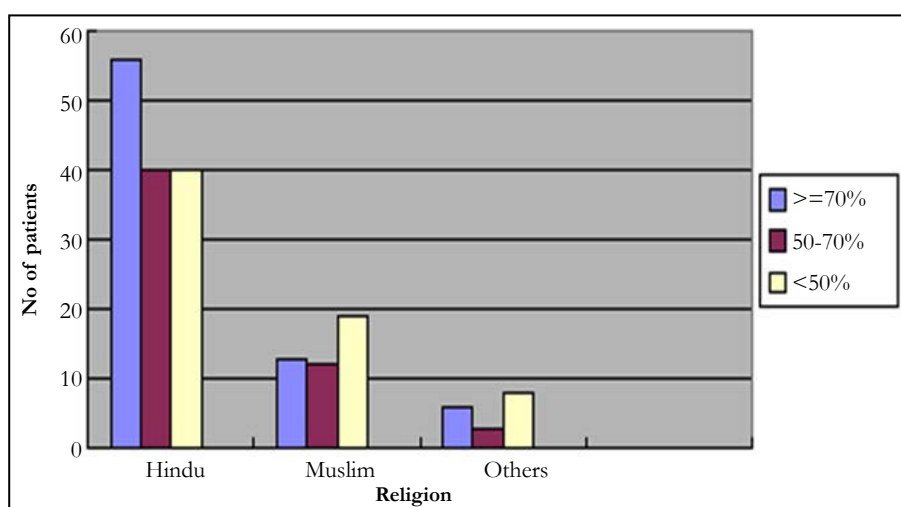
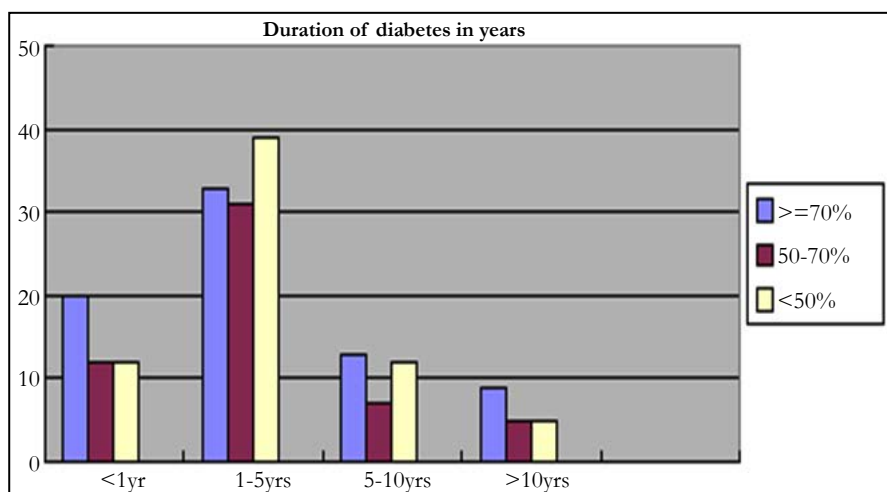


Figure 5.8. Distribution of knowledge with duration of diabetes.



square value obtained was 4.472. Religion was not significantly associated in relation to knowledge ($p=$) regarding foot care.

Effect of Duration of Diabetes on Patient Awareness

Subjects with duration of diabetes 20(10%) had good knowledge in <1year and 12(6%) had satisfactory knowledge and 12(6%) had poor knowledge. In subjects with 1-5 years diabetes 33(17%)

had good knowledge, 31(16%) had satisfactory knowledge and 39(20%) had poor knowledge. In subjects with 5-10 years diabetes 13(6%) had good, 7(3%) had satisfactory and 12(6%) had poor knowledge. In subjects with more than 10 years diabetes 9(5%) had good, 5(2.5%) had satisfactory and 5(2.5%) had poor knowledge. History of duration of diabetes has shown statistically no association with the knowledge ($p= 0.6509$.) regarding foot care.

Figure 5.9. Distribution of knowledge with smoking status.

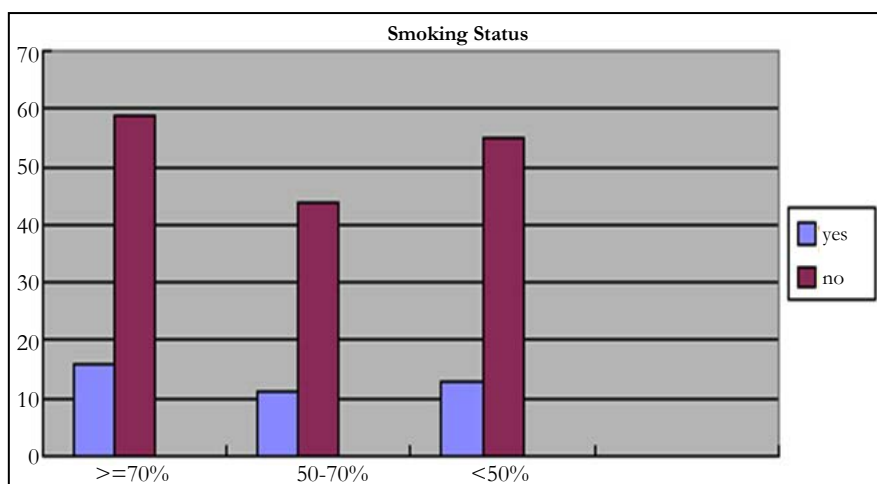
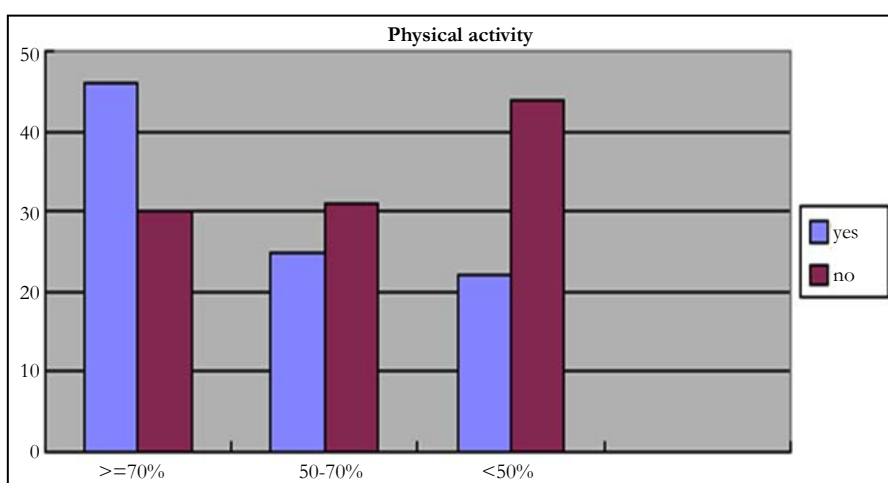


Figure 5.10. Distribution of knowledge with physical activity.



Effect of Smoking Status on Patient Awareness

Subjects with a smoking history 16(8%) had good knowledge, 11(6%) had satisfactory knowledge and 13(7%) had poor knowledge. In subjects without smoking history 59(8%) had good knowledge, 44(22%) had satisfactory knowledge and 55(27%) had poor knowledge. History of smoking has shown statistically no association with the knowledge (p= 0.646) regarding foot care.

Effect of Physical Activity on Patient Awareness

Subjects with a history of physical activity 45(25%) had good knowledge, 25(13%) had satisfactory knowledge and 23(12%) had poor knowledge. In subjects without physical activity 30(15%) had good knowledge, 30(15%) had satisfactory knowledge and 45(22.5%) had poor knowledge. History of physical activity has shown statistically association with the knowledge (p=0.646) regarding foot care.

We are given counseling to the poor and satisfactory patients about diabetic foot care according to who guidelines.

Discussion Of Results

Diabetic foot care is essential for preventing complications of diabetic neuropathy and vascular insufficiency. A substantial

proportion of diabetic patients are not offered adequate foot care, even in the presence of major risk factors for lower limb complications. In our study we found that patient knowledge and practices are strongly related to literacy status, income and foot care education.

In this study sex has no relationship regarding knowledge on foot care, the results in the above referred study conducted by Seema Hasnain et al., are consistent with our study. Low scores of foot care were common in males than in females. However this can be explained on the basis that in this study there were more males than females [123].

Out of 198 patients majority were males and belong to the age group between 40-60 years. This shows that diabetic foot problem is mainly concentrated on elderly which increases the morbidity in them due to diabetes.

In a study conducted by C. H. Ding et al., to assess the knowledge of diabetic and non diabetic patients in Klinik Kesihatan Seremban found that higher education and higher income were associated with higher knowledge score [124]. In this study also the income level which is mostly influenced by occupation has shown a positive relationship with foot care knowledge.

A study conducted by Seema Hasnain et al., to assess the

knowledge and practices of the diabetic patients on foot care. It concluded that literacy has significant association with the knowledge related to foot care.

Regarding knowledge, only 29% respondents had good information (>70%) about foot care and formal education had a role in better knowledge about foot care [123]. In this study, there were 34 (46.5%) respondents who were illiterate and their score was <50% and 21(31.5%) respondents whose educational qualifications were matric and above matric, their score regarding knowledge was more than >70%. almost same we found in our study.

A study by Fabio Batista et al., suggests by their study that a few diabetic patients were appear to be adequately educated on potential morbidity of diabetic foot ulcers or preventive measures to avoid foot specific morbidity [125]. The data's obtained from their study supports that coordinated program combining preventive foot specific patient education, skin and nail care and foot wear decrease the diabetic foot disease. The present study also reveals that patient education regarding these aspects of foot care in poor knowledge was improved. Thus the foot care education has shown an impact on knowledge regarding foot care.

Patients with diabetes who are at risk for the development of diabetic foot ulcers should receive ongoing foot-specific patient education. This information needs to be constantly reinforced, as retention drops with time. Preventive practices must be stressed and reinforced so those without foot ulcers should not develop ulcers. A diabetic educator should be present in each diabetes outpatient clinic and in medical indoor departments.

By our study we can say that to provide a better foot care to the diabetic patient a clinical pharmacist can play pioneer role which is much more important in today's health scenario in India where due to overload of patients in hospitals or clinics a physician is not able to provide these vital information due to his/her busy schedule.

Summary

Our study shows that among the patients 75(38%) had good knowledge, 55(28%) had satisfactory and 68(34%) had poor knowledge regarding diabetic foot care.

The awareness and attitude regarding the diabetic foot care is poor among diabetic patients with low income and illiterates. This may cause lower extremity complications and recurrent foot infections, if left untreated which ultimately lead to amputation. From the study it is identified that the well structured patient counseling by a clinical pharmacist regarding diabetic foot care can be beneficial in the improvement of their knowledge.

Research Outcome

1. From this study we can say that to provide a better foot care to the diabetic patient a clinical pharmacist can play pioneer role which is much more important in today's health scenario in India where due to overload of patients in hospitals or clinics a physician is not able to provide these vital information due to his/her busy schedule.

2. This study provides Counselling to the poor and satisfactory knowledge patients about diabetic foot care according to WHO guidelines.

References

- American Diabetes Association. Report of the expert committee on the diagnosis and classification of diabetes mellitus. *Diabetes Care*. 1997 Jul;20(7):1183-97. PubMed PMID: 9203460.
- Genuth S, Alberti KG, Bennett P, Buse J, DeFronzo R, Kahn R, et al. Follow-up report on the diagnosis of diabetes mellitus. *Diabetes Care*. 2003 Nov;26(11):3160-7. PubMed PMID: 14578255.
- Carpenter MW, Coustan DR. Criteria for screening tests for gestational diabetes. *Am J Obstet Gynecol*. 1982 Dec 1;144(7):768-73. PubMed PMID: 7148898.
- Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes Care*. 2004 May;27(5):1047-53. PubMed PMID: 15111519.
- Diabetes in India current status.
- World Health Organization. World Health Organization Diabetes Fact Sheet.
- Diwakar B. Diabetes and operation. *THE HINDU* [Internet]. 2008 Nov 14;03.
- Frykberg RG, Armstrong DG, Giurini J, Edwards A, Kravette M, Kravitz S, et al. Diabetic foot disorders. A clinical practice guideline. For the American College of Foot and Ankle Surgeons and the American College of Foot and Ankle Orthopedics and Medicine. *J Foot Ankle Surg*. 2000;Suppl:1-60. PubMed PMID: 11143819.
- Konstantikaki V. The role of primary care in the prevention of diabetic foot amputations. *Int J Care Sci*. 2008 Jan 1;1(1):26-33.
- Reiber GE. Epidemiology of foot ulcers and amputations in the diabetic foot. *Diabet foot*. 2001.
- Slovenkai MP. Foot problems in diabetes. *Med Clin North Am*. 1998 Jul 1;82(4):949-71.
- Apelqvist J, Larsson J, Agardh CD. Long-term prognosis for diabetic patients with foot ulcers. *J Intern Med*. 1993 Jun;233(6):485-91. PubMed PMID: 8501419.
- Mantey I, Foster AV, Spencer S, Edmonds ME. Why do foot ulcers recur in diabetic patients?. *Diabet Med*. 1999 Mar;16(3):245-9. PubMed PMID: 10227571.
- Pecoraro RE, Reiber GE, Burgess EM. Pathways to diabetic limb amputation: basis for prevention. *Diabetes Care*. 1990 May;13(5):513-21. PubMed PMID: 2351029.
- Edmonds ME, Foster AV. Diabetic foot ulcers. *BMJ*. 2006 Feb 18;332(7538):407-10. PubMed PMID: 16484268.
- Singh N, Armstrong DG, Lipsky BA. Preventing foot ulcers in patients with diabetes. *JAMA*. 2005 Jan 12;293(2):217-28. PubMed PMID: 15644549.
- Holzemer WL, editor. *Improving Health through nursing research*. John Wiley & Sons; 2009 Aug 25.
- Singh D. Diabetic foot: It's time to share the burden. *J Vasc Surg*. 2006;15(6):533-4.
- Zgonis T, Stapleton JJ, Girard-Powell VA, Hagino RT. Surgical management of diabetic foot infections and amputations. *AORN J*. 2008 May;87(5):935-46. PubMed PMID: 18512303.
- Lobmann R. Diabetic foot syndrome. *Internist (Berl)*. 2011 May;52(5):539-48. doi: 10.1007/s00108-010-2733-z. PubMed PMID: 21476091.
- Snyder RJ, Hanft JR. Diabetic foot ulcers--effects on quality of life, costs, and mortality and the role of standard wound care and advanced-care therapies in healing: a review. *Ostomy Wound Manage*. 2009 Nov 1;55(11):28-38. PubMed PMID: 19934461.
- Bakker K, Riley PH. The year of the diabetic foot. *Diabetes Voice*. 2005 Mar;50(1):11-4.
- Sitonen OI, Niskanen LK, Laakso M, Sitonen JT, Pyörälä K. Lower-extremity amputations in diabetic and nondiabetic patients. A population-based study in eastern Finland. *Diabetes Care*. 1993 Jan;16(1):16-20. PubMed PMID: 8422771.
- Trautner C, Haastert B, Giani G, Berger M. Incidence of lower limb amputations and diabetes. *Diabetes Care*. 1996 Sep;19(9):1006-9. PubMed PMID: 8875099.
- Kristian N. Every thirty seconds a limb is lost somewhere in the world as a consequence of diabetes. *Lancet* 2005;366(9498):1719-1724.
- Goldner MG. The fate of the second leg in the diabetic amputee. *Diabetes*. 1960 Mar-Apr;9:100-3. PubMed PMID: 13850722.
- Boulton AJ, Vileikyte L, Ragnarson-Tennvall G, Apelqvist J. The global burden of diabetic foot disease. *Lancet*. 2005 Nov 12;366(9498):1719-24.

- PubMed PMID: 16291066.
- [28]. Tabatabaei-Malazy O, Mohajeri-Tehrani MR, Madani P, Heshmat R, Larijani B. Prevalence of effective factors on peripheral neuropathy. *IJDLD*. 2010;9(3):241-8.
- [29]. Khatib O, Malazy OT. Prevention and public approach to diabetic foot. *Iran J Diabet Metab*. 2007 Sep 15;7(2):123-33.
- [30]. International Working Group on the diabetic foot: International Diabetes Federation Report. International Diabetes Federation.
- [31]. Boulton AJ. The pathogenesis of diabetic foot problems: an overview. *Diabetes*. 1997 Sep;46 Suppl 2:S58-61. PubMed PMID: 9285501.
- [32]. Wieman TJ. Principles of management: the diabetic foot. *Am J Surg*. 2005 Aug;190(2):295-9. PubMed PMID: 16023449.
- [33]. Reiber GE, Vileikyte LO, Boyko ED, Del Aguila M, Smith DG, Lavery LA, et al. Causal pathways for incident lower-extremity ulcers in patients with diabetes from two settings. *Diabetes Care*. 1999 Jan;22(1):157-62. PubMed PMID: 10333919.
- [34]. Frykberg RG, Lavery LA, Pham H, Harvey C, Harkless L, Veves A. Role of neuropathy and high foot pressures in diabetic foot ulceration. *Diabetes Care*. 1998 Oct;21(10):1714-9. PubMed PMID: 9773736.
- [35]. Reiber GE. Epidemiology of foot ulcers and amputations in the diabetic foot. *Diabet Foot*. 2001.
- [36]. Reiber G, Lipsky B, Gibbons G. The burden of diabetic foot ulcers. *The American journal of surgery*. 1998 Aug 1;176(2):5S-10S. PubMed PMID: 9777967.
- [37]. Most RS, Sinnock P. The epidemiology of lower extremity amputations in diabetic individuals. *Diabetes Care*. 1983 Jan-Feb;6(1):87-91. PubMed PMID: 6839926.
- [38]. Calle-Pascual AL, Redondo MJ, Ballesteros M, Martinez-Salinas MA, Diaz JA, De PM, et al. Nontraumatic lower extremity amputations in diabetic and non-diabetic subjects in Madrid, Spain. *Diabetes Metab*. 1997 Dec;23(6):519-23. PubMed PMID: 9496558.
- [39]. Adler AI, Boyko EJ, Ahroni JH, Smith DG. Lower-extremity amputation in diabetes. The independent effects of peripheral vascular disease, sensory neuropathy, and foot ulcers. *Diabetes Care*. 1999 Jul;22(7):1029-35. PubMed PMID: 10388962.
- [40]. Ramachandran A. Specific problems of the diabetic foot in developing countries. *Diabetes Metab Res Rev*. 2004 May-Jun;20 Suppl 1:S19-22. PubMed PMID: 15150808.
- [41]. van Houtum WH, Lavery LA, Harkless LB. The impact of diabetes-related lower-extremity amputations in The Netherlands. *J Diabetes Complications*. 1996 Nov-Dec;10(6):325-30. PubMed PMID: 8972384.
- [42]. Bakker K, Riley PH. The year of the diabetic foot. *Diabetes Voice*. 2005 Mar;50(1):11-4.
- [43]. Levin ME. Foot lesions in patients with diabetes mellitus. *Endocrinol Metab Clin North Am*. 1996 Jun;25(2):447-62. PubMed PMID: 8799709.
- [44]. Boyko EJ, Ahroni JH, Smith DG, Davignon D. Increased mortality associated with diabetic foot ulcer. *Diabet Med*. 1996 Nov;13(11):967-72. PubMed PMID: 8946155.
- [45]. Pliskin MA, Todd WF, Edelson GW. Presentations of diabetic feet. *Arch Fam Med*. 1994 Mar;3(3):273-9. PubMed PMID: 8180719.
- [46]. Gibbons GW. The diabetic foot: amputations and drainage of infection. *J Vasc Surg*. 1987 May;5(5):791-3. PubMed PMID: 3553624.
- [47]. Goodridge D, Trepman E, Embil JM. Health-related quality of life in diabetic patients with foot ulcers: literature review. *J Wound Ostomy Continence Nurs*. 2005 Nov-Dec;32(6):368-77. PubMed PMID: 16301902.
- [48]. Tennvall GR, Apelqvist J. Prevention of diabetes-related foot ulcers and amputations: a cost-utility analysis based on Markov model simulations. *Diabetologia*. 2001 Nov;44(11):2077-87. PubMed PMID: 11719840.
- [49]. Larijani B, Afshari M, Darvishzadeh F, Bastanhigh MH, Pajouhi M, Baradarjaili R, et al. Lower limb amputation in patients with diabetic foot ulcer: A 22 year review. *MJIRC*. 2006;8:21-24.
- [50]. Nather A, Bee CS, Huak CY, Chew JL, Lin CB, Neo S, et al. Epidemiology of diabetic foot problems and predictive factors for limb loss. *J Diabetes Complications*. 2008 Mar-Apr;22(2):77-82. doi: 10.1016/j.jdiacomp.2007.04.004. PubMed PMID: 18280436.
- [51]. Widatalla AH, Mahadi SE, Shawer MA, Elsayem HA, Ahmed ME. Implementation of diabetic foot ulcer classification system for research purposes to predict lower extremity amputation. *Int J Diabetes Dev Ctries*. 2009 Jan;29(1):1-5. doi: 10.4103/0973-3930.50707. PubMed PMID: 20062556.
- [52]. Shojaeifard A, Khorghami Z, Larijani B. Independent risk factors for amputation in diabetic foot. *Int J Diabetes Dev Ctries*. 2008 Apr;28(2):32-7. doi: 10.4103/0973-3930.43096. PubMed PMID: 19902045.
- [53]. Thomson FJ, Veves A, Ashe H, Knowles EA, Gem J, Walker MG, et al. A team approach to diabetic foot care--the Manchester experience. *The Foot*. 1991 Jul 1;1(2):75-82.
- [54]. Williams R, Airey M. The size of the problem: epidemiological and economic aspects of foot problems in diabetes. *Foot Diabet*. 2000 Apr 19:3-17.
- [55]. Pendsey SP. Epidemiological aspects of Diabetic Foot. *Int J Diab Dev Countries*. 1994;14:37-38.
- [56]. Apelqvist J, Bakker K, van Houtum WH, Nabuurs-Franssen MH, Schaper NC. International consensus and practical guidelines on the management and the prevention of the diabetic foot. International Working Group on the Diabetic Foot. *Diabetes Metab Res Rev*. 2000 Sep-Oct;16 Suppl 1:S84-92. PubMed PMID: 11054895.
- [57]. Mohan V, Premalatha G, Sastry NG. Peripheral vascular disease in non-insulin-dependent diabetes mellitus in south India. *Diabetes Res Clin Pract*. 1995 Mar;27(3):235-40. PubMed PMID: 7555607.
- [58]. Fernando DJ, Siribaddana S, Perera N, Perera S, De Silva D. The prevalence of macrovascular disease and lipid abnormalities amongst diabetic patients in Sri Lanka. *Postgrad Med J*. 1993 Jul;69(813):557-61. PubMed PMID: 8415344.
- [59]. Pendsey SP. Peripheral Vascular disease: an Indian scenario. *Diabetol Croat*. 1998:27-4.
- [60]. Pendsey SP. Diabetic Foot Syndrome. *RSSDI Textbook of Diabetes Mellitus*. 2008;2:959-72.
- [61]. Migdalis IN, Kourti A, Zachariadis D, Voudouris G, Samartzis M. Peripheral vascular disease in newly diagnosed non-insulin-dependent diabetic. *Int Angiol*. 1992 Jul-Sep;11(3):230-2. PubMed PMID: 1460358.
- [62]. Marinelli MR, Beach KW, Glass MJ, Primozich JF, Strandness DE. Non-invasive testing vs clinical evaluation of arterial disease: a prospective study. *JAMA*. 1979 May 11;241(19):2031-4. PubMed PMID: 430797.
- [63]. Walters DP, Gatling W, Mullee MA, Hill RD. The prevalence, detection, and epidemiological correlates of peripheral vascular disease: a comparison of diabetic and non-diabetic subjects in an English community. *Diabet Med*. 1992 Oct;9(8):710-5. PubMed PMID: 1395462.
- [64]. Janka HU, Standl E, Mehnert H. Peripheral vascular disease in diabetes mellitus and its relation to cardiovascular risk factors: screening with the Doppler ultrasonic technique. *Diabetes Care*. 1980 Mar-Apr;3(2):207-13. PubMed PMID: 7389542.
- [65]. Palumbo PJ, Melton LJ. Peripheral vascular disease and diabetes. *Diabet Am*. 1995;2:401-8.
- [66]. Armstrong DG, Lavery LA. Diabetic foot ulcers: prevention, diagnosis and classification. *Am Fam Physician*. 1998 Mar 15;57(6):1325-32, 1337-8. PubMed PMID: 9531915.
- [67]. Kelkar P. Diabetic neuropathy. In *Seminars in neurology*; 2005. p.168-173
- [68]. Bowering CK. Diabetic foot ulcers. Pathophysiology, assessment, and therapy. *Can Fam Physician*. 2001 May;47:1007-16. PubMed PMID: 11398715.
- [69]. Dyck PJ, Davies JL, Wilson DM, Melton LJ, O'Brien PC. Risk factors for severity of diabetic polyneuropathy: intensive longitudinal assessment of the Rochester Diabetic Neuropathy Study cohort. *Diabetes Care*. 1999 Sep;22(9):1479-86. PubMed PMID: 10480512.
- [70]. Zochodne DW. Diabetic polyneuropathy: an update. *Curr Opin Neurol*. 2008 Oct;21(5):527-33. doi: 10.1097/WCO.0b013e32830b84cb. PubMed PMID: 18769245.
- [71]. Feldman EL, Russell JW, Sullivan KA, Golovoy D. New insights into the pathogenesis of diabetic neuropathy. *Curr Opin Neurol*. 1999 Oct;12(5):553-63. PubMed PMID: 10590892.
- [72]. Simmons Z, Feldman EL. Update on diabetic neuropathy. *Curr Opin Neurol*. 2002 Oct;15(5):595-603. PubMed PMID: 12352003.
- [73]. Huijberts MS, Schaper NC, Schalkwijk CG. Advanced glycation end products and diabetic foot disease. *Diabetes Metab Res Rev*. 2008 May-Jun;24 Suppl 1:S19-24. doi: 10.1002/dmrr.861. PubMed PMID: 18442180.
- [74]. Boulton A, Armstrong D, Albert S, Frykberg R, Hellman R, Kirkman MS, et al. Comprehensive foot examination and risk assessment. *Endocr Pract*. 2008 Jul-Aug;14(5):576-83. PubMed PMID: 18753100.
- [75]. Paraskevas KI, Baker DM, Pompella A, Mikhailidis DP. Does diabetes mellitus play a role in restenosis and patency rates following lower extremity peripheral arterial revascularization? A critical overview. *Ann Vasc Surg*. 2008 May-Jun;22(3):481-91. doi: 10.1016/j.avsg.2007.12.012. PubMed PMID: 18411027.
- [76]. International Working Group on the Diabetic Foot. International consensus on the diabetic foot and practical guidelines on the management and the prevention of the diabetic foot. Amsterdam: The Netherlands; 2011.
- [77]. International Diabetes Federation Clinical Guidelines Taskforce. Global guideline for type 2 diabetes. Brussels: IDF. 2012.
- [78]. Meaney B. Diabetic foot care: prevention is better than cure. *J Ren Care*. 2012 Feb;38 Suppl 1:90-8. doi: 10.1111/j.1755-6686.2012.00276.x. PubMed PMID: 22348368.
- [79]. Margolis DJ, Malay DS, Hoffstad OJ, Leonard CE, MaCurdy T, Tan Y, Molina T, de Nava KL, Siegel KL. Economic burden of diabetic foot ulcers and amputations. In *Data Points Publication Series [Internet]* 2011 Mar 8. Agency for Healthcare Research and Quality (US).

- [80]. Stockl K, Vanderplas A, Tafesse E, Chang E. Costs of lower-extremity ulcers among patients with diabetes. *Diabetes Care*. 2004 Sep;27(9):2129-34. PubMed PMID: 15333473.
- [81]. Dang CN, Boulton AJ. Changing perspectives in diabetic foot ulcer management. *Int J Low Extrem Wounds*. 2003 Mar;2(1):4-12. PubMed PMID: 15866821.
- [82]. Pinzur MS, Slovenkai MP, Trepman E, Shields NN. Guidelines for diabetic foot care: recommendations endorsed by the Diabetes Committee of the American Orthopaedic Foot and Ankle Society. *Foot Ankle Int*. 2005 Jan;26(1):113-9. PubMed PMID: 15680122.
- [83]. The diabetic foot. Position statement. International Diabetes Federation [Internet].
- [84]. Herber OR, Schnepf W, Rieger MA. A systematic review on the impact of leg ulceration on patients' quality of life. *Health Qual Life Outcomes*. 2007 Jul 25;5:44. PubMed PMID: 17651490.
- [85]. American Diabetes Association. Standards of medical care in diabetes-2006. *Diabetes Care*. 2006 Jan;29 Suppl 1:S4-42. PubMed PMID: 16373931.
- [86]. Chandalia HB, Singh D, Kapoor V, Chandalia SH, Lamba PS. Footwear and foot care knowledge as risk factors for foot problems in Indian diabetics. *Int J Diabetes Dev Ctries*. 2008 Oct;28(4):109-13. doi: 10.4103/0973-3930.45269. PubMed PMID: 20165597.
- [87]. Calle-Pascual AL, Durán A, Benedí A, Calvo MI, Charro A, Diaz JA, et al. A preventative foot care programme for people with diabetes with different stages of neuropathy. *Diabetes Res Clin Pract*. 2002 Aug;57(2):111-7. PubMed PMID: 12062856.
- [88]. Boulton AJ. The diabetic foot: from art to science. The 18th Camillo Golgi lecture. *Diabetologia*. 2004 Aug;47(8):1343-53. PubMed PMID: 15309286.
- [89]. Munro NM, McIntosh C, Walker R, Cavan DA. What is important in diabetes education?. *Diabetic Medicine Supplement*. 2003 Apr 1;20:77-8.
- [90]. Diabetes UK. Recommendations for the management of diabetes in primary care. 2000.
- [91]. Mensing C, Boucher J, Cypress M, Weinger K, Mulcahy K, Barta P, et al. National standards for diabetes self-management education. Task Force to Review and Revise the National Standards for Diabetes Self-Management Education Programs. *Diabetes Care*. 2000 May;23(5):682-9. PubMed PMID: 10834430.
- [92]. MacKinnon M. *Providing Diabetes Care in General Practice: a practical guide to integrated care*. Class Publishing Ltd; 2002.
- [93]. Young MJ, McCardle JE, Randall LE, Barclay JI. Improved survival of diabetic foot ulcer patients 1995-2008: possible impact of aggressive cardiovascular risk management. *Diabetes Care*. 2008 Nov;31(11):2143-7. doi: 10.2337/dc08-1242. PubMed PMID: 18697900.
- [94]. Mulder G, Armstrong D, Seaman S. Standard, appropriate, and advanced care and medical-legal considerations: Part one-diabetic foot ulcerations. *Wounds*. 2003 Apr;15(4):92-106.
- [95]. Dorresteijn JA, Kriegsman DM, Assendelft WJ, Valk GD. Patient education for preventing diabetic foot ulceration. *Cochrane Database Syst Rev*. 2012 Oct 17;10:CD001488. doi: 10.1002/14651858.CD001488.pub4. PubMed PMID: 23076893.
- [96]. Melville A, Richardson R, Lister-Sharp D, McIntosh A. Complications of diabetes: renal disease and promotion of self-management. *BMJ Quality & Safety*. 2000 Dec 1;9(4):257-63.
- [97]. Griffin S, Kinmonth AL, Skinner C, Kelly J. *Educational and psychosocial interventions for adults with diabetes*. London: British Diabetic Association. 1999.
- [98]. Clark M, Hampson SE. Implementing a psychological intervention to improve lifestyle self-management in patients with type 2 diabetes. *Patient Educ Couns*. 2001 Mar;42(3):247-56. PubMed PMID: 11164324.
- [99]. Konstantikaki V. The role of primary care in the prevention of diabetic foot amputations. *International Journal of Caring Sciences*. 2008;1(1):26.
- [100]. Feba B, Vikas RC, Dhandapani C, Geetha K, Vijayakumar A. Knowledge assessment and patient counseling on diabetic foot care. *Indian journal of pharmacy practice*. 2012 Apr;5(2):11.
- [101]. Gondal M, Bano U, Moin S, Masood R, Ahmad A. Evaluation of knowledge and practices of foot care in patients with chronic type 2 diabetes mellitus. *JPMI*. 2011 Jul 18;21(2).
- [102]. George H, Rakesh PS, Krishna M, Alex R, Abraham VJ, George K, et al. Foot care knowledge and practices and the prevalence of peripheral neuropathy among people with diabetes attending a secondary care rural hospital in southern India. *J Family Med Prim Care*. 2013 Jan;2(1):27-32. doi: 10.4103/2249-4863.109938. PubMed PMID: 24479039.
- [103]. Madanchi N, Tabatabaei-Malazy O, Pajouhi M, Heshmat R, Larijani B, Mohajeri-Tehrani MR. Who are diabetic foot patients? A descriptive study on 873 patients. *J Diabetes Metab Disord*. 2013 Jul 5;12:36. doi: 10.1186/2251-6581-12-36. PubMed PMID: 23826947.
- [104]. Anselmo MI, Nery M, Parisi MC. The effectiveness of educational practice in diabetic foot: a view from Brazil. *Diabetol Metab Syndr*. 2010 Jun 29;2(1):45. doi: 10.1186/1758-5996-2-45. PubMed PMID: 20587043.
- [105]. Shah SF, Hameed S, Khawaja Z, Abdullah T, Waqar SH, Zahid MA. Evaluation and management of diabetic foot: a multicenter study conducted at Rawalpindi, Islamabad. *Ann Pak Inst Med Sci*. 2011;7(4):233-7.
- [106]. Desalu OO, Salawu FK, Jimoh AK, Adekoya AO, Busari OA, Olokoba AB. Diabetic foot care: self reported knowledge and practice among patients attending three tertiary hospitals in Nigeria. *Ghana Med J*. 2011 Jun;45(2):60-5. PubMed PMID: 21857723.
- [107]. Saeed N, Zafar J, Atta A. Frequency of patients with diabetes taking proper foot care according to international guidelines and its impact on their foot health. *JPMA. J Pak Med Assoc*. 2010 Sep;60(9):732-5. PubMed PMID: 21381579.
- [108]. Wipa SS, Khomapak M, T Kurniawan. Effect of a self-management support program on diabetic foot care behaviors. *International Journal of Research in Nursing*. 2013;4(1):14-21.
- [109]. Hawal NP, Shivaswamy MS, Kambar S, Patil S, Hiremath MB. Knowledge, attitude and behaviour regarding self-care practices among type 2 diabetes mellitus patients residing in an urban area of South India. *International Multidisciplinary research journal*. 2012;2(12).
- [110]. Thomas C, Hyppönen E, Power C. Obesity and type 2 diabetes risk in midadult life: the role of childhood adversity. *Pediatrics*. 2008 May;121(5):e1240-9. doi: 10.1542/peds.2007-2403. PubMed PMID: 18450866.
- [111]. Shaibi GQ, Goran MI. Examining metabolic syndrome definitions in overweight Hispanic youth: a focus on insulin resistance. *J Pediatr*. 2008 Feb;152(2):171-6. doi: 10.1016/j.jpeds.2007.08.010. PubMed PMID: 18206684.
- [112]. Ray JG, Mohllajee AP, van Dam RM, Michels KB. Breast size and risk of type 2 diabetes mellitus. *CMAJ*. 2008 Jan 29;178(3):289-95. doi: 10.1503/cmaj.071086. PubMed PMID: 18227448.
- [113]. Maty SC, Lynch JW, Raghunathan TE, Kaplan GA. Childhood socioeconomic position, gender, adult body mass index, and incidence of type 2 diabetes mellitus over 34 years in the Alameda County Study. *Am J Public Health*. 2008 Aug;98(8):1486-94. doi: 10.2105/AJPH.2007. PubMed PMID: 18556612.
- [114]. Haas T, Svacina S, Pav J, Hovorka R, Sucharda P, Sonka J. Risk calculation of type 2 diabetes. *Comput Methods Programs Biomed*. 1994 Jan;41(3-4):297-303. PubMed PMID: 8187472.
- [115]. Sayeed MA, Mahtab H, Khanam PA, Latif ZA, Banu A, Khan AK. Prevalence of diabetes and impaired fasting glucose in urban population of Bangladesh. *Bangladesh Med Res Counc Bull*. 2007 Apr;33(1):1-12. PubMed PMID: 18246729.
- [116]. Um HD, Lee DC, Lee SY, Kim YS. A prospective cohort study of exercise and the incidence of type 2 diabetes in impaired fasting glucose group. *J Prev Med Public Health*. 2008 Jan;41(1):45-50. PubMed PMID: 18250605.
- [117]. Puepset FH, Ohwovoriole AE. Prevalence of risk factors for diabetes mellitus in a non-diabetic population in Jos, Nigeria. *Niger J Med*. 2008 Jan-Mar;17(1):71-4. PubMed PMID: 18390138.
- [118]. Weiss R, Kaufman FR. Metabolic complications of childhood obesity: identifying and mitigating the risk. *Diabetes Care*. 2008 Feb;31 Suppl 2:S310-6. doi: 10.2337/dc08-s273. PubMed PMID: 18227502.
- [119]. Wang J, Luben R, Khaw KT, Bingham S, Wareham NJ, Forouhi NG. Dietary energy density predicts the risk of clinically incident type 2 diabetes: the EPIC-Norfolk study. *Diabetes Care*. 2008 Nov;31(11):2120-5. doi: 10.2337/dc08-1085. PubMed PMID: 18689693.
- [120]. Qi L, Hu FB, Hu G. Genes, environment, and interactions in prevention of type 2 diabetes: a focus on physical activity and lifestyle changes. *Curr Mol Med*. 2008 Sep;8(6):519-32. PubMed PMID: 18781959.
- [121]. Kafaie P, Noorbala MT, Soheilikhah S, Rashidi M. Evaluation of patients' education on foot self-care status in diabetic patients. *Iran Red Crescent Med J*. 2012 Dec;14(12):829-32. doi: 10.5812/ircmj.1138. PubMed PMID: 23482390.
- [122]. Riaz M, Rehman RA, Hakeem R, Shaheen F. Health related quality of life in patients with diabetes using SF-12 questionnaire. *J Diabetol*. 2013 Jun;2(1).
- [123]. Hasnain S, Sheikh NH. Knowledge and practices regarding foot care in diabetic patients visiting diabetic clinic in Jinnah Hospital, Lahore. *J Pak Med Assoc*. 2009 Oct;59(10):687-90. PubMed PMID: 19813683.
- [124]. Ding CH, Teng CL, Koh CN. Knowledge of diabetes mellitus among diabetic and non-diabetic patients in Klinik Kesihatan Seremban. *Med J Malaysia*. 2006 Oct;61(4):399-404. PubMed PMID: 17243515.
- [125]. Batista F, Pinzur MS, Monteiro AC, Taira R. Education for diabetic foot. *Einstein*. 2009 Jan 1;7(1 Pt 1):24-7.