



**Knowledge and Practice Regarding Prevention of Foot Ulcer Among Patients with
Type 2 Diabetes Mellitus**

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ABSTRACT

Foot ulceration is the common major end point among diabetic complications. In order to control foot ulcer complications, patient's knowledge and practice play an important role. Proper foot care and early recognition and management of risk factors prevent foot ulcer of diabetic patient. This descriptive correlational study aimed to identify the relationship between knowledge and practice regarding prevention of foot ulcer among patients with diabetes mellitus attending the Diabetic Center in Rangpur, Bangladesh. One hundred and twenty subjects attending out-patient department were willing to participate and signed a consent form. The research instrument was a set of questionnaires developed by the researcher, which consisted of three parts; Demographic Data and Health characteristics Form, Knowledge Regarding Prevention of Foot Ulcer Questionnaire, and Practice Regarding Prevention of Foot Ulcer Questionnaire. KR-20 coefficient was used to test for internal consistency of Knowledge Regarding Prevention of Foot Ulcer Questionnaire and the coefficient was .71. Cronbach's alpha coefficient was used to test for internal consistency reliability of Practice Regarding Prevention of Foot Ulcer Questionnaire and Cronbach's alpha coefficient was .81.

Data were collected from November 2009 to January, 2010. Frequency, percentage, mean, standard deviation, and Pearson's correlation were employed for data analysis.

The mean of the total knowledge score was at high level ($M = 84.55$) and the mean of the total practice score was at low level ($M = 61.47$). The result revealed a small but significant correlation between total knowledge and total practice ($r = .33$, $p < 0.01$). In addition, there was a significantly positive relationship between total practice and sub-dimensions of knowledge: exercise/physical activity and foot care knowledge ($r = .23$, $p < 0.05$ and $r = .30$, $p < 0.01$, respectively). To improve patients' practice about prevention of foot ulcer, nurses should assess their practice, identify obstacles, and help improve practice skill.

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CHAPTER 1

INTRODUCTION

Background and Significance of the Problem

Diabetes is a group of diseases marked by high levels of blood glucose resulting from defects in insulin production, insulin action, or both (World Health Organization, 2005). Diabetes can lead to serious complications and premature death, but people suffering from diabetes can take steps to control the disease and reduce the risk of complications (World Health Organization). Foot complications in persons with diabetes have become an increasingly significant public health concern in both developed and developing world (Wu, Driver, Wrobel, & Armstrong, 2007). It is estimated that the developing countries will bear the brunt of diabetes epidemics in the 21st century (Sayeed et al., 2003). Bangladesh is a developing country and its population is about 150 millions. In Bangladesh, about one million diabetic patients were registered in various project and affiliated association (Ibrahim, 2008).

The duration of diabetes increased the risk of neuropathy (Duby, Campbell, Setter, White, & Rasmussen, 2004). Foot ulceration is the common major end point among diabetic complications and diabetic neuropathy and peripheral vascular disease are the main etiologic factors in foot ulceration (Rathur & Boulton, 2007). Risk factors of foot ulcers are local skin changes, cardiovascular changes, autonomic neuropathy, motor neuropathy and sensory neuropathy (Rocha, Zanetti, & Snatos, 2009). Foot ulcer develops in approximately 15% of people with diabetes and is a preceding factor in approximately 85% percent of lower limb amputations

(Delmas, 2008). Foot ulcers causes are substantial emotional, physical, productivity, and financial losses. The most costly and feared consequence of a foot ulcer is limb amputation which occurs 10 to 30 times more often in diabetic patients (Singh, Armstrong, & Lipsky, 2005).

In Bangladesh, the majority of people with diabetic foot disease also suffer from diabetic peripheral neuropathy (Sayeed, Banu, Khan, & Hussain, 2005). Intensive knowledge may be effective in the prevention of amputation or foot ulceration (Sayeed et al.). Many patients lack the knowledge about diet and exercise which should be followed in case of diabetes (Bastiaens et al., 2009). Long duration of diabetes mellitus, poor glycemic control, low socioeconomic condition, lack of proper diabetic foot care education and incorrect footwear are considered to be of great importance for the development of diabetic foot ulcer and thus leads to amputation in Bangladesh (Wadud, Samad, Enaayet, Rubayat, & Bhowmik, 2006).

In order to control foot ulcer complications, patient's knowledge and practice may contribute to prevention of foot ulcer (Pollock, Unwin, & Connolly, 2003). Patients with diabetes should have the knowledge about prevention of foot ulcer which includes knowledge about dietary habits. The significance of control of blood glucose level needs dietary modifications (Uchenna, Ljeoma, Peace, & Ngozi, 2009). Patient should receive individualized medical nutrition therapy as needed to achieve treatment goal, which provided by a registered dietitian familiar with the complication of nutrition therapy in diabetes (American Diabetes Association, 2008). Most patients still identify food as the single largest challenge in balancing elements of diabetes therapy and additionally, misinformation long standing habit and cultural preference (Brown, Lackey, Millter, & Priest, 2001). For counseling of diabetic patients is easy

to maintain diet plan by following this two diet habits from American Diabetes Association and the United States Department of Agriculture's Food Guide Pyramid to Idaho Plate Method (Brown et al.). Patient's calorie intake should be individualized so as to determine the body mass index, and follow the diabetic guidebook and should also maintain diet habit (Mahtab, Khan, Latif, Pathan, & Ahmed, 2003).

In addition to dietary management, exercise is also important. Exercise helps controlling of blood glucose level, maintains ideal body weight, improves insulin sensitivity and also reduces diabetic complications (Mahtab et al.). Exercise help reducing fasting of plasma glucose level (Prueksaritanond, Tubtimtes, Asavanich, & Tiewtranon, 2004). Patients should be advised to exercise i.e., brisk walking, swimming, cycling, or jogging for 10-30 minutes at least three times a week (Mahtab et al.), and should be encouraged to exercise during their daily activities or walk 30 minutes a day, at least four times a week (Prueksaritanond et at.). In Bangladesh, lack of knowledge about exercise, no habit of exercise and unavailability of place for exercise cause more risk of diabetes and its complications (International Diabetes Federation, 2009).

Foot care is the most important means in prevention of foot ulcer. Proper foot care and early recognition and management of risk factors can prevent or delay adverse outcomes of the diabetes (American Diabetes Association, 2008). Preventive strategies will decrease the burden of foot problems in patients with diabetes mellitus (Malgrange, Richard, & Leymarie,). Patients' knowledge about prevention of foot care are foot hygiene, care of toenails, foot skin care, daily inspection of feet and legs, foot exercise and proper footwear (Pollock et al., 2003). All these preventive measures can be helpful in improving the foot health and prevention of foot ulcer (McIntosh, 2008).

Patients' general knowledge about the disease is an important component to control diabetes and prevent foot ulcer. In this study, patients' knowledge about diabetes with special emphasis on general knowledge about diabetes, diet habits, exercise/physical activity and foot care are given importance. If patients have adequate general knowledge about diabetes, diet habits, exercise and foot care, they will be able to practice to prevent or delay diabetic foot ulcer.

Studies have shown that dietary practice with prepared meal plans led to weight loss, improvement of blood lipid and glucose profile and other indicators of risk for cardiovascular disease and chronic complication of diabetes (Mumu, Saleh, Afnan, Akter, Ahmed,). Patients' self-management practice account for 90-98 % of the variance in glycemic control (Osborn & Egede, 2009). So, diet habit and practice may play an important role in preventing or delaying diabetic foot ulcer.

In addition, dietary practice is also needed in prevention of foot complication. Studies have shown that 122 (13.20 %) subjects were observed to have abnormal glucose tolerance (AGT). Prevalence of AGT was significantly greater in people having sedentary physical activity (33.84 %), as compared to people having heavy physical activity (11.53 %) (Kokiwar, Gupta, & Durge, 2007). Exercise will also help improving insulin sensitivity, increasing demand of blood supply to different vital organs and prevention of foot complications (Mahtab et al., 2003). Dietary practice is also needed for prevention of foot ulcer.

Foot care practice may prevent foot ulcer of patients with diabetes mellitus. It is estimated that the foot problems may account for as much as 40 % of the total available resources and can be improved by the foot care practice (Sayeed et al.,

). Patient's foot care practices that may prevent foot ulcer are foot hygiene, toenails care, skin care, inspection of feet and legs and footwear (Pollock et al., 2003).

Very limited data exists on the dietary pattern of patients with diabetes in Bangladesh. Studies have shown that daily carbohydrate intake was higher than the recommended value up to 50 % of total daily energy intake in 99 % of the patients. It is accounted for traditional lifestyle and also socioeconomic condition (Mumu et al., 2009). Bangladeshi people, especially women, do light regular exercise to improve their health, predominant due to certain cultural beliefs and attitudes. For women, they sometimes go swimming and walking (Khanam, 2008). Low frequency of doing physical activities are related to lack of motivation along with barriers such as poverty, transport, time, place and competing responsibilities (Sriskantharajah & Kai, 2006). A study was conducted in Bangladesh with 350 patients presented with foot problems, varying from tropic ulcer to gangrene (Wadud et al., 2006). Ninety nine percent of the patients had non-insulin dependent diabetes mellitus (NIDDM) and only 1 % had insulin dependent diabetes mellitus (IDDM). Ninety percent of the patients were older than 45 years; 71 % were male and 28.29 % were female. Some of them were from rural areas with low socioeconomic condition and low educational level (Wadud et al., 2006). Seventy-five percent of those who had higher risk for development of diabetic foot ulcer had poor glycemic control, while 45 % of them were using incorrect foot ulcer such as slippers and ill fitting shoes. Thirty-one percent of them had incidence of neuropathy, 31% had ischemic heart disease, 19% had nephropathy, 14% had retinopathy and 21% had peripheral vascular disease (Wadud et al., 2006).

It was found that in Bangladesh, diet habit, physical activities, and diabetic foot care practice have relationships with traditional lifestyle, cultural barrier, poor socioeconomic condition, and low level of education (Wadud et al., 2006; Mumu et al., 2009). Knowledge and practice may prevent of foot ulcer of patients with diabetes mellitus.

Objectives of the Study

1. To examine the level of knowledge regarding the prevention of foot ulcer among patients with diabetes mellitus.
2. To examine the level of practice regarding the prevention of foot ulcer among patients with diabetes mellitus.
3. To examine the relationship between knowledge and practice regarding the prevention of foot ulcer among patients with diabetes mellitus.

Research Questions of the Study

1. What is the level of knowledge regarding the prevention of foot ulcer among patients with diabetes mellitus?
2. What is the level of practice regarding the prevention of foot ulcer among patients with diabetes mellitus?
3. What is the relationship between knowledge and practice regarding the prevention of foot ulcer among patients with diabetes mellitus?

Conceptual Framework of the Study

The conceptual framework of this study was based on the knowledge-attitude and practice (KAP) model and literature review related to prevention of foot ulcer

among patients with diabetes. The KAP model was first used in the field of family planning and population studies in the 1950s (Launiala, 2009). The model suggests that the right information (knowledge) will influence attitudes, and thus change the behavior (practice) (Launiala, 2009). Knowledge and practice may prevent the foot ulcer, so patients should have knowledge about high risk foot (loss of protective sensation, absent pedal pulses, foot deformity, history of foot ulcer and prior amputation, one or more risk factors present) and low risk foot (without any risk characteristics). Patients with high foot risk should receive enhanced foot care and education. Patients with low foot risk should be instructed about the foot hygiene, nail care, footwear, and avoidance of trauma (Pollock et al., 2003). Foot care keeps the feet healthy and prevents foot ulcer (Delmas, 2008). Foot care is a well-defined practice, which includes physical and functional assessment, foot hygiene, toenails care and skin care (Bryant & Beinlich, 2003). Practice and self-management activities help avoiding diabetes-related morbidity and mortality (Sarker, Fisher, & Schillinger, 2006). Knowledge and practice (skill) are necessary for diabetes care (Funnell et al., 2007).

Knowledge helps the patients to recall and increase understanding level of diseases. So, knowledge and practice were explored in this study for prevention of foot ulcer among patients with diabetes mellitus.

ypothesis

There is a positive relationship between knowledge and practice regarding prevention of foot ulcer among patients with diabetes mellitus.

Definition of Terms

Knowledge regarding the prevention of foot ulcer

Knowledge regarding the prevention of foot ulcer is defined as patients understanding of foot care management. The knowledge regarding prevention of foot ulcer includes: (1) general knowledge about diabetes, (2) diet habit, (3) exercise or physical activity, and () foot care. Knowledge of subjects' regarding prevention of foot ulcer was measured by the Knowledge Regarding Prevention of Foot Ulcer Questionnaire developed by the researcher.

Practice regarding the prevention of foot ulcer

Practice regarding prevention of foot ulcer is defined as patients' skill to perform prevention of foot ulcer. Practice in foot care includes: 1) general practice about diabetes, (2) diet habit, (3) exercise or physical activity and (4) foot care. Practice of subjects' regarding prevention of foot ulcer was measured by the Practice Regarding Prevention of Foot Ulcer Questionnaire developed by the researcher.

Significance of the Study

1. This study will be helpful for the nurses to understand the scope of knowledge and practice regarding the prevention of foot ulcers among patients with diabetes and thus they can provide better health education about foot care to the patients.

2. The findings will also be useful in the development of intervention in order to promote and maintain of foot care of patients with diabetes mellitus.

CHAPTER 2

LITERATURE REVIEW

This chapter presents the literature relevant to the present study, which are presented as follows:

1. Overview of type 2 diabetes and its complications
2. Diabetic foot ulcer
3. Prevention of diabetic foot ulcer
4. Diabetic foot ulcer and its preventing management in Bangladesh
5. Summary

Overview of Type 2 Diabetes and Its Complications

This section covered the following reviews: definition of diabetes mellitus, types of diabetes mellitus, definition of type 2 diabetes mellitus, signs and symptoms, its complications, pharmacological and non-pharmacological management of diabetes mellitus.

Definition of diabetes mellitus

Diabetes mellitus is generally and clinically the heterogeneous group of disorders of metabolism manifested ultimately by loss of carbohydrate tolerance. In its fully developed clinical expression, diabetes mellitus is characterized by rapid hyperglycemia, atherosclerotic and microangiopathic vascular disease, and neuropathy. The clinical manifestations of hyperglycemia are usually preceded from many years as the clinical recognition of vascular disease (Price & Wilson, 1997).

There are two types of diabetes mellitus: (1) Type 1 diabetes mellitus, called insulin dependent diabetes mellitus (IDDM) or juvenile onset diabetes and (2) Type 2 diabetes mellitus, called non-insulin dependent diabetes mellitus (NIDDM) or adult onset diabetes (Fain, 2005).

Definition of type 2 diabetes mellitus

Type 2 diabetes mellitus was previously called as non-insulin dependent diabetes mellitus or adult-onset diabetes. It usually begins as insulin resistance, a disorder in which the cells do not use insulin properly. As the need for insulin rises, the pancreas gradually loses its ability to produce it (World Health Organization, 2005). Type 2 diabetes occurs most often in patients over the age of 40 who are overweight (Sayeed et al., 2003).

Criteria for the diagnosis of diabetes

Person can be diagnosed with diabetes based on one of the following criteria:

1. Fasting plasma glucose is equal or greater than 126 mg/dl (7.0 mmol/L).
2. Random plasma glucose is equal or greater than 200 mg/dl (11.1 mmol/L).
3. Two hours plasma glucose is equal or greater than 200 mg/dl (11.1mmol/L)

during an oral glucose tolerance test (OGTT) (American Diabetes Association, 2008).

Although for some patients whose glucose levels do not meet diagnostic criteria for diabetes, their results are not completely normal, and are classified as pre-diabetes which are as follows:

1. Two hours plasma glucose equal or greater than 140 mg/dl, but less than 200 mg/dl is considered as impaired glucose tolerance (GIT).

2. Fasting plasma glucose equal or greater than 110 mg/dl, but less than 126 mg/dl is considered as impaired fasting glucose (IFG) (Fain, 2005).

Signs and symptoms of diabetes mellitus

Hyperglycemia causes fluid and electrolyte imbalances, which is known as classic symptoms of diabetes. These include polyuria (frequent and excessive urination), polydipsia (excessive thirst), polyphagia (excessive eating), and glycosuria (glucose in urine) (McLeod, 2002). Classic signs and symptoms of hyperglycemia include: confusion, disorientation, slurred speech, bizarre behavior, stupor, convulsions, restlessness, headache, sleep disturbances, difficulty being aroused (Ignatavicius, Workman, & Mishler, 1995). In addition, symptoms like weight loss, recurrent blurred visions, skin infections, vaginitis, ketonuria, weakness, fatigue, and dizziness are often asymptomatic symptoms. Clinical manifestation of hyperglycemia includes sudden onset of hunger, tremors, tachycardia, excessive perspiration, pallor, shakiness, headache, slurred speech, double or blurred vision (Fain, 2005).

□omplikations of diabetes mellitus

Complications of diabetes mellitus can be divided into two categories: (1) acute metabolic complications, and (2) long-term vascular complications (Price & Wilson, 1997).

□□□ *□cute complications.* Acute life threatening consequences of uncontrolled diabetes are hyperglycemia with ketoacidosis (American Diabetes Association, 2009). Ketoacidosis results from an increase of serum glucose at the level of 300 mg/dl or greater, arterial pH less than 7.3, and arterial bicarbonate level less than 15 mEq/L. Firstly, ketoacidosis leads to increased development of hyperglycemia and glycosuria, decreased lipogenesis, increased lipolysis and increased oxidation of free fatty acid with production of ketone bodies. Increased ketones will cause an increased hydrogen ion load and metabolic acidosis. Secondly, marked glycosuria and ketonuria also

leads to osmotic diuresis and results in dehydration and loss of electrolytes. Thirdly, the patient may become hypotensive and develop a state of shock, and because the use of decreased cerebral oxygen, the patient may become comatose and die eventually (Ignatavicius et al., 1995; Price & Wilson, 1997).

□□□*Long-term vascular complications.* Long-term vascular complications of diabetes involve small vessels-microangiopathy, middle and large size vessel macroangiopathy (Price & Wilson, 1997). These 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 and cardiovascular symptoms and sexual dysfunction (American Diabetes Association, 2009).

Management of diabetes mellitus

The main goal of diabetes managements is to normalize insulin activity and blood glucose levels to reduce the development of vascular and neuropathic complications (Smeltzer & Bare, 2004). Diabetes is a chronic disease and have no cure but is controllable. It is associated with an impaired glucose cycle which alters metabolism. For management of this disease, enhancing knowledge and practice to lifestyle modifications such as achieving and maintaining weight, diet, exercise, and foot care are needed (American Diabetes Association, 2008).The management of diabetes mellitus is based on pharmacological management and non pharmacological management (Price & Wilson, 1997).

Pharmacological management

Basic approach of pharmacological management is to increase insulin availability in the body either exogenously or endogenously and to improve insulin resistance (Pathan, 2007). Pharmacological management should be considered when the patients cannot achieve normal or near-normal blood glucose levels with nutrition and exercise therapies. Oral hypoglycemic agents are effective in patients with type 2 diabetes after nutritional and exercise therapy have failed. Patients should have knowledge about the indications for these agents which include: (1) random blood glucose levels less than 300 mg/dl (2) fasting blood glucose levels less than 250 mg/dl (3) and inadequate control after exercise and dietary therapies and consultation with physician for maintaining the therapy (Fain, 2005).

Non-pharmacological management

In this management strategy, diagnosis of metabolic syndrome is made and the future management of the condition should be aggressive and uncompromising in its aim to reduce the risk of cardiovascular disease and type 2 diabetes. Yet there is no single treatment for this syndrome, thus, the carefully structured multifaceted therapy is the only way to reduce the health risk. Non-pharmacological management is achieved in the way of preventive lifestyle (Ashrafuzzaman, 2007). Non-pharmacological management includes increasing daily physical exercise and reducing body weight by diet control (Pathan, 2007).

Diet habit

There are different types of diets to consider, depending on the type of diabetes. Each type of diabetes requires a specialized dietary management. Many of the basic dietary principles are similar for every diabetic patient. Patients with type 2

diabetes need to change their eating habit which can reduce insulin resistance and improve metabolic status (Gray, 2006). Patient's knowledge, re-education, dietary advice will help the patient to achieve improvement in glycemic control (Chan, Yee, Leung, & Day, 2006).

Role of diet in the management of diabetes

For people having diabetes, food is an important part of treatment and diet has long been considered as the cornerstone in the management of diabetes. Dr. Mohammad Ibrahim institute had stated three principles for the treatment of diabetes in Bangladesh popularly known as D's i.e., Diet, Drug, and Discipline (Nahar, 2007). Diet is the first and foremost principle to be followed by diabetic patients (Nahar). Some factors that give rise to type 2 diabetes mellitus are obesity, sedentary habit, and inadequate diet (Llerenas, Sanchez, Allen, Munoz, & Ponce, 2005). For type 2 diabetes, diet and lifestyle changes can control blood sugar very well and in such cases, medication is not needed (X-PlainTM, 2005). The recommended number of calories varies, depending on the need for maintaining, reducing or increasing body weight. If the patient is obese, a calories restricted diet should be prescribed until the patient's weight has dropped to the normal range. If young patient lose weight during the state of decompensation, they should receive sufficient calories to restore their weight and growth. The general goal of dietary management is to help the patients with diabetes improve their metabolic control. A nutritionally well balanced diet is necessary to maintain good health and this is also true for diabetes (Fain, 2005).

Knowledge about macronutrients and micronutrients

Macronutrients

Macronutrients are proteins, fats and carbohydrates which are often called primary principles because they form the main bulk of food (Reza, 1998). The basic principles are similar to those which stated that, in general, everyone needs daily supply of macronutrients. Macronutrients are needed in appropriate proportions for optimal nutritional health and glucose control.

Carbohydrate. The primary goal in management of diabetes mellitus to achieve the near normal regulation of blood glucose as much as possible. The amount, and possibly the type of carbohydrate in fact greatly influence the overall glucose control. Carbohydrate is an important source of fiber, water-soluble vitamins, minerals and energy. The brain and central nervous system have an absolute requirement of glucose.

Fiber. A fiber rich meal is processed more slowly, which will promote early satiety, less caloric, and lower fat and sugars (Gray, 2006). Fiber diet can be helpful in combating obesity because it can reduce twenty to thirty percent of the risk of developing type 2 diabetes with increased cereal and whole grain fiber intake. Insulin resistance can be reduced with high intake of whole grain fiber. A variety of high fiber foods includes whole grain breads and cereals, whole fruits and vegetables (Gray, 2006).

Fat. There are three types of fat, which are polyunsaturated fat, saturated fat and trans fats. Polyunsaturated fat are Corn, soybean, safflower, fish, cottonseed oils, etc. Saturated fat are whole milk, butter, cheese and ice cream, red meat, chocolate, coconuts, coconut milk, coconut oils, etc. Trans fat are most

margarine, vegetable shortening, partially hydrogenated vegetable oil, deep-fried chips, many fast foods, etc.(Gray, 2006).

Protein. Protein is the main body building food. Relative insulin deficiency is associated with increased protein breakdown and gluconeogenesis, which is the process through which certain amino acids are converted into glucose. Sources of protein are animal protein such as meat, egg, fish, and nuts, cereals, soybeans, and pulses are the rich source of plant protein.

Micronutrient

Optimum micronutrients can be obtained from a diet which has an optimal composition of macronutrients and process minimal food items. These are needed in the form of supplemented diet in the individual patients. Micronutrients are classified into two groups: Vitamins and minerals (Reza, 1998).

Vitamin. Vitamins are vital accessory food ingredients which are needed in minute quantities by the patient and are required by body in small quantities and act as a catalyst in various body functions which are essential for normal growth and developments of the body. Two types of vitamin are found in different types of food: Fat soluble vitamins, which include vitamins A, D, E and K, and water soluble vitamins, which include vitamin B-complex and vitamin C.

Minerals. Minerals include sodium, magnesium, and chromium. Several recent studies have shown that a potential role of chromium supplementation is to help in management of insulin resistance, body weight, gestational diabetes and corticosteroid-induced diabetes (Gray, 2006; Reza, 1998).

Percentage of nutrition intake and recommendation

Table 1

Percentage of Nutrition Intake and Recommendations in Various Countries including Bangladesh

Nutrient for	Rural	Developing	Western	American
diabetics	Bangladesh	Countries	Countries	Diabetes Association Recommendation
Protein	Total 11% 48.4 gm Person/day.	Total 11% veg. 7% animal 4%	Total 12% veg. 4% animal 8%	Total 10-15 %
Carbohydrate	Total 84% Person/day (include sugar)	Total 77% Unrefined 67% Refined 10% (include sugar)	Total 48% Unrefined 20% Refined 28%	Total 50-60%
Fat	Total 5% 9.8 gm Person/day	Total 12% veg. 7% animal 5%	Total 40% veg. 10% animal 30%	Total <30% Saturated fat <10%
Fiber		Total 60-120 gm Starch 53 -05 gm Fruits and veg. 7-15 gm.	Total 15-20 gm Starch 4-6 gm Fruits and veg 11-14 gm	Total 20 gm

(Source: Nahar, 2007).

Food exchange and balance of macronutrient in a fixed diet plan

Food exchange means when one food item can be exchanged with another that provides a balanced variety of macronutrients in a fixed diet plan. Some examples of food exchange are as follows (Patil, 2007).

(1) Instead of 2 whole wheat chapattis (60 g each), 1 chapatti and 120 g of cooked rice (1 full bowl) can be used.

(2) A 110 g jawar roti (about 2 medium size thin), or 1 restaurant nan/thick roti can be replaced by 2 chapattis.

(3) 200 g of the edible part of a water melon (about 5-6 slices) can be replaced by 1 whole orange (about 120 g) or 1 apple or medium size banana or half a custard apple.

(4) 4-5 whole almonds and 4 dry dates can be replaced by 1 cup of coffee and 4 biscuits.

(5) Half of chapatti or half bowl of rice can be replaced by a full scoop of ice cream.

(6) One boiled egg can be replaced by 50 g of boiled/grilled fish (2 small pieces) or a 50 g piece of chicken (Patil, 2007). In Bangladesh, diabetic centers provide diabetic guidebook for each patient and teach him/her how to keep record and maintain report, and how to make a diet plan (Mumu et al., 2009).

Knowledge and practice of food pyramid and “plate method.”

Knowledge and practice about food pyramid is suitable and accessible for both rural and urban people. Patients should be informed about food pyramid and make his/her healthy diet plate (Brown et al., 2001).

Food pyramid

The food pyramid is a guide for healthy eating that suggests eating a variety of food and eating the appropriate amount from each group of food. The food pyramid guide was created by The US Department of Agriculture. It has six colors, each color represents a particular food group which are as follows:

Grains *Orange* Patients should take at least three ounces of the following selections everyday: whole grain bread, cereal, cracker, rice, or pasta.

Vegetables *Green* Patients should take more dark green and orange veggies, more dry beans and peas, and also a variety of vegetables to get the supply of different vitamins and nutrients. Vegetables are organized into 4 subgroups, based on their nutrient content: Dark green vegetables, dry beany vegetables, peas, and other vegetables.

Fruits *Red* Patients should take a variety of fruits; preferably they should choose fresh, frozen, canned or dried fruit. Patients should also consider fruit juice which counts as part of the fruit group.

Oil *Yellow* Most of the fat sources come from fish, nut, and vegetable oils and solid fat from butter and stick margarine.

Milk *Blue* Patients should take low-fat or fat-free milk and choose lactose-free products or other calcium sources.

Proteins *Purple* Low fat or lean meat and poultry products should be chosen. It should be baked, boiled, or grilled. Patients should include more quantity of fish, beans peas, nuts and seeds in their diet (X-plainTM, 2009).

Plate method

According to the Idaho Plate Method, patients should make their diet plates as follows:

At breakfast, one-fourth of the plate should have protein or meat, half of the plate should have starch, and one fourth should be empty. The meal should be taken along with milk, yogurt, or fruit.

At lunch and dinner, the plate should have a similar pattern. One-fourth (1/4) of the plate should be starch (e.g. noodles, cooking rice etc). One-fourth (1/4) should be protein or meat source and half of the plate (1/2) should be filled with low-calorie vegetables (not starchy, such as: potatoes, corn or peas). On the side of the plate, there should be a cup of milk or half a cup of ice cream or a small amount of fruits.

The Plate Method is particularly suitable for type 2 diabetic patients who eat three meals a day and have low literacy level, cognitive difficulties, and seniority (Brown et al., 2001).

In Bangladesh, patients' carbohydrate intake are 84% of the total calories per day and the people of rural areas lack the diet, which is rich in essential nutrients. But the people in the high society have western type of dietary habits. It may be because of poverty, lack of knowledge, eating habit, poor meal planning knowledge and practice found among the people of rural areas (Nahar, 7). So food pyramid and plate method should be effective and beneficial for developing countries like Bangladesh in planning their daily diet. Diet should be planned to meet individual needs for availabilities of food and lifestyle.

Exercise Concept of exercise physical activity

Exercise burns calories, which help losing the body weight or maintaining healthy body. For patients suffering from type 2 diabetes, physical exercise may improve insulin sensitivity and assist in diminishing elevated blood glucose levels to the normal range (American Diabetes Association, 2003). Exercise and physical activity reduce the risk of mortality from all causes and are particularly advantageous in patients with type 2 diabetes (Loreto et al., 2005). Previous studies had shown that regular exercise is able to control the blood glucose level, contribute to weight loss,

and improve well-being of the patients (Bastiaens et al., 2009). Physical exercise was proven to be helpful for type 2 diabetic patients.

Frequency and types of exercise

Frequency. Patients should exercise at the same time every day for the same duration. This will help controlling blood sugar level. Exercise should be done at least three times a week for at least 30 minutes (Mahtab et al., 2003). General report recommended that the most adults should spend at least 30 minutes of moderate-intensity ideally every day (American Diabetes Association, 2008).

Types of exercise

A comprehensive physical activity routine includes three kinds of activities:

1. Aerobic exercise: Brisk walking, swimming, roller-skating, playing tennis and bicycling. Brisk exercise 30 minutes a day, at least 5 days a week. Doing a 10 minutes brisk walk after each meal is considered a good habit.

2. Strength training/anaerobic exercise: Join a class to do strength Training with weight lifting, elastic bands or plastic tubes or lift light weights at home.

3. Flexibility exercise: Walk instead of drive whenever possible, use stairs instead of elevator, work in the garden, do some housecleaning everyday and park at the far end of the shopping center lot and walk to the store (American Diabetes Association, 2009).

Evaluation of the patient before recommending an exercise program

Evaluation of the diabetic patient before recommending an exercise program includes: Recommends that anyone with diabetes should have a thorough medical examination to see if there are risks for coronary artery disease and that blood glucose level is adequate before starting an exercise program.

Before doing an exercise, check following conditions:

1) Blood glucose should be monitoring before and after exercise. Blood glucose should be less than 250 mg/dl., 2) There should be no symptoms of retinopathy (damage to the blood vessels of eye), neuropathy (damage to the nerves and circulation to extremities) or nephropathy, 3) There should be no cardiovascular problems or aneurysm and 4) There is no other conditions making exercise inadvisable (American Diabetes Association, 2003).

Guidelines for exercise

Guidelines for exercise are as follows:

Patients should be ready to exercise. It should be started out easily and generally, then gradually increases intensity and duration of exercise. A warm-up should consist of 5-10 minutes of aerobic activity (walking, cycling, etc) at a low intensity level. The warm-up session helps preparing the skeletal muscles, heart, and lungs for a progressive increase in exercise intensity. After the activities session, a cool-down should be structured similarly to the warm-up. Do not exercise outdoor on a very hot or humid day because patient may get heat exhaustion or heat stroke. In warm weather, dress light weight, light-color, loose-fitting cotton clothing or special fabrics that promote heat loss. Patient should use silica gel or cotton-polyester socks to prevent blisters and keeping the feet dry is important for minimizing trauma to the feet. Proper footwear is essential and must be emphasized for diabetic patients. Patients should drink 17 ounces of fluid before doing physical activity/exercise to prevent dehydration (American Diabetes Association, 2003).

Benefits of exercise

Exercise is a major contributor in controlling hyperglycemia through improved peripheral insulin sensitivity (Latif & Ashrafuzzaman, 2007). Exercise reduces the risk of heart disease and obesity and prevents long term complications (American Diabetes Association, 2003). Exercise and diet may help delaying type 2 diabetes for at least three years (Larkin, 2001).

Diabetic foot ulcer

This section covered the review of diabetic foot ulcer, pathophysiology, risk factors, early sign and symptoms and management of foot ulcer.

Diabetic foot ulcer

A full-thickness wound below the ankle, irrespective of duration is called foot ulceration (Reiber & LeMaster, 2008). Despite treatment, ulcers readily become chronic wounds. Unresponsive wounds on debilitated patients and those with multiple medical problems should be addressed based on a triad of care: intrinsic, extrinsic and wound environment factors. Intrinsic factors include the patient's medical status, prescribed medication and concomitant disease. Extrinsic factors include repetitive trauma, off-loading and pressure reduction. The wound environment examination includes the wound bed status (amount of necrotic tissue, fibrotic tissue, percent of granulation, re-epithelialization), cellular activity in the wound, and devices and dressings used for treatment (Mulder, 2001).

Pathophysiology

The distal neuropathy of diabetes affects all components of the nervous system including sensory, motor and autonomic systems, which contributes to the foot ulcer

development. Chronic hyperglycemia correlates with the loss of nerve function and is reflected in the mean level of glycosylated hemoglobin over time. Ischemia of the endoneurial microvascular circulation including metabolic abnormalities from hyperglycemia is believed to be the underlying mechanism for nerve deterioration (Bowering, 2001). Arterial disease in the legs of patients with intermittent claudication, which is calf pain on walking, is caused by poor circulation of blood to leg muscles. It causes the narrowing of the blood vessels which reduces the blood flow, resulting in ischemia and developed foot ulcer (Shilling, 2003).

Risk factors

Risk factors for the development of diabetic foot in diabetic patients are as follows: Local skin changes, cardiovascular changes, autonomic neuropathy, motor neuropathy, and sensory neuropathy (Rocha et al., 2009).

Early sign and symptoms

Early sign and symptoms of foot ulcers are: Local skin changes, inadequate nail cutting, ingrown toenails, increased moisture and white mass between toes. Peripheral vascular disease: Feet redness in down position, varicose veins, edema, abnormal tibial pulse, hairless skin.

Autonomic neuropathy: The feet of the suspected patient should have dryness, fissures, and Charcot's arthropathy.

Motor neuropathy □ Calluses, claw toes, planter instep alterations, planter arch alterations, prominence of metatarsal heads, hallux hammer toe.

Sensory neuropathy □ Cramps, numbness, tingling, burning pain, paresthesia and hyperesthesia (Rocha et al., 2009).

Management of foot ulcer

Management of diabetic foot is divided into five stages and should be managed according to the patient's condition (Edmonds & Edmonds, 2001).

The stages of diabetic foot are as follows:

Stage 1) The foot is normal and should not have the risk factors of ulceration as neuropathy, ischemia, deformity, callus and edema.

Stage 2) The patient should have developed one or more of these foot risk factors (Edmonds & Edmonds).

Stage 3) Foot with ulcer: Patients in this stage should have developed a break in the skin, including deep splits, blister, pressure sore, burns or traumatic wounds (Shilling, 2003).

Stage 4) Foot with cellulites: The ulcer should have developed infection with the presence of cellulites, which can complicate both the neuropathic and neuroischemic foot.

Stage 5) Foot with necrosis: The neuropathic foot infection is the most common reason for tissue destruction (Rocha et al., 2009).

Management of stage 1) Patient should get advice on basic foot care, including nail cutting techniques, the treatment of minor injuries. Patient should be advised about purchasing of good fitting shoes, they also should not wear high heels to avoid excessive toe pressure on the fore foot. The patients should never try to cut the corner of the nail or dig down the side.

Management of stage 2) Management of dry skin and fissures: Dry skin of the patient should be treated with an emollient calmurid cream or moisture cream. Deformity including Charcot foot should be recognized early and accommodated in

properly fitted shoes before ulceration occurs. Patient should never cut his/her callus off or use callus removers (Rocha et al., 2009).

Management of stage 3) Foot ulcers can develop due to a number of causes acting together. Only a single cause may not result in the development of a foot ulcer. Neuropathy, ischemia and infection are the three main components of foot ulcers. The moist wound healing in the care of diabetic foot ulcer is well documented. Regular removal of callus around the wound prevents it to spread on the surrounding vascular system. Debridement of necrotic tissue also encourages wound healing (Shilling, 2003).

Management of stage 4) Patients who have developed of cellulites and discoloration of foot should get emergency foot care. Patient should be transferred to the specialized foot care team within 24 hours and antibiotic should be given as soon as possible.

Management of stage 5) Necrosis has very grave implications, such as threatening of loss of the limb caused by infection or ischemia or both together (Edmonds & Edmonds, 2009). In the neuropathy of foot, operative debridement is indicated for wet necrosis. There is a good arterial circulation and the wound usually heals as infection is controlled. In neuroischemic foot, wet necrosis should be removed when it is associated with severe spreading sepsis. In case when the limb is not immediately threatened and the necrosis is limited to one or two toes, it may be possible to control infection by intravenous antibiotics.

Prevention of Diabetic Foot Ulcer

Prevention foot ulcer of diabetic patients includes knowing the importance of foot care and concept of foot care, maintaining daily foot hygiene and foot skin care, inspection of feet and legs, care of toenails, foot exercise, and footwear.

Importance of foot care for diabetic patients

Foot care is important for diabetic patients because foot ulceration is the common major end point among diabetic complications. In population surveys, more than five percent of diabetic patients have history of foot ulcers (Pataky & Vischer, 2007). Foot problems in diabetic patient is found in most of the patients in the hospitals more than any other long term complications of diabetes and also result in increasing morbidity and mortality (Rathur & Boulton, 2007). Present cost of treating the diabetic foot worldwide is about a billion dollars (Sharifirad, Hazavehi, Baghianimoghadam, & Mohebi, 2007). In some manners, feet are like car tires, they adds up the mileage of life. In average, during a lifetime, a person walks more than one hundred thousand miles. But unlike tires, feet cannot be retreated or replaced with new ones. That's why caring for feet is an important part of diabetes care (Roberts, 2000). Foot care can delay or prevent foot ulcer in diabetic patients (Pollock et al., 2003), so it is very essential for diabetic patients to practice.

Concept of foot care practice

A diabetic patient should acts as their own doctor. Diabetes differs from other chronic diseases in which the patient should take part in monitoring and treating their own conditions (Latif, 2007). Foot care is well defined, it includes physical and functional assessment, foot hygiene, nail care and skin care (Bryant & Beinlich, 2003). Diabetic foot ulcer is common but often neglected complications of diabetes

(Rathur & Rajbahandari, 2003). Step by step project was initiated in India, (Pendsey & Abbas, 2007) with participation from neighboring countries to improve diabetic foot care around the world. The goal was to train the health care professionals in basic foot care to train up patients and prevent foot ulcer (Pendsey & Abbas).

Maintain daily foot hygiene

Patients should wash their feet thoroughly every day and dry them thoroughly after washing especially between the toes. Before washing feet, patients should check the bath water with their forearms elbows, or water thermometer in order to prevent burns (Haas, 2008). After washing feet, patients should wear slippers, they should not walk barefoot after washing their feet because walking barefoot can cause harm to feet. Maintaining daily foot hygiene is helpful in preventing or delaying foot ulcer in patients with diabetes. Patients with dry skin should use soap in small amount and apply cream or lotion on their legs and feet every day. Diabetic patients should be careful regarding the addition of oils to the bath water, since they can make their feet and bathtub very slippery thus they can fall down and get injured (National Institute of Health, 2007).

Foot skin care of the patients

Skin care is an important practice for diabetic patients. Changes in skin may relate to specific skin diseases and also reflect an underlying system disorder. Skin care helps keeping the skin in healthy condition (McLeod, 2002). After washing the feet, patients should dry their feet with a soft towel and use baby oil or lotion to keep their feet soft and healthy. Patients having feet with dry skin should use moisturizing lotion to prevent cracking, but should never use lotion or cream between their toes as it leads to infection (Life clinic International, 2009). Patients should not use irritant

cleansing agents such as Epsom salt, table salt, iodine, detergents that may develop ulcers or maceration (Pollock et al., 2003).

Daily inspection of feet and legs

Diabetic patients should inspect their feet daily to avoid unwanted dangers. Daily foot inspection is a good habit for everyone with diabetes. It should not be considered as a burden but should be done as a brief examination of the feet in good light. Diabetic patients should inspect their feet once dried after taking a shower or bath, or when putting on socks or applying skin lotion, or before going to bed. Patients should look for cuts, blister, bruises and anything unusual on their feet and take precautionary measures immediately. A magnifying glass or magnifying mirror is helpful in detecting any abnormal changes on their feet, and if they happen to find any abnormalities, they should inform the physician and make proper decision to prevent such complications. Patients should inspect interdigital areas to look for cuts, bruises and anything unusual (Haas, 2008). Daily foot inspection is very helpful and immediate actions should be taken to prevent foot ulcer (Pollock et al., 2003). Patients should check feet skin to make sure whether it is intact or not, including the area between the toes, because in patients suffering from diabetes, even a tiny foot injury can turn into a major problem. Patients should also check their skin for patches of redness, warmth or calluses, which denotes the sign of tissue damage. So, inspection is essential for diabetic patients (Roberts, 2003).

□are of toenails

Toenail care is an important care for diabetic patients. Patients should cut or file their toenails, keeping to the contour of the toe maintained, and should not cut the nails too short. All sharp or jagged edges should be smoothed with a file or emery

board (Haas, 2008). Sometimes ingrown toenails are caused by a piece of the nail breaking the skin. This can happen if patients do not cut toenails straight across, thus the corner of the nail can be seen above the skin. Ingrown toenails are very common in case of large toe. Patients should carefully cut the toenails or get help from the physician. (National Institute of Health, 2007). For better practice, diabetic patients should trim their toenails straight across with nail clippers after washing and drying their feet because after washing feet, nails become soft and are easy to cut, then patients should smooth the nails with an emery board. If patient faces any problems in cutting their toenails as toenails are thick or cannot be seen well, in that case, the patients should consult the foot doctor, family members or friends to help them (Roberts, 2005). A sharp instrument like blade, if used for cutting or cleaning toenails may result in perforation of skin (Pollock et al., 2003). Patients should not use chemicals, razor blades on their feet for flaky fungal debris or to cut toenails to avoid danger (Haas, 2008).

Regular foot exercise of the patients

Regular foot exercise improves the blood circulation of the feet and prevents foot problems of diabetic patients. Impaired blood flow to skin contributes to foot ulceration and amputation. Skin blood flow is crucial to maintaining the flow of nutrients to that area, regulating body temperature, and in healing any cutaneous injuries (Colberg, Stansberry, McNitt, & Vinik, 2002). Simple chair exercise of the foot ankles and legs patient should be easy to practice at home. Some procedures are as follows:

Foot ankles: (1) Lift one foot slightly off the ground, (2) circle the ankle first in one direction then repeat in the other direction, (3) Move the toes up and down and

(4) place the foot back on the ground and repeat the opposite foot and repeat 5-10 times each foot.

Legs: (1) Sit forward on the chair and place feet on the floor (2) Bend knees, lift one foot a few centimeters off the floor (3) hold it for a second and then return it to the floor and repeat with the other leg. Patient should repeat this 10-15 times (Diabetes Australia NSW, 2007).

Importance of proper foot wear

Wearing comfortable shoes that fit well can prevent many foot problems. Patients should protect their feet by wearing shoes whenever they go outdoor (National Institute of Health, 2007). Inappropriate footwear is a major cause of diabetic foot ulceration (McIntosh, 2008). It has generally been accepted by the diabetes community that good footwear can help preventing foot ulceration. Similarly, most health care professionals believe that bad footwear is a major cause of foot ulceration (Boulton & Jude, 2004). A footwear-related pivotal event results in amputation (Reiber et al., 2002). For people suffering from diabetes, even a tiny foot injury can turn into a major problem, thus wearing proper shoes can deal with many of these problems. Good shoes can reduce pressure, reduce the number of new calluses and ulcers and protect the feet from dangers. Proper footwear is important in preventing foot ulcers (Roberts, 2003). Appropriate footwear is essential for diabetic patients to improved quality of foot care and decrease lower-limb morbidity (Johnston et al., 2006) because inappropriate footwear is a major cause of diabetic foot ulceration (Pataky & Vischer, 2007).

□ *Choose the proper footwear and practice*

Choosing the right footwear is an important part of foot care, since poorly fitted shoes are involved in as many as half of serious foot problems. Proper knowledge for choosing the proper footwear of the patients is as follows:

1) Patients should avoid wearing shoes with high heels or pointed toes. They can create pressure, which might contribute to bone and joint disorders as well as diabetic ulcers.

2) Patients should avoid wearing open-toed shoes or sandals with a strap between the first two toes. They can lead to the changes which injure the toe.

3) Patients should buy new shoes and be sure that their shoes are of proper size and well-fitted. Shoes should fit patient's feet, both length and width, with a room for toes to wiggle freely.

4) Patients' new shoes should be sturdy and comfortable. They should have leather or canvas uppers with a free access to air to keep patients' feet free from sweating. Avoid vinyl or plastic shoes because they do not stretch or breathe.

5) Patients should get new shoes, make them free and soft gradually, so that the patients' feet do not blister.

6) Patients should shake their shoes before wearing them. Because a small pebble in the shoes can give rise to foot problems. So, the best practice is to choose well-fitted footwear which is essential for diabetic patients to prevent or delay foot clinic ulcers (Life Clinic International, 2009).

Diabetic Foot Ulcer and Its Preventive Management in Bangladesh

The literature, reviewed from databases such as CINAHL, PUBMED, SCIENCE, DIRECT since 1999-2009, is performed to identify diabetic foot ulcer and its preventing management in Bangladesh. Very few studies have been explored about prevention of foot care in the health system.

Ninety to ninety-five percent of diabetic patients in Bangladesh are type 2 diabetic patients. Onset of diabetes is often insidious and asymptomatic (Mahtab et al., 2003). Developing countries have been typically focusing only on communicable disease. Non-communicable diseases like diabetes and diabetic foot care have been neglected. This disease needs more attention before these countries are overwhelmed by diabetic epidemic (International Diabetes Federation, 2009). It is emphasized that the patients should act as their own doctor while physicians, nurses and educators are only guides. Primary objectives of management are relief of symptoms, improvement of quality of life, sense of well-being, achievement of normal metabolic control and prevention or delay of acute and chronic complications and foot care advice. Educational advice is necessary for patients to promote compliance and to alleviate fear about the disease condition (Mahtab et al., 2003). Diabetes Association in Bangladesh adopted a decentralized model and has spread care throughout the country. There are 54 affiliated associations in Bangladesh, almost one in every district. Fifty four associations are all affiliated with DAB (International Diabetes Federation, 2009). They have followed certain standards i.e., they must be democratic, transparent, run by social worker and must be non-profitable. In this way, Bangladesh has been able to create comparatively excellent diabetes awareness program (International Diabetes Federation). In Bangladesh, there

is no special foot care out-patient department or ward providing foot care in tertiary hospital, but there is an overall diabetes care unit. Tertiary hospital examines and manages people who have diabetic foot risk and then refer to diabetic hospital (BIRDEM) (Habib, Biswas, Akter, Saha, & Ali, 2009). Studies have shown that 906 patients were analyzed and 200 patients with diabetic foot were purposively selected from a tertiary diabetic care hospital. Within 200 patients, 100 patients were late in detection and poorly managed and 100 were detected early and properly managed. Among 906 patients, 2.8% (25 patients) were found to develop diabetic foot. Total cost of treatment was US\$13,308.16 with an average of US\$443.60 per patient (Habib et al., 2009). Early diabetic foot consumed US\$18,918. Fifty percent of the costs were attributable to drugs for both groups of which 77% was for late diabetic foot and 29% was for hospitalizations. So, proper management can substantially reduce the cost care of patients with diabetic foot (Habib et al.).

Summary

Diabetic foot is one of the most devastating chronic complications of diabetes and the leading causes of foot amputation. Foot care practice can help preventing the complications of foot ulcer. Step by step foot care, knowledge and practice can delay, reduce or prevent foot ulcer of diabetic patients. Basic foot cares included in this study are foot hygiene, foot skin care, daily inspection of feet and legs, toenails care, foot exercise and footwear. These are the basic requirements to be fulfilled in order to protect foot problems, but some disease conditions influence the foot problem permanently, like long time uncontrolled blood sugar (hyperglycemia), which will lead to peripheral neuropathy and it is the main cause of foot ulcer. Proper diet controls the

blood glucose level while exercise / physical activities reduce insulin resistance. Thus, the dietary habit, exercise and foot care are the important practices which were studied in the present study to prevent foot ulcer in patients with diabetes mellitus. Patients should have knowledge about the disease of diabetes, symptoms of diabetes, diabetic foot ulcer, pathophysiology of foot ulcer, risk factors, early symptoms of foot ulcer and also foot ulcer management so that the patients will be able to identify problems early, take care or may be prevent foot ulcer.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter presents the methodology with the following sections: Research design, setting, target population, samples and sampling, instruments, ethical consideration, data collection, and data analysis.

Research Design

The descriptive correlational design was used to identify level of knowledge and practice regarding prevention of foot ulcer of patients with type 2 diabetes mellitus and to explore the relationship between knowledge and practice of the prevention of foot ulcer.

Setting

This study was conducted at Rangpur Diabetic Association Radhaballove (DAR), Rangpur (Diabetic center), Bangladesh. It is a private organization which has only out-patient department and there are more than fifty diabetic patients visiting per day. Rangpur Diabetic Association Radhaballove Rangpur is affiliated to the Diabetes Association in Bangladesh (DAB). This center has some facilities for the patients such as: pathology, radiology, ECG and ultra sonogram sectors which is maintained by the one charge medical doctor and other employees but does not have any nursing personnels. This center doest not provide counseling session but when the doctors review patient's history and perform physical examination, they also give advice to each patient according to their needs.

Target Population

The target population was type 2 diabetic patients who attended out-patient department at Rangpur Diabetic Association Radhaballove, Rangpur, Bangladesh.

Samples and Sampling

Samples in this study were type 2 oriented, diabetic patients who attended out-patient department at Rangpur Diabetic Association Radhaballove, Rangpur, Bangladesh during November 2009 to January, 2010. An oriented patient means a patient who is fully conscious about time, place and person.

Sample size

Sample size of this study was estimated by power analysis (Polit & Hungler, 1999). The estimated sample size was calculated for an accepted minimum level of significance of 0.05 and accepted power of 0.80. Estimated population effect size of the study was based on previous study with $r = 0.24$ (Chan & Molassiotis, 1999), and it was adjusted to the closest number in Estimated Population Correlation Coefficient table ($r = 0.25$). The number of subjects needed was 126.

Sampling technique

Purposive sampling method was used in recruiting diabetic patients in this study.

Instruments

The instruments of the study were questionnaires, developed by the researcher. The questionnaire consisted of three parts: Part- A: Demographic Data Assessment Form (DDAF), part-B: Knowledge Regarding Prevention of Foot Ulcer Questionnaire

(KRPFUQ), and part- C: Practice Regarding Prevention of Foot Ulcer Questionnaire (PRPFUQ).

Part III: Includes Demographic Data Assessment Form

The Demographic Data Assessment form (DDAF) consisted of eleven questions. It sought out-patients' demographic data and their health status including: age, gender, religion, level of education, marital status, occupation, monthly income, number of family member, duration of illness, experience of foot ulcer, and smoking habit.

Part III: Knowledge Regarding Prevention of Foot Ulcer Questionnaire

The (KRPFUQ) was developed by the researcher. The KRPFUQ was used to examine the level of patients' knowledge regarding prevention of foot ulcer. It included four sub-dimensions to measure knowledge needed for prevention of foot ulcer in the following areas: general knowledge about diabetes, diet habit, exercise/physical activity, and foot care. This questionnaire consisted of 35 true-false items. There were 27 true questions and 8 false questions. By getting one correct response, the subject received a score of (1), and by getting incorrect response, the subject received (0). The KRPFUQ had a total score of 35 and PRPFUQ had a total score of 105. The score of each subject was converted to percentage. Based on this percentage, the researcher categorized the percent scores into five levels, according to the well accepted cutoff points using in modern education. According to McDonald (2002), a composite percent of correct score can be used to interpret the competencies of a respondent (student), and the score can be categorized into 5 grades: A, B, C, D, and F. The higher grades indicate the higher level of knowledge.

Composite Percent Score	Grade	Level of Knowledge and Practice
90.00- 100%	A	Very High
80.00- 89.99%	B	High
70.00- 79.99%	C	Moderate
60.00- 69.99%	D	Low
<60%	F	Very Low

Part III Practice Regarding Prevention of Foot Ulcer Questionnaire

The PRPFUQ was developed by the researcher and was used to measure patients' practice regarding prevention of foot ulcer. The factors, including practice needed for prevention of foot ulcer, was four sub-dimensions general practice about diabetes, diet habit, exercise/ physical activity and foot care. These questionnaires consisted of 35 items. Each items was rated on a 4-point Likert scale with response portions ranging from (0) = never practice, (1) = seldom practice, (2) = sometimes practice, and (3) = always practice. The item ratings were summed for the total score, ranging from 0-105, and it was transformed into percentage and categorized similar to the KRPFUQ scores. The higher scores indicated the higher level of practice.

Translation of Instruments

The questionnaires were originally developed in English language by the researcher. The English version was translated to a Bengali version by a Bangladeshi bilingual translator. Then the Bengali version was back translated to another English version. Finally, the two English versions were examined for comparability of language and similarity of interpretability by the third bilingual translator.

Validity and Reliability of the Instrument

Validity of the instruments

The content validity of the instruments was assessed by three experts in diabetes. One physician from OPD and one nurse educator who had experiences in diabetes at Rangpur Medical College Hospital in Bangladesh, and one expert nurse educator in Thailand were consulted for content validity, then the researcher modified the instruments based on the experts' recommendations.

Reliability of the instruments

The reliability of the instrument was tested among 20 subjects with type 2 diabetes. The reliability of the KRPFUQ in this study was analyzed for internal consistency by Kuder-Richardson (KR-20) reliability coefficient (Waltz, Strickland, & Lenz, 2005). KR-20 coefficient was used to test the internal consistency of Knowledge Regarding Prevention of Foot Ulcer Questionnaire, and the coefficient was .71. Cronbach's alpha Coefficient was used to test the internal consistency reliability of Practice Regarding Prevention of Foot Ulcer Questionnaire and the Cronbach's alpha Coefficient was . 1.

Ethical Considerations

The study was conducted with the intention of protecting human rights of every subjects. The subjects were approached with all needed information and an opportunity to ask question. A simple language statement was provided to subjects. The investigator clearly explained the subjects of all the steps they needed to do to participate in the study. Subjects were assured that they had the right to quit any time.

The identities of all samples were encoded, in order to keep confidentiality and anonymity.

Data Collection Methods

Data collection section was discussed in two phases: Preparation phase and implementation phase.

Preparation phase

After getting written permission from the Faculty of Nursing, Prince of Songkla University by submitting the thesis proposal to the Institute of Review Board (IRB), the researcher asked permission from General Secretary Rangpur Diabetic Association Radhaballove, Rangpur, Bangladesh for collecting data. With permission from General Secretary of Rangpur Diabetic Association Radhaballove, Rangpur (Diabetic center), the researcher visited the charge doctor and asked for the permission for collecting data and was introduced to the technician and other employee, then the researcher explained the objectives of the study to them.

Implementation phase

After getting permission from General Secretary Rangpur Diabetic Association Radhaballove Rangpur, the researcher visited the potential subjects at out-patient department (OPD) to identify the eligible subjects, then the researcher explained the purpose of the study to them. Subjects who were agreed to participate gave written/oral consent, followed by taking interview. After taking consent, the researcher clarified the questions to the subjects and filled up the questionnaire. For the illiterate subjects, the researcher verbalized the questions and filled the

questionnaire according to their opinion. The interview for each subject lasted for 25-30 minutes.

Data analysis

Both descriptive and inferential statistics were used to analyze the data. Descriptive statistics consisted of frequency, percentage, means, standard deviations used to analyze subjects' demographic characteristics and the level of knowledge and practice regarding prevention of foot ulcer. Pearson's product moment correlation (r) was used to examine the relationship between patients' knowledge and practice regarding prevention of foot ulcer. Since the knowledge and practice scores were not normally distributed and six subjects had extremely low score, the researcher decided to delete those cases, yielding the final sample size of 120. Finally, the knowledge and practice scores were normally distributed. In addition, the linearity assumption was tested and the finding supported this assumption. Therefore, Pearson's product moment correlation coefficient was used to examine the relationship between knowledge and practice to prevent foot ulcer among patients with type 2 diabetes mellitus.

CHAPTER 4

RESULTS AND DISCUSSION

This descriptive correlational study was aimed to investigate the level of knowledge, level of practice and their relationship with prevention of foot ulcer among type 2 diabetic patients. Collected data from 120 subjects were analyzed. The results and discussion are presented as follows:

1. Subjects' demographic characteristics
2. Subjects' health characteristics
3. Knowledge regarding prevention of foot ulcer
4. Practice regarding prevention of foot ulcer
5. Relationship between knowledge and practice to prevent foot ulcer of the patients

Results

Subjects' demographic characteristics

The characteristics of 120 Bangladeshi subjects are presented in Table 2. The subjects' mean age was 51.1 years old (SD 11.7, minimum 30, maximum 75). More than half of the subjects (54.2%) were female. Most of the subjects (88.3%) were Muslim, followed by Hindu (11.7%). The educational level of subjects was mainly high school (65%). Other subjects' demographics characteristics are presented in Table 2.

Table 2

Frequency and Percentage of Subjects Categorized by their Demographic Characteristics (N = 200)

Characteristics	n	%
Age (years) (M = 50.61, SD = 11.73, Min =30, Max =82)		
30 - 39	22	18.3
40 - 49	34	28.3
50 - 59	31	25.8
	33	27.5
Gender		
Male	55	45.8
Female	65	54.2
Religion		
Islam	106	88.3
Hindu	14	11.7
Level of education		
Primary school	29	24.2
High school	51	42,5
Vocational/ Technical certificate	2	1.7
College	22	18.3
University	16	13.3
Marital status		
Single	1	0.8
Married	199	99.2

Table 2 □□continued□□

Characteristics	n	%
Occupation		
Farmer	3	2.5
Private employee	13	10.8
Government employee	13	13.8
Business	19	15.8
Retirement	14	11.7
House-wife	58	48.3
Monthly income (Taka)		
<1,500	2	1.7
1,501 - 3,000	16	13.3
3,001 - 5,000	29	24.2
5,001- 10,000	48	40.0
> 10,000	25	20.8
Number of people live together		
(M = 5.20, SD = 2.37, Min = 2, Max = 14)		
1 - 5	79	65.8
> 5	41	34.2

Note: 1 \$ = 70 Taka.

Subjects' health characteristics

Health and illness history of the subjects are presented in Table 3. More than half (57.5%) were diagnosed with diabetes for less than 5 years with a mean duration of 5.02 years (SD = 4.46) and a range between 1- 1 years. Other subjects' health characteristics are presented in Table 3.

Table 3

Frequency and Percentage of Subjects' Health Characteristics (N = 120)

Characteristics	n	%
Years since diagnosed (M = 5.02, SD = 4.46, Min = 1.00, Max = 21.00)		
Under 5 years	69	57.5
5-10 years	38	31.7
Above 10 years	13	10.8
Past experience of foot ulcer		
No	111	92.5
Yes	9	7.5
Smoking habit		
No	113	94.2
Yes	7	5.8

Knowledge regarding prevention of foot ulcer

The overall mean score of knowledge regarding the prevention of foot ulcer was at high level (M = 84.5%, SD = 7.83). The mean score of the sub-dimensions about knowledge regarding prevention of foot care was at high level, except for diet habit knowledge in Table 4.

Table 4

Mean, Standard Deviation (SD) and Level of Subject's Knowledge Regarding Prevention of Foot Ulcer (N = 100)

KRPFU	Mean	SD	Level
General knowledge about diabetes	84.67	16.45	High
Diet habit	92.66	10.02	Very high
Exercise/physical activity	81.94	13.21	High
Total foot care knowledge	83.20	10.01	High
Total knowledge	84.55	7.83	High

Practice regarding prevention of foot ulcer

The overall mean score of practice regarding the prevention of foot ulcer was at low level (M = 61.4%, SD = 10.06). The mean score of the sub-dimensions about practice regarding the prevention of foot ulcer were at low level, except for foot care practice as shown in Table 5.

Table 5

Mean, Standard Deviation and Level of Subject's Practice Regarding Prevention of Foot Ulcer (N = 100)

PRPFU	Mean	SD	Level
General practice about diabetes	67.78	11.31	Low
Diet habit	62.83	13.60	Low
Exercise/physical activity	60.88	16.83	Low
Total foot care practice	59,09	12.53	Very low
Total practice	61.47	10.06	Low

Relationship between □knowledge and practice to prevent foot ulcer of the patients

Table 6 shows the correlation between total practice score and total knowledge score and each of the sub-dimensions. The result showed that there was a positive relationship between total knowledge score and total practice score ($r = .33$, $p < 0.01$). In addition, there was statistically positive relationship between total practice and sub-dimension of knowledge, exercise/physical activity, and foot care knowledge ($r = .23$, and $.30$, $p < 0.05$ and $p < 0.01$, respectively). There was no relationship between total practice and sub-dimension of knowledge, general knowledge about diabetes and diet habit.

Table 6

Correlation between Total Practice, Total Knowledge and the Subdimensions of Knowledge (N = 100)

	1	2	3	4	5	6
1. General knowledge	1					
2. Diet habit of knowledge	.09	1				
3. Exercise knowledge	.06	.24**	1			
4. Foot care knowledge	.29	.27**	.18	1		
5. Total knowledge	.52**	.48**	.48**	.87**	1	
6. Total practice	.06	.12	.23*	.30**	.33**	1

* $P < .05$, ** $P < .01$

Discussion

The discussion of the result is presented in the following sequence: demographic characteristics of the subjects, including subjects' health characteristics, knowledge regarding prevention of foot ulcer; practice regarding prevention of foot ulcer, and the relationship between knowledge and practice in prevention of foot ulcer of diabetic patients.

Subjects' demographic characteristics

The present study has shown that the age of the subjects vary from 30-82 years (M = 50.61, SD = 11.73). Nearly thirty percent (28.3%) of the subjects were

40-49 years old. These findings were congruent with the study of Oliveira et al. (2009), who found that type 2 diabetes mellitus is likely to occur more in people aged over 40 years. This study also revealed that subjects (39.2%) in this study had low income (<1500-5000), similar to another previous study which mentioned that patients had poor socioeconomic condition (Wadud et al., 2006).

Subjects' health characteristics

Long duration of diabetes is one of the most common causes of foot ulcer. In this study, nearly sixty percent (57.5%) of the subjects had been diagnosed with diabetes for less than 5 years, 31.7% had been diagnosed for 5-10 years, and 10.8% had been diagnosed for more than 10 years. Hence, the subjects that reached the risky group of having foot ulcer were 10.8%. According to American Diabetes Association (2003), the risk of foot ulcer was high among the subjects who had diabetes for 10 years or more. Most of the subjects (92.5%) were not familiar with foot ulcer but 7.5% had experienced foot ulcer, which was caused by minor injury. Pollock et al. (2003) stated that, the main pathway to diabetic foot amputation arises from a breakdown in the skin that often resulting from minor trauma or repetitive injury.

Knowledge regarding prevention of foot ulcer

Findings of this study has shown that the total level of knowledge of the subjects were at high level (84.55%) (Table 4). In Bangladesh, diabetic health facilities provides 'diabetic guide book' for each diabetic patient. Diabetic guide book provides overall information about diabetes that can help improving the knowledge

level of the patients. Like Mumu's study, they reported that diabetic guide book' provides information including medical test report, which helped the patients to control their diabetics (Mumu et al., 2009). In addition, mass media such as television, newspaper can also influence the people to gain knowledge to prevent complications of diabetes. All of the subjects (100%) in the present study stated that they had followed the instructions of the guidebook and physician's advice, and gained general knowledge about diabetes and diet habit. Regarding the findings of the present study, more than forty percent (42.5%) of the subjects completed high school, while 24.2% completed only primary level, and others were highly educated (Table 2). These findings supported the study of Lijteroff (2008) which stated that low literacy severely complicates the day to day management of the patients' condition, entire procedure of an effective self-care and many cases leading to tragic consequence. When patients are unable to read instructions relating to their medication, understand an appointment card, or even tell the time, they are placed at risk for the disabling and life threatening complications of diabetes. Literate person are likely to solve their problems and follow instruction about management of diabetes.

In addition, exercise/physical activity was at high level. Most of the subjects knew that exercise helps in controlling the blood glucose level and increasing blood circulation which promotes foot health. Subjects also knew that exercise improves blood glucose level and reduces blood glucose resistance. This finding was supported by the previous study that physical activities assist controlling of blood glucose level and improve insulin sensitivity (Mahtab et al., 2003).

Foot care knowledge was composed of nineteen questions for assessment of subjects' knowledge about foot care. Findings of the present study revealed that

subjects needed to know more about the danger of foot ulcer and how to manage it. The result had shown that subjects had high knowledge about basic foot care, as the questions were about basic foot care and personal hygiene. However, Bryant and his colleagues mentioned that the concept of managed foot care is well suited to the outpatient setting and offers comprehensive foot care education with ongoing evaluation to patients for the purpose of health promotion (Bryant & Beinlich, 2003).

Practice regarding prevention of foot ulcer

Findings of this study revealed that total practice was at low level (61.47%) (Table 5). Sub-dimension general practice about diabetes was also at low level. Nearly ninety percent (87.5%) of subjects stated that they could not measure blood glucose level, urine glucose level and also body weight because of the lack of measuring equipments, such as glucometer, urine sugar measuring materials and weight machine for measuring body weight. When the subjects felt discomfort, they went to health center for physical check up by the physician, and even they did not have any problems, they still visited the health center, due to the physician's date of appointment. This is the reason why their practice was at low level. Another previous study also supported that most of the subjects gained high marks on factual knowledge on diabetes, but low marks in the application of knowledge to their real life practice (Chan & Molassiotis, 1999).

Diet habit practice level was at low level due to many reasons such as cultural eating habit, food taboos, and poverty. In Bangladesh, cultural eating habit is the major problem, especially in rural areas. Most of the people are taking carbohydrate more than the recommended value. More than 32.5% of the subjects stated that they

sometimes take cooked rice instead of whole wheat chapattis. These findings supported the study conducted by Mumu et al. (2009) which found that daily carbohydrate intake was higher than the recommended value (up to 50% of total dietary energy intake) in 99% of the subjects. About half of the subjects in this study (48.3%) were housewives. Most of the subjects stated that they did not take food at the same time each day because they had to prepare food for their husband, their children and other family members, and then they took their food lastly. In addition, most housewives from the low income family sometimes take less food than their children and husband. These findings supported the study of Mahtab and Habib (2009), which stated that traditionally, the housewife is the last one to eat and the food is often constituted by leftovers and scraps.

Exercise/physical activity was also at low level. Findings of the present study revealed that most of the subjects exercised only by walking. This may be due to their conditions, lack of a place to exercise, no habit of exercise, and cultural barrier, especially women should not go out to join exercise freely with other people or alone in the street or field. Sriskantharajah and his colleagues supported this study that cultural barrier such as, religious, avoidance of mixed sex activity and fear of going out alone inhibit the participation in joint exercise (Sriskantharajah & Kai, 2006).

Finding of the present study revealed that the practice level of foot care was at very low level (59.09%). Foot care practice was at very low but 56.7% subjects had always performed washing feet and 37.5% had performed sometimes. Most of the subjects were Muslim and they performed feet ablution before offering prayers. These findings supported the study by Hasnain and Sheikh (2009) which revealed that some people are already doing good practices without knowing they are good for their

health. This may explain the basis of Islamic rituals, which they are performing religiously without knowing that some of these activities are part of a good foot care practice. This study also found that nearly ninety percent (88.7%) of the respondents were practicing feet washing as they did ablution before offering prayers. Nearly forty percent (37.5%) of the subjects stated that they did not take care of their toenails in proper ways, and one of the reasons was that most of the subjects stated that their feet had no problems, so there was no need to inspect foot daily or all the time. This study was supported by another previous study which stated that, 67.1% of the patients in the study did not examine their feet on daily basis (Rocha et al., 2009). In the present study, subjects knew that they needed to wear soft, suitable footwear. Eighty six subjects stated that they had always bought soft shoes to avoid trauma, but the researcher observed that most of the subjects wore open and hard shoes. Rocha's study also supported this finding that 98.2% of the patients wore open footwear (Rocha et al., 2009). Moreover, most of the subjects cut their hand nails by nail clipper and toenails by blade as it was suitable and easy for them and the toenails were cut round and short. This finding was also supported by a previous study, which stated that 83.6% of the patients cut their toenails inappropriately, very short and round (Rocha et al., 2009). Another previous study also supported this study, it stated that among large population of individuals with type 2 diabetes, more than half reported that they never had their feet examined by their physician (Pataky & Vischer, 2007).

Relationship between knowledge and practice to prevent foot ulcer of diabetic patients

The present study had found a small but significant positive relationship between total practice and sub-dimensions of total knowledge, exercise/physical activity and total foot care knowledge. The total practice had no relationship with general knowledge about diabetes and diet habit. Even though the total knowledge of the subjects was at high level and the total practice was at low level, but there was a positive relationship between them. These findings were consistent with the KAP model which suggested that there is a positive relationship between knowledge and practice. The KAP model also suggested that the right information (knowledge) will influence a change of behavior (practice) (Launiala, 2009). These findings are also different from the study by Chan, & Molassiotis (1999) which found that there was no relationship between diabetes knowledge and practice. Also, there was a gap between what the patients were taught and what they were actually doing.

Even though total knowledge and total practice had a correlation, but not all sub-dimensions of knowledge are correlated to practice. Exercise/physical activity and total foot care knowledge had a correlation with total practice as these were familiar to subjects and were a part of personal hygiene. This finding was supported by Rocha and colleagues' study that the health team needs to develop strategies to encourage diabetic patients to follow adequate foot care behaviors and to find ways to overcome the obstacles of their adaptation (Rocha et al., 2009).

General knowledge about diabetes and diet habit had no relationship with total practice. The other factors contributed to the practice are socioeconomic condition (low and middle income), too many family members, cultural eating habit and

urbanization. This finding was supported by Mumu el al's () study that daily carbohydrate intake was higher than the recommended value and the diabetic patients are increasing in developing countries due to rapid transition from traditional life style to an urbanized culture and socioeconomic.

CHAPTER 5

CONCLUTIONS AND RECOMMENDATION

This descriptive correlational study was proposed to describe the level of knowledge and level of practice in prevention of foot ulcer. One-hundred and twenty patients with type 2 diabetes attending the out-patient department of Rangpur Diabetic Association Radhaballove, Rangpur, Bangladesh, from November 2009 to January 2010 were recruited purposively. The instrument was based on literature review and incorporated three parts: (1) Demographic Data Assessment Form, (2) Knowledge Regarding Prevention of Foot Ulcer Questionnaire and (3) Practice Regarding Prevention of Foot Ulcer Questionnaire. The data was analyzed by using computer program. According to the foregoing results and discussion, the summary, limitations as well as implications and recommendations of the study are presented as follows:

Summary of the findings

In this present study, total knowledge of foot care performed by the Bangladeshi type 2 diabetic patients was at high level ($M = 84.55$, $SD = 7.83$), and total practice of foot care was at low level ($M = 61.47$, $SD = 10.06$), and sub-dimension foot care was performed at low level ($M = 59.09$, $SD = 12.53$), so it implies that foot care may have been neglected by the patients. It was found that the total foot care knowledge and total foot care practice had a low but positive and significant correlation ($r = .33$, $p < .01$), and there was also a positive and significant relationship between total practice of foot care and sub-dimension of total knowledge,

exercise/physical activity and foot care ($r = .23$, and $.30$, $p < 0.05$ and $p < 0.01$, respectively). Sub-dimension of total knowledge, general knowledge and diet habit had no statistically significant relationship with total practice.

Limitations

The limitations of the study were:

(1) Assessed knowledge of the patients using true-false questionnaire had no scope of intervention toward practice. Most of the patient wanted to know how to manage better practices;

(2) Some patients had low level of education, problem of vision, and also some aged subjects did not fill up the questionnaire by themselves. The researcher verbalized and filled up the questionnaire as they gave their opinion. This might have some contribution to their answers.

(3) It was time consuming and when asking item, it might have interrupted patients' thinking.

(4) Question no. 8 of the knowledge test did not measure knowledge, it expressed the opinion of the patients. Practice regarding item no. 29 was multiple practice options, so patients might have confused, and that may be the reason why almost forty-percent (37.5%) of the given answers was never practice .

(5) The present study was conducted in only one diabetic center, so this study has limited generalizability.

Implications and Recommendations

There are four important implications: nursing practice, nursing education, nursing research and health policy making.

Nursing practice

The finding of the present study indicated that health care team should be used as an important source of information for diabetic foot care in prevention of foot ulcer, which can help improving the patients who have very low level of foot care practice. Nurses should provide health education to the patients toward foot care practice by demonstrating foot care procedure and then let the patients redo the procedure by themselves. Low level of foot care needs to be improved to a higher level, and this study provides appropriate information about foot care practice.

Nursing education

Based on the findings, in four sub-dimensions of practice, foot care was at very low level, and the other three were at low level. Information about foot care of the patient remains inadequate. Training program should be arranged for nurses about foot care of diabetes mellitus. In addition, the knowledge from this study should be included in nursing curriculum, it would help nursing students to gain knowledge about foot hygiene, foot skin care, daily inspection of the foot, care of toenails, foot exercise and footwear. Instruction should also be provided to nurses for preventive foot care in preventing of foot ulcer.

Nursing research

The present study offers baseline evidence regarding knowledge about foot care, promotes and influences high level practice of type 2 diabetic patients. Further studies should be conducted to explore this phenomenon with a greater number of

samples and settings in order to obtain more variance of data. Moreover, in order to gain deeper understanding, more detailed studies are needed, not only descriptive correlational study but interventional study would also be helpful.

□ *Health policy*

According to all findings of this study, preventive foot care program should be placed in each health care center and hospital in order to prevent the foot ulcer, and each diabetic patient should be encouraged to go to the counseling session in order to develop awareness and ensure quality care.

Recommendations

The finding of the present study indicated that foot care practice of Bangladeshi nurses is at a very low level and needs to be improved to higher level, and patients should be educated about foot care practice.

Based on the study findings, the researcher would like to emphasize on foot care activities by the nursing personnel. The researcher would like to recommend further interventional study in order to enhance the foot care practice and diabetic patients should undergo counseling session in order to develop their awareness.

Furthermore, the instrument of this study needs further exploration and revision in order to enhance its validity to yield more extensive and detailed result.

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APPENDICES

APPENDIX A
INFORMED CONSENT FORM

Dear Participant

My name is Sheule Begum. I am a master student at Faculty of Nursing, Prince of Songkla University, Thailand. I was working as a charge nurse of surgery ENT male ward of Rangpur Medical College Hospital in Bangladesh. I am conducting a study to explore the level of knowledge and foot care practice to prevent foot ulcer of patients with type 2 diabetes. This study is part of my research of the master of nursing program at Prince of Songkla University, Hat Yai, Thailand.

The study and its procedures have been approved by the appropriate persons and the Institutional Review Board (IRB) of Prince of Songkla University, Thailand. The study procedures involve no risk or harm to you. You are requested to respond to the questions about your personal information and your perception of the level of your need of information regarding knowledge and practice in prevention of foot ulcer. Please write your answers as accurately as possible. It should take approximately 20- 30 minutes to complete the questionnaire. Your identity will not be disclosed and coding system will be used in this study.

The information gathered will be used to write a research report. The information will be helpful to enhance the practice of foot care among diabetic patients. It will also be helpful to delay or prevent foot ulcer. All information and your responses in connection with this study will remain confidential. Only the researcher and the advisors are eligible to access the data. Neither your name nor any identifying information will be used in the report of this study. The questionnaires will be

destroyed after the completion of this study. Your participation in this study is on volunteer basis. You have the right to participate or not to participate. You also have the right to withdraw from this study at any time. There is no cost for participating in this study and no financial reward.

.....

(Name of Researcher)	(Signature of Researcher)	Date
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If you have any questions related to the questionnaires now or any time during this study, please feel free to ask or discuss with me. Please contact me at the following address.

Mrs. Sheule Begum.

Tel: 88- 67195. Mob: 01746255659.

E-mail: Sheule_Begum@yahoo.com.

I have already read and understood all information and agree to participate in this study.

.....

(Name of Participant)	(Signature of Participant)	Date
-----------------------	----------------------------	------

APPENDIX B
INSTRUMENTS

Code:

Date/ Time:

Hospital:

Part A: Demographic data and Health Characteristics Form (DDHCF).

I would like to ask you some information about your personal data and disease related data. Please answer the best choice by putting mark (no. 1, 7, 10, & 11), and fill in the available Space (no. 1, 8, & 9) which is appropriate for you.

1. Age _____ year
2. Gender 1. Male 2. Female
3. Religion 1. Islam 2. Hindu
 3. Buddhist 4. Christian
4. Level of education 1. Primary school 2. High school
 3. Vocational/ Technical certificate
 4. College 5. University
 . Others (identify
5. Marital status 1. Single 2. Married
 3. Separated 4. Divorced
6. Occupation 1. Farmer 2. Labor
 3. Private employee 4. Government employee
 5. Business person 6. Retirement

7. Monthly Income 1. Taka < 1,500 2. Taka 1,501- 3,000
3. Taka 3,001-5,000 4. Taka 5,001-10,000
5. Taka > 10,000

8. How many people live with you?

. How long do you have diabetes

10. Did you have foot ulcer before? 1. No 2. Yes

11. Do you smoke? 1. No 2. Yes

Part- B: Knowledge Regarding the Prevention of Foot Ulcer Questionnaire (KRPFUQ). Below are statements about your knowledge regarding to prevention of diabetic foot ulcer. Please answer the statement by mark (✓) choices: On the Column that the best answer for the each question according to your understanding.

Statements		True	False
	General knowledge related		
1	Classic symptoms of hyperglycemia are polydipsia, polyuria, polyphagia and unexplained weight loss. (T)		
2	Hypoglycemia is called high blood glucose level more than normal.(F)		
3	Manifestation of hypoglycemia is tremor, tachycardia , sudden onset of hunger, excessive perspiration, pallor, shakiness etc. (T)		
4	Local change of feet skin due to increased moisture and white mass between toe, redness of down portion, edema, dryness, and fissure are early signs of foot ulcer. (T)		
5	Risk factors of foot ulcer are local change of foot skin, cardiovascular disease, autonomic neuropathy, motor neuropathy, and sensory neuropathy. (T)		
	Diet habit		
6	Dietary habit plays an important role on control of blood sugar level. (T)		
7	High fiber food such as legumes, whole grain, breads, whole fruits and vegetables are controlled blood glucose level and reduced insulin resistance. (T)		
8	Diabetic guide book is helpful to follow food exchange method. (T)		
9	Dietary habit and knowledge is most important to prevent diabetic complication like hyperglycemia and foot ulcers. (T)		
10	Food is a less important part of treatment of diabetes type 2. (F)		

(Continued)

Statements		True	False
	Exercise/Physical activity		
11	Regular exercise is a good habit. (T)		
12	Exercise is less important to control diabetes. (F)		
13	Exercise increases the blood circulation of body and maintains the blood glucose level and prevents foot complications. (T)		
14	Exercise has a little effect on insulin resistance. (F)		
15	Maintain daily schedule of exercise at the regular time for same duration is good for health. (T)		
16	During or after exercise drinking of water is good habit to prevent dehydration. (T)		
	Total foot care		
	Foot hygiene		
17	Washing feet daily with soap will prevent foot infection and keeps foot healthy. (T)		
18	Washing with warm water keeps feet soft and prevents cracking. (T)		
19	After washing feet, wearing slippers is a good habit as it protects feet from accidental injury. (T)		
	Foot skin care		
20	Drying of feet with soft towel can prevent irritation. (T)		
21	Excessive moisture lotion or oils used in between toes to prevent maceration. (F)		
22	Moisturizing cream or oil prevent cracks in feet and keeps them soft.(T)		
	Daily inspection foot		
23	Daily inspection of feet to detect the danger early as: cut, blister, bruises, redness, etc. (T)		

(Continued)

Statements		True	False
	Daily inspection foot		
24	When checked feet, there is no need of good light. (F)		
25	Inspection of feet during or after bath is unnecessary. (F)		
26	Inspection of feet during wearing the socks or applying lotion will help to identify any problems. (T)		
27	Toenails will be cut to keep the contour of the toes to prevent in growing. (T)		
28	Trim toenails straight and sharp or keep the jagged edges smooth with a file or emery board to prevent injury and in-growing. (T)		
29	Cut toenails by nail clipper after washing and drying the feet in order to prevent injury to feet. (T)		
	Foot exercise		
30	Sitting foot exercise is easy to perform for blood circulation. (T)		
31	Feet ankle and legs exercise increases blood circulation and keeps the foot healthy. (T)		
	Footwear		
32	Measure the feet, buy right new shoes and choose soft shoes to avoid trauma. (T)		
33	New shoes should be worn gradually to avoid blister formation. (T)		
34	Inspect footwear inside before putting them is less important. (F)		
35	Stocking helps to keep feet dry and soft also absorb moisture and avoid warmness. (T)		

Part-C: Practice Regarding Prevention of Foot Ulcer Questionnaire (PRPFUQ)

please read each question and answers them by marking a (✓) in the appropriate statements of your current practice.

Statements		Never practice (0)	Seldom practice (1)	Sometimes practice (2)	Always (3)
	General practice.				
1	I measure body weight to maintain health.				
2	I measure blood glucose level to check hyper and hypoglycemia.				
3	I take food timely to prevent hypoglycemia.				
4	I check local foot skin to identify problems.				
5	I do my physical examination by physician to avoid diabetic risk factors.				
	Diet habit				
6	I change and maintain my dietary habit to control blood glucose level.				
7	I take high fiber food to control glucose level and reduce insulin resistance.				
8	I maintain the food exchange method following the diabetic guide book, such as instead of 2 whole wheat chapattis (60g each), only 1chapatti equal 120g of cooked rice, 1 whole orange (about 120g) or 1 apple or 1 medium size banana etc.				
9	I practice good dietary habit for reducing diabetic complication like hyperglycemia and foot ulcers.				

(Continued)

Statements		Never practice (0)	Seldom practice (1)	Sometimes practice (2)	Always (3)
	Diet habit				
10	I practice and give importance to food like the part of treatment of diabetes type 2.				
	Exercise/Physical activity				
11	I practice exercise regularly.				
12	I practice exercise to control diabetes.				
13	I do exercise to increase blood circulation of the body and maintain blood glucose level and prevent foot complications.				
14	I do exercise to reduce insulin resistance.				
15	I practice exercise daily at same time and duration.				
16	I drink water during or after exercise to prevent dehydration				
	Total foot care practice				
	Foot hygiene				
17	I wash feet daily with soap to prevent infection and keeps foot healthy.				
18	I wash feet with warm water to prevent cracking and keep the feet soft.				
19	After washing feet, I wear slippers.				
	Foot skin care				
20	I dry the feet well with soft towel to prevent irritation.				
21	I use moisture lotion or oils in between toes.				
22	I use moisture lotion or oils to prevent cracks in feet and keeps them soft.				

(Continued)

Statements		Never practice (0)	Seldom practice (1)	Sometimes practice (2)	Always (3)
	Daily inspection foot				
23	I inspect the feet daily to detect early danger as: cut, blister, bruises, redness, etc.				
24	I inspect the feet under good light.				
25	I inspect feet during and after shower/ bath.				
26	I inspect feet while putting on socks or during applying lotion.				
	Care of toenails				
27	I cut the toenails to keep the contour of the toes.				
28	I trim the toenails straight and sharp jagged edges smooth by emery board.				
29	I cut toenails by nail clipper after washing and drying the feet in order to prevent injury to feet.				
	Foot exercise				
30	I perform sitting foot exercise.				
31	I practice feet ankle and leg exercise.				
	Footwear				
32	I measure the feet, buy right new shoes and choice soft shoes to avoid trauma.				
33	I wear new shoes gradually to avoid foot blisters.				
34	Inspect footwear inside before putting them.				
35	I wear socks to keep feet dry and soft also to absorb moisture and to keep them warm.				

APPENDIX C

Table 7

The Frequency and Percentage of Subjects Answered Correctly on the Subjects

Knowledge Regarding Questions (N = 1000)

Knowledge of Subjects	n	%
1 Classic symptoms of hyperglycemia are polydipsia, polyuria, polyphagia and unexplained weight loss. (T)	120	100.0
2 Hypoglycemia is called high blood glucose level more than normal. (F)	70	58.0
3 Manifestation of hypoglycemia is tremor, tachycardia , sudden onset of hunger, excessive perspiration, pallor, shakiness etc.	92	76.6
4 Local change of feet skin due to increased moisture and white mass between toe, redness of down portion, edema, dryness, and fissure are early signs of foot ulcer. (T)	116	96.6
5 Risk factors of foot ulcer are local change of foot skin, cardiovascular disease, autonomic neuropathy, motor neuropathy, and sensory neuropathy. (T)	110	91.6
6 Dietary habit plays an important role on control of blood sugar level. (F)	120	100.0
7 High fiber food such as legumes, whole grain, breads, whole fruits and vegetables are controlled blood glucose level and reduced insulin resistance. (F)	115	95.8
8 Diabetic guide book is helpful to follow food exchange method. (T)	120	100.0
9 Dietary habit and knowledge is most important to prevent diabetic complication like hyperglycemia and foot ulcers. (T)	118	98.3
10 Food is a less important part of treatment of diabetes type 2. (F)	83	69.1

Table 7 *Continued*

Knowledge of Subjects		n	%
11	Regular exercise is a good habit. (T)	117	97.5
12	Exercise is less important to control diabetes. (F)	65	57.1
13	Exercise increases the blood circulation of body and maintains the blood glucose level and prevents foot complications. (T)	116	96.6
14	Exercise has a little effect on insulin resistance. (F)	56	46.6
15	Maintain daily schedule of exercise at the regular time for same duration is good for health. (T)	117	97.5
16	During or after exercise drinking of water is good habit to prevent dehydration. (T)	119	99.1
17	Washing feet daily with soap will prevent foot infection and keeps foot healthy. (T)	119	99.1
18	Washing with warm water keeps feet soft and prevents cracking. (T)	117	97.5
19	After washing feet, wearing slippers is a good habit as it protects feet from accidental injury. (T)	118	98.3
20	Drying of feet with soft towel can prevent irritation. (T)	116	96.6
21	Excessive moisture lotion or oils used in between toes to prevent maceration. (F)	32	26.6
22	Moisturizing cream or oil prevent cracks in feet and keeps them soft. (T)	118	98.3
23	Daily inspection of feet to detect the danger early as: cut, blister, bruises, redness, etc. (T)	114	95.0
24	When checked feet, there is no need of good light. (F)	42	35.0
25	Inspection of feet during or after bath is unnecessary. (F)	44	36.6
26	Inspection of feet during wearing the socks or applying lotion will help to identify any problems. (T)	106	88.3

Table 7 *Continued*

Knowledge of Subjects		n	%
27	Toenails will be cut to keep the contour of the toes to prevent in growing. (T)	110	91.6
28	Trim toenails straight and sharp or keep the jagged edges smooth with a file or emery board to prevent injury and in-growing. (T)	113	94.1
29	Cut toenails by nail clipper after washing and drying the feet in order to prevent injury to feet. (T)	115	95.8
30	Sitting foot exercise is easy to perform for blood circulation. (T)	110	91.6
31	Feet ankle and legs exercise increases blood circulation and keeps the foot healthy. (T)	109	90.8
32	Measure the feet, buy right new shoes and choose soft shoes to avoid trauma. (T)	115	95.8
33	New shoes should be worn gradually to avoid blister formation. (T)	117	97.5
34	Inspect footwear inside before putting them is less important. (F)	65	54.1
35	Stocking helps to keep feet dry and soft also absorb moisture and avoid warmness. (T)	117	97.5

Table 8

The Frequency and Percentage of Subjects' Action on Subjects Practice Regarding

Questions (N = 120)

Practice of Subjects	n	%
1 I measure body weight to maintain health (n = 120)		
Seldom Practice	4	3.3
Sometimes practice	105	87.5
Always	11	9.2
2 I measure blood glucose level to check hyper and hypoglycemia (n = 120)		
Seldom Practice	3	2.5
Sometimes practice	106	88.3
Always	11	9.2
3 I take food timely to prevent hypoglycemia (n = 120)		
Never practice	3	2.5
Seldom Practice	1	0.8
Sometimes practice	78	65.0
Always	38	31.7
4 I check local foot skin to identify problems (n = 120)		
Never practice	18	15.0
Seldom Practice	15	12.5
Sometimes practice	74	61.7
Always	13	10.8
5 I do my physical examination by physician to avoid diabetic risk factors (n = 120)		
Seldom Practice	3	2.5
Sometimes practice	103	85.8
Always	14	11.7

Table 8 □□continued□□

Practice of Subjects	n	%
6 I change and maintain my dietary habit to control blood glucose level (n = 120)		
Never practice	1	0.8
Seldom Practice	9	7.5
Sometimes practice	91	75.9
Always	19	15.8
7 I take high fiber food to control glucose level and reduce insulin resistance (n = 120)		
Never practice	1	.8
Seldom Practice	50	41.7
Sometimes practice	56	46.7
Always	13	10.8
8 I maintain the food exchange method following the diabetic guide book, such as instead of 2 whole wheat chapattis (60g each), only 1chapatti equal 120g of cooked rice, 1 whole orange (about 120g) or 1 medium size banana etc. (n = 120)		
Never practice	1	.8
Seldom Practice	69	57.5
Sometimes practice	39	32.5
Always	11	9.2
9 I practice good dietary habit for reducing diabetic complication like hyperglycemia and foot ulcers.		
Never practice	2	1.7
Seldom Practice	15	12.5
Sometimes practice	82	68.3
Always	21	17.5

Table 8 □□continued□

Practice of Subjects	n	%
10 I practice and give importance to food like the part of treatment of diabetes type 2 (n = 120)		
Seldom Practice	7	5.8
Sometimes practice	86	71.7
Always	27	22.5
11 I practice exercise regularly (n =120)		
Never practice	1	.8
Seldom Practice	10	8.3
Sometimes practice	80	66.7
Always	29	24.2
12 I practice exercise to control diabetes (n = 120)		
Never practice	1	.8
Seldom Practice	12	10.0
Sometimes practice	78	65.0
Always	29	24.2
13 I do exercise to increase blood circulation of the body and maintain blood glucose level and prevent foot complications (n = 120)		
Never practice	4	3.3
Seldom Practice	28	23.3
Sometimes practice	70	58.4
Always	18	15.0
14 I do exercise to reduce insulin resistance (n = 120)		
Never practice	26	21.7
Seldom Practice	47	39.1
Sometimes practice	39	32.5
Always	8	6.7

Table 8 □□*continued*□□

Practice of Subjects	n	%
15 I practice exercise daily at same time and duration (n = 120)		
Never practice	5	4.2
Seldom Practice	21	17.5
Sometimes practice	80	66.6
Always	14	11.7
16 I drink water during or after exercise to prevent dehydration (n = 120)		
Never practice	12	10.0
Seldom Practice	24	20.0
Sometimes Practice	67	55.8
Always	17	14.2
17 I wash feet daily with soap to prevent infection and keeps foot healthy (n = 120)		
Never practice	2	1.7
Seldom Practice	5	4.1
Sometimes Practice	45	37.5
Always	68	56.7
18 I wash feet with warm water to prevent cracking and keep the feet soft (n = 120)		
Never practice	29	24.2
Seldom Practice	33	27.5
Sometimes Practice	44	36.6
Always	14	11.7
19 After washing feet, I wear slippers (n = 120)		
Seldom Practice	7	5.8
Sometimes Practice	32	26.7
Always	81	67.5

Table 8 □□continued□

Practice of Subjects	n	%
20 I dry the feet well with soft towel to prevent irritation (n =120)		
Never practice	2	1.7
Seldom Practice	10	8.3
Sometimes Practice	93	77.5
Always	15	12.5
21 I use moisture lotion or oils in between toes (n = 120)		
Never practice	25	20.8
Seldom Practice	31	25.8
Sometimes Practice	50	41.7
Always	14	11.7
22 I use moisture lotion or oils to prevent cracks in feet and keeps them soft (n = 120)		
Never practice	3	2.5
Seldom Practice	11	9.2
Sometimes Practice	80	66.6
Always	26	21.7
23 I inspect the feet daily to detect early danger as: cut, blister, bruises, redness, etc (n = 120)		
Never practice	20	16.7
Seldom Practice	51	42.5
Sometimes Practice	40	33.3
Always	9	7.5
24 I inspect the feet under good light (n = 120)		
Never practice	23	19.2
Seldom Practice	61	50.8
Sometimes Practice	27	22.5
Always	9	7.5

Table 8 □□*continued*□□

Practice of Subjects	n	%
25 I inspect feet during and after shower/ bath (n = 120)		
Never practice	41	34.2
Seldom Practice	44	36.6
Sometimes Practice	26	21.7
Always	9	7.5
26 I inspect feet while putting on socks or during applying lotion (n = 120)		
Never practice	25	20.8
Seldom Practice	47	39.2
Sometimes Practice	26	21.7
Always	22	18.3
27 I cut the toenails to keep the contour of the toes (n =120)		
Never practice	1	0.8
Seldom Practice	7	5.9
Sometimes Practice	24	20.0
Always	88	73.3
28 I trim the toenails straight and sharp jagged edges smooth by emery board (n = 120)		
Never practice	3	2.5
Seldom Practice	7	5.8
Sometimes Practice	23	19.2
Always	87	72.5

Table 8 □□continued□□

Practice of Subjects	n	%
29 I cut toenails by nail clipper after washing and drying the feet in order to prevent injury to feet (n =120)		
Never practice	45	37.5
Seldom Practice	30	25.0
Sometimes Practice	13	10.8
Always	32	26.7
30 I perform sitting foot exercise (n =120)		
Never practice	45	37.5
Seldom Practice	57	47.5
Sometimes Practice	12	10.0
Always	6	5.0
31 I practice feet ankle and leg exercise (n = 120)		
Never practice	44	36.7
Seldom Practice	49	40.8
Sometimes Practice	17	14.2
Always	10	8.3
32 I measure the feet, buy right new shoes and choice soft shoes to avoid trauma (n =120)		
Never practice	4	3.3
Seldom Practice	7	5.8
Sometimes Practice	23	19.2
Always	86	71.7
33 I wear new shoes gradually to avoid foot blisters (n = 120)		
Never practice	3	2.5
Seldom Practice	6	5.0
Sometimes Practice	37	30.8
Always	74	61.7

Table 8 □□*continued*□□

Practice of Subjects	n	%
34 I inspect footwear inside before putting them (n = 120)		
Never practice	12	10.0
Seldom Practice	43	35.8
Sometimes Practice	32	26.7
Always	33	27.5
35 I wear socks to keep feet dry and soft also to absorb moisture and to keep them warm (n = 120)		
Never practice	13	10.8
Seldom Practice	46	38.4
Sometimes Practice	36	30.0
Always	25	20.8

APPENDIX D
LIST OF EXPERTS

Three experts examined the content validity of the instrument for type 2 diabetes patients' knowledge and practice related prevention of foot ulcer.

They are

1. Assist. Prof. PhD. Dr. Ploenpit Thaniwattananon Faculty of Nursing PSU.
2. Dr. Dabirul Islam (Medical doctor) School Health Clinic, Rangpur in Bangladesh.
3. Mrs. Salina Akter (Master-prepared nurse administrator) Nursing Institution Rangpur, Bangladesh.

VITAE

Name Sheule Begum

Student ID 5110420087

Education Attainment

Degree	Name of Institution	Year of Graduation
Bachelor of Arts	Rangpur Govt. College, National University Gazipur Dhaka, Bangladesh	1993
Bachelor of Nursing Science	College of Nursing Mohakhali, Dhaka University, Bangladesh	2001

Scholarship award during Enrollment

Scholarship provide from Bangladesh Government.

Work Position and Address

Work as a senior staff nurse.

Rangpur Medical College Hospital, in Bangladesh.

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