# CLINICAL PROFILE AND PATTERN OF INFECTION AMONG DIABETIC PATIENTS IN A DIABETIC HOSPITAL, CHATTOGRAM

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**Session: 2020-2021**

**A thesis submitted in the partial fulfillment of the requirements for the degree of Master in Public Health**

**One Health Institute**

**Chattogram Veterinary and Animal Sciences University**

**Chattogram-4225, Bangladesh**

**December, 2022**

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**DR. SUCHANA SEN**

**December 2022**

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**This is to certify that we have examined the above Master's thesis and have found that is complete and satisfactory in all aspects, and that all revisions required by the thesis examination committee have been made**

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**DECEMBER, 2022**

**Dedicated to**

My beloved parents, my husband and my children

Dipta, Purna and Riddhi

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# Abstract

Diabetes and prediabetes affect a substantial proportion of Bangladeshi people. To date, the economic burden and resource allocation for common diabetic complications like infection is not well defined in Bangladesh. Given the increasing prevalence of Diabetes mellitus in Bangladesh, there is a need to quantify the frequency in which diabetics seek care for infection and evaluate the associated clinical profile. This study aimed to investigate the clinical profile and pattern of infection among diabetic patients who attended a diabetic hospital in Chattogram, Bangladesh. This descriptive cross-sectional study included conveniently selected 206 known diabetic patients from the outpatient and inpatient Department of Diabetic Hospital, Chattogram, Bangladesh from May 2022 to 31st October 2022. Data regarding sociodemographic, behavioral, clinical features, biochemical parameters, and infections were collected using a structured case record form. Infections were identified by clinical examination and reviewing the medical records. Both descriptive and inferential statistics were used for the results. The sociodemographic features considered in this study were age, sex, education, monthly income and marital status which was 50.0±10.1 years, 53.9% were men, 34% completed SSC and most of the participants (86.4%) were married. 51.5% of the patients had a monthly income ≥ 30000 Taka. Diabetic patients with low level of education 'P'value(0.002) and lower monthly income 'P' value(0.028) had more infection than those who had education above SSC and monthly income more than 30000Tk. Glycemic status was poor for 34.5%(7.4±3.9), 56.3%(9.8±2.7) and 46.6%(7.9±2.2) of the patients based on FBS, BS2hrsABF and HbA1c levels, respectively. Most of the patients, had eye complications (70.4%), followed by chronic kidney disease (20.4%), cardiovascular diseases (10.7%), neurological problems (2.9%). Fifty-seven (27.7%) patients had documented infection or evidence of infection on examination. The most common of them were UTI (33.3%), followed by pneumonia (24.6%), skin and soft tissue infections (14%), diabetic foot infection (8.8%). Other less frequently observed infections were fungal infections, tuberculosis, eye, ear, and bone infections. Significantly, higher proportion of patients with infections had poor glycemic status compared to the diabetic patients without infections (2HABF 73.7% versus 49.7%, HbA1c 61.4% versus 40.9%, $P<0.05$. One in four diabetes patients had evidence of infection, most commonly involving urinary and respiratory tracts. The results of this study can increase awareness of common infections associated with DM in a specialized hospital in Bangladesh.



**Keywords:** Diabetes Mellitus, Infection, Diabetic hospital, Chattogram**.**

# Chapter 1: Introduction

## 1.1 Introduction

Diabetes mellitus (DM) is one of the most common systemic diseases worldwide contributing to a major share of premature morbidity and mortality in age 30-70. Globally, the estimated number of people living with diabetes has risen from 108 million in 1980 to 476 million in 2017 with the prevalence of diabetes among adults over 18 years of age rising from 4.7% in 1980 to 8.5% in 2014.Worldwide, 1.4 million deaths and 2.5% of total deaths are attributed to diabetes in 2017(Arokiasamy et al., 2021).Prevalence of diabetic patients in Bangladesh is 14.2% (IDF-Atlas-10$^{th}$ Edition-2021, pp:94-95)

Diabetes and prediabetes affect a substantial proportion (over one-quarter) of the Bangladeshi adult population (Islam et al., 2021). Alarmingly, recent evidence suggested a poor management of diabetes in Bangladesh. Less than one-third of the people with diabetes were aware of their condition. Just over one-fourth of the people with diabetes were on treatment, and among those who were treated only one-fourth had controlled diabetes (Khan et al., 2022). The global and national burden of diabetes not only poses serious challenge to public health but tend to have an overwhelming effect on the global development through substantial social and economic loss (Arokiasamy et al., 2021; Islam et al., 2017).

DM is associated with multiple co-morbid conditions – including infection. Patients with Type 1 and Type 2 DM are at increased risk for infection secondary to poor glycemic control, diabetic neuropathy, and impaired innate and adaptive immune responses (Knapp, 2013). Diabetics are at increased risk for community-acquired infections as well as rare infections like malignant otitis externa, rhinocerebral mucormycosis, and emphysematous pyelonephritis (Casqueiro J and Alves, 2012). Sepsis also occurs more frequently and has a higher mortality rate in patients with DM than in other individuals (Shah and Hux, 2003). In general, patients with diabetes are often more likely to develop recurrent infections or complications from infections that require inpatient hospital management (Joshi et al., 1999).

To date, the economic burden and resource allocation for common diabetic complications like infection is not well defined in Bangladesh. Given the increasing prevalence of DM in Bangladesh, there is a need quantify the frequency in which diabetics seek care for infection and evaluate the associated risk factors of infections. Therefore, it was intended to study the various types of infections in diabetic patients and its correlation with sociodemographic, behavioural, clinical, and biochemical features in a Diabetic Hospital of Bangladesh, so that it would help us to develop clinically relevant guidelines and targets to reduce mortality, morbidity and improve the quality of life of diabetic patients.

## 1.2 Objectives

### 1.2.1 General objective

- To determine the prevalence of different types of infections and their relationship with clinical profile in diabetic patients attended to a Diabetic Hospital of Chattogram, Bangladesh

### 1.2.2 Specific objectives

1. To know the lifestyle and sociodemographic condition of diabetic patients
2. To assess glycemic control of diabetic patient
3. To correlate infection with diabetes control
4. To describe the clinical patterns and common infection in diabetic patients

# Chapter 2: Review of Literature

In general, infectious diseases are more frequent and/or serious in patients with DM, which potentially increases their morbimortality. Recent prevalence of different types of infections and its associated factors among diabetic patients are underreported in Bangladesh. In the following sections the overview of DM, its complications, and factors associated with the infections are described in brief.

## 2.1 Overview of Diabetes Mellitus:

### 2.1.1 Definition of Diabetes Mellitus:

The term "Diabetes" refers to a group of metabolic disorder characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action or both. Several pathogenic processes are involved in the development of diabetes. The chronic hyperglycaemia is associated with long-term damage, dysfunction, and failure of various organs like eyes, kidneys, nerves, heart, and blood vessels. In diabetes the deficient action of insulin on the target tissues causes the dysfunction of carbohydrate, fat, and protein metabolism. It is one of the commonest endocrine disorders. The causation and management of the disease is closely linked to diet & nutrition. This is a hereditary metabolic disorder and a universal health problem (ADA, 2021).

**2.1.2 Classification of Diabetes Mellitus:** DM can be classified as (ADA, 2021):

**1. Type 1 DM or insulin dependent diabetes**: The beta cells in the pancreas that make insulin are destroyed. This form includes cases due to an autoimmune process and those for which the etiology of beta cell destruction is unknown. There is an absolute deficiency of insulin and people with T1DM require insulin injections every day to sustain life. This form of diabetes is more common in childhood and young adulthood but can occur at any age. Poorly controlled T1DM leads to early onset of complications.

**2. Type 2 DM or non-insulin dependent diabetes**: T2DM is the most common form of diabetes characterized by insulin resistance. Type 2 diabetes usually occurs in middle aged and elderly people, but its incidence is increasing in younger adults. Most people with this form of diabetes are obese and obesity itself causes some degree of insulin

resistance. T2DM leads to microvascular complications-retinopathy, nephropathy and neuropathy and macrovascular complications-coronary heart disease, cerebrovascular disease & peripheral vascular disease.

**3. Gestational diabetes mellitus** refers to glucose intolerance with onset or first recognition during pregnancy.

**4. Other specific types** which include genetic defects of beta cell function or insulin action, diseases of the exocrine pancreases, endocrinopathies, infections, uncommon immunomodulated, another genetic syndrome and drug or chemical induced.

### 2.1.3 Diagnostic criteria of glucose tolerance categories according to the ADA and WHO criteria (ADA 2021; WHO 2006):

**Table 1: Diagnostic criteria for DM**

| | FPG (mmol/l) | | 2HPG (mmol/l) |
|---|---|---|---|
| | **ADA** | **WHO** | **ADA & WHO** |
| **NFG, NGT** | < 5.6 | < 6.1 | <7.8 |
| **IFG** | ≥ 5.6 to 6.9 | ≥ 6.1 to ≤ 6.9 | <7.8 |
| **IGT** | < 5.6 | < 7.0 | ≥ 7.8 to <11.1 |
| **Diabetes Mellitus** | ≥ 7.0 | ≥ 7.0 | ≥ 11.1 |

ADA: American Diabetic association; FPG: Fasting plasma glucose; 2HPG: 2 hours postprandial glucose; WHO: World Health Organization; NFG: Normal fasting glucose; NGT: Normal glucose tolerance; IFG: Impaired fasting glucose; IGT: Impaired glucose tolerance.

## 2.2. Diabetic burden

### 2.2.1. Global perspective

Type 2 diabetes mellitus (T2DM) is a serious public health concern that considerably impacts human life and health expenditures. It is one of the world's leading causes of morbidity and mortality, with an estimated 462 million individuals are affected by T2DM, corresponding to 6.28% of the world's population (Khan et al., 2020). There is a growing prevalence of diabetes worldwide enhanced by global incidence rates rising

by over 100% between 1990 and 2017, reaching to 22.94 million in 2017 (Liu et al., 2020).

### 2.2.2 Bangladesh perspective:

Bangladesh is no exception to the general worldwide trend in the growing prevalence of diabetes. Diabetes and prediabetes affect a substantial proportion of Bangladeshi people. Based on data from the latest Bangladesh Demography and Health Survey 2017-18, over one-quarter of individuals aged 18 years and older had diabetes or prediabetes in Bangladesh, representing more than 25 million individuals in 2020 (Hossain et al., 2022). Currently, up to 8.4 million adults have diabetes in Bangladesh (8.1%), with prevalence rates expected to increase to 15.0 million by 2045 unless addressed (Afroz et al., 2019; Yuen et al., 2019). The pooled prevalence of diabetes in urban populations (11.5%) is significantly higher than rural populations (6.2%) in Bangladesh. Epidemiological data indicate interactions between acculturation, urbanization and genetic disposition are involved in T2DM among Bangladeshi (Akhtar et al., 2020).

### 2.2.3 Cost of diabetes: Global and national

DM hits people at the most productive age, slows economic growth, reduces life-expectancy in elders, causes increasing healthcare expenditure. Diabetes mellitus is among the top 10 causes of death and [together with major non-communicable diseases (NCDs) – cardiovascular, cancer, respiratory disease] accounts for over 80% premature NCD deaths. Upon introduction of insulin, insulin-dependent people with diabetes started enjoying longer lives, but long-term complications emerged and T1DM became a chronic disease (Polonsky et al., 2012).

Based on 2017 data, the global healthcare expenditure on people with diabetes mellitus was estimated at USD 850 billion (Cho et al., 2018). The cost of diagnosed diabetes mellitus in the United States has been USD 327 billion (including USD 90 billion for reduced productivity) and care for diabetes mellitus accounts for 1 in 4 healthcare dollars (ADA, 2018). Over the last 7 years, cost has grown by 26%. In Lombardy (Northern Italy) the average yearly expense per diabetic subject was 3300 Euro.

Hospitalizations were the cost drivers contributing 54% of the total, followed by drugs (32%) and outpatient claims (14%) (Scalone et al., 2014).

DM had 2 times more days of inpatient treatment, 1.3 times more outpatient visits, and nearly 10 times more medications than nonDMs, as reported by BMJ Global Health 2017. The total annual per capita expenditure on medical care was 6.1 times higher for DMs than non-DMs (US$635 vs US$104, respectively) (Shariful et al., 2017). A recent study by World Bank found $160 per year in household expenses for diabetes care (2013 dollars) in Bangladesh. The annual cost of diabetes care per person in the outpatient department of a tertiary care facility was US$314. Based on this finding, it is estimated that the total annual burden of some 5.1 million diabetic patients will be US$1.5 billion, which is a large burden for a developing country like Bangladesh (Afroz et al., 2016). In 2016, approximately 55,703 diabetic individuals received in-hospital care, with an estimated 2 6,41,000 outpatient visits. The total annual estimated cost of diagnosed diabetes was approximately US$217.71 million (Sarker et al., 2017). The median monthly cost of diabetes maintenance was close to USD 10, approximately 10% of the median monthly income (Vanderlee et al., 2016).

### 2.3. Infections in diabetes:

#### 2.3.1 Pathogenesis of infection in diabetes:

In general, infectious diseases are more frequent and/or serious in patients with DM, which potentially increases their morbimortality. The greater frequency of infections in diabetic patients is caused by the hyperglycemic environment that favors immune dysfunction (e.g., damage to the neutrophil function, depression of the antioxidant system, and humoral immunity), micro- and macro-angiopathies, neuropathy, decrease in the antibacterial activity of urine, gastrointestinal and urinary dysmotility, and greater number of medical interventions in these patients. The infections affect all organs and systems. Some of these problems are seen mostly in diabetic people, such as foot infections, malignant external otitis, rhinocerebral mucormycosis, and gangrenous cholecystitis. In addition to the increased morbidity, infectious processes may be the first manifestation of diabetes mellitus or the precipitating factors for complications inherent to the disease, such as diabetic ketoacidosis and hypoglycemia. The main mechanisms associated with the interface DM and infections are depicted in Figure 1.

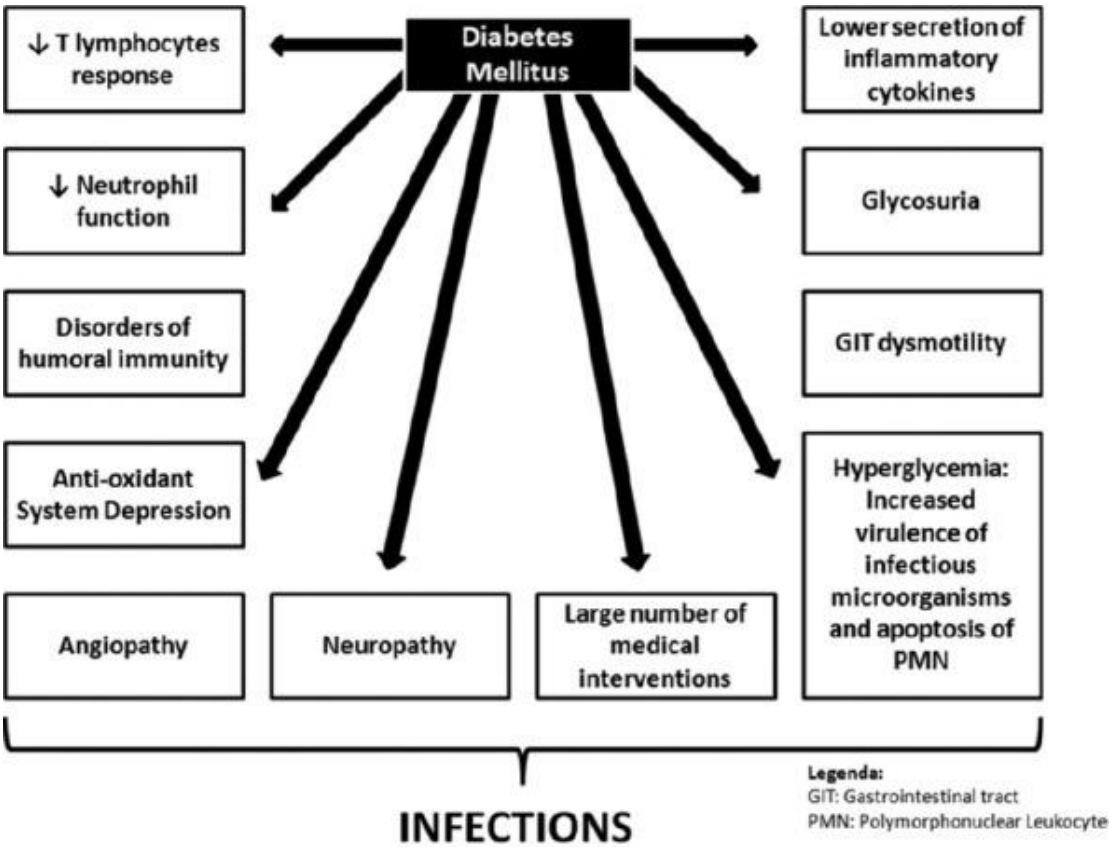


**Figure 1: Pathophysiology of infections associated with diabetes mellitus (Casqueiro, Casqueiro, and Alves 2012).**

**2.3.2 : common infections in DM:**

Infectious diseases are more prevalent in individuals with DM. Due to impaired defenses and disease complications, people with diabetes are prone to new infections and recurrences [urinary tract infection (UTI), periodontitis, pneumonia, skin, and soft tissue (including the diabetic foot), osteomyelitis, peritonitis]. Uncommon life-threatening infections are more frequent in people with diabetes than in people without diabetes (necrotizing soft tissue infection, emphysematous pyelonephritis, emphysematous cholecystitis, malignant otitis, perioperative infection). Some infections almost always affect only diabetic persons, such as malignant external otitis, rhinocerebral mucormycosis, and gangrenous cholecystitis (Calvet and Yoshikawa, 2001). In addition to being potentially more serious, infectious diseases in DM may result in metabolic complications such as hypoglycemia, ketoacidosis, and coma. The recommendation of compulsory immunization with anti-pneumococcal and influenza vaccines is essential because of their impact on the reduction of respiratory infections,

the number and length of hospitalizations and the number of deaths related to respiratory tract diseases. Table 1summarizes the major infections associated with DM.

**Table 2: Major infections associated with diabetes mellitus (Casqueiro, Casqueiro, and Alves 2012; Cockram et al., 2017)**

| | |
|---|---|
| 1. | Respiratory infections |
| | Streptococcus penumoniae |
| | Influenza |
| | H1N1 |
| | Tuberculosis |
| 2. | Urinary tract infection |
| | Asymptomatic bacteriuria |
| | Fungasl cystitis |
| | Emphysematous cystitis |
| | Bacterial pyelonephritis |
| | Perinephric abscess |
| 3. | Gastrointestinal and liver infections |
| | H. pylori infection |
| | Oral and oesophageal candidiasis |
| | Emphysematous cholecystitis |
| | Hepatitis C |
| | Hepatitis B |
| | Enterovirus |
| 4. | Skin, soft tissue, bones and joint infections |
| | Foot infection |
| | Superficial mycoses and onychomycosis |
| | Necrotizing fasciitis |
| | Fournier's gangrene |
| | Osteomyelitis, septic arthritis |
| 5. | Head and neck infections |
| | Invasive external otitis |
| | Rhinocerebral mucormycosis |
| | Endophthalmitis |
| | Periodontitis |
| 6. | Bacteremia and sepsis |
| | Community-acquired and hospital-acquired |
| 7. | Other infections |
| | Human immunodeficiency virus |

## 2.4 Prevalence of different infections in previous studies:

DM, both type 1 and type 2, is associated with a high risk of infection. A number of studies have been done worldwide to find out the etiology, risk factors, pattern of infection and complications of DM. A large retrospective study of primary care patients revealed that diabetes is likely to account for 6% of infection-related hospitalizations and 12% of infection-related deaths, with the strongest associations being for bone and joint infections, development of sepsis, and cellulitis (Carey et al., 2018).

A number of studies have been performed on the rate of infection among patients with diabetes in the primary care and other outpatient settings. In a Canadian cohort of 1,779 patients with DM matched to 11,066 without DM the patients with DM had an increased risk of infection (adjusted odds ratio 1.21, adjusted for confounding variables). with skin and soft tissue infections having the strongest association with having DM. Interestingly, DM was not found in this study to be associated with head and neck, musculoskeletal, or viral infections (Abu-Ashour et al., 2018). Another Canadian study including more than a million individuals matched those with DM to those without and assessed all physician and hospital claims for infectious disease. It found that almost half of all individuals with DM had a claim for an infectious disease within a cohort year compared with 38% of those without DM. The risk ratio was skewed most towards those with DM for upper respiratory tract infections, cystitis, and pneumonia (Shah et al., 2003).

One of the studies, having diabetes led to a 2-fold increased risk for hospitalization when presenting with an infection to the emergency room, and up to 12% of inpatient admissions in patients with diabetes were the consequence of an infection (Korbel et al., 2015). A South Korean study showed that those with diabetes had a significantly greater risk of infection-related ICU admission and death when hospitalized with infections of skin or soft tissue, central nervous system infection, or bone and joints (Kim et al., 2019). The previously-mentioned Canadian retrospective cohort study showed that, while the overall risk ratio for infection in those with diabetes versus without was 1.21, this number rose to 2.17 and 1.92 when considering infection which led to hospitalization and death, respectively (Shah et al., 2003).

One important entity to consider in the inpatient arena is sepsis. The studies on sepsis are not consistent —though some show worse outcomes from DM, others have

suggested either no effect or even a protective effect from DM. Data for the latter come from studies assessing acute respiratory failure and respiratory distress syndrome in the ICU, and it may be that the blunted immune response that we see in some patients with DM are responsible for the findings (i.e., reduced inflammation and injury related to impaired neutrophil function as described in section on Innate Immunity). More studies are needed to better understand in what specific clinical contexts DM results in higher risk.

A descriptive cross-sectioned study was performed on 700 diabetic patients in Iran showed that the number of non-infectious patients were 506 (72.3%) and infectious patients were 194 (27.7%). The mean of age, duration of diabetes and glucose were 62.3±14.38 years, 11.11±7.18 years and 271.98±90 (mg/dl) in patients with infection respectively. The most common infections were diabetic foot infections (32.5%), Pneumonia (18%), soft tissue abscess (13.9%) and UTIs (11.3%) (Ahmadi et al., 2019).

According to a single-centre retrospective observational study conducted in a tertiary care hospital, in North India between January 2018 to June 2019, 152 diabetic patients aged 12 years and above were diagnosed with the infectious syndrome. UTIs syndrome (32.3%), followed by Pneumonia and Empyema (26.3%), skin soft tissue infections (6.61%), sepsis of unknown primary source (6.61%), Pulmonary Tuberculosis (4.6%), rhinocerebral infection (4.6%), Infectious diarrhoea (3.9%) and Viral Encephalitis (2.6%). The majority of the infections were community-acquired (94.7%) 80.3% of the study cases had type 2 DM. The common symptoms were fever (46.1%), dyspnoea (27.6%) and altered sensorium (25.7%). Shock and diabetic ketoacidosis were frequent, and each was seen in 27.6% of cases. The mortality rate was 27.6% and was higher with sepsis of unrecognized source (50.0%) and lung infections (30.0%). The presence of shock was an independent predictor of mortality on a multivariant analysis (p-value 0.000) (Pannu et al., 2020).

In another study out of 842 DM patients 254 had infections. There was effect of age, sex, duration of diabetes, type of treatment. The commonest comorbidity was hypertension (62.99%). Common infections encountered were Upper respiratory tract infection (29.13%), UTI (26.77%), Lower respiratory tract infection (15.74%), Tuberculosis (11.81%), Skin and soft tissue infection (11.02%) and Foot infection (8.66%) (Bettegowda et al., 2014).

Chandra et al. (2017) observed that infections were a common cause of hospital admissions in patients with uncontrolled DM. They studied 115 patients with DM (60 males) admitted in acute medical ward with subacute, acute and chronic illnesses in all of them. Eighty six of the 115 patients (75%) had infections in their study. Of these, acute, subacute, and chronic presentation were seen in 67, 12 and 7 patients respectively; 76 had community acquired infections and nosocomial infections were seen in 10 cases. Pulmonary infections were most common (29.1%) followed by UTI (26.7%). Of the 86 patients with infection 9 had HbA1c < 7%, 56 had HbA1c of 7%-10%, and 21 patients had HbA1c of >10%. The mean HbA1c in patients with sepsis/multiorgan dysfunction syndrome (MoDS) was 11.3 ±2.8% as against 8.4% ± in the non-sepsis group.

Mohapatra et al. (2019) studied a total of 105 hospitalized diabetic cases, out of which infections were detected in 72 (68.6%) patients. The most common infection detected was UTI (45.8%). Among the UTI patients, E. coli was the most common organism isolated (52.3%) followed by Enterococcus (19%), Pseudomonas (19%) and Citrobacter (9.5%). Infections occurred in 61 (82.4%) patients with HbA1C >6.5% and in 11 (35.5%) patients with HbA1C

Masoodi et al. (2007) analyzed the pattern of, and predispositions to, infections in patients with diabetes mellitus admitted in Endocrinology division of a tertiary care hospital of India. They reviewed the hospital records of 380 consecutive diabetic patients admitted with infection were screened for age, sex, type and duration of diabetes, glycemic control, clinical and laboratory evidence of microvascular complications of diabetes, coronary artery disease and the site/type of infection and available relevant microbiologic studies. An equal number of sex-matched diabetic patients admitted without infections served as controls. The infections encountered included soft tissue infections (171, 42.8%), pulmonary infections (121, 30.2%), UTIs (108, 28.4%) and more than one infection (20, 5.3%); two patients had rhinocerebral mucormycosis. They concluded that, longer duration of diabetes, presence of diabetes specific complications and older age are risk factors for development of infection in patients with diabetes.

Hossain et al. (2022) conducted a cross-sectional study in 108 centres of the Diabetic Association of Bangladesh (BADAS), with a sample size of 3,649 patients with DM.

They found that, out of 3,649 patients with DM, 676 presumptive TB cases were identified and tested; from them, 85 patients were detected as TB cases. Another 39 patients were already diagnosed and on anti-TB medication. Prevalence of TB among patients with DM attending diabetic care centres was 3.4%.

Chowdhury et al. (2020) conducted a cross-sectional study in Bangladesh Institute of Research and Rehabilitation for Diabetes, Endocrine and Metabolic Disorders (BIRDEM) General Hospital, Dhaka from March 2014 to April 2015. It included 309 patients of diabetes (male-169, female-140; age mean±SD- 49.3±14.7 years) admitted in medicine or endocrinology department, who were screened for clinical evidence of infections according to revised McGeer criteria. Among the participants 25.9% (80 out of 309) had evidence of infection. The most common of them were UTI (53.8%) and respiratory tract infection (30.0%). E. coli and Klebsiella were the most common organisms that were isolated by urine (55.3% and 13.2%) and blood culture (57.1% and 42.9%).

### 2.5 Impact of Glycemic Control on infection

There is good evidence that glycemic control is correlated with infection. A study of 69,318 patients with type 2 DM in Denmark revealed an association between increased risk for community- and hospital-treated infection in those with higher HbA1c ≥10.5% compared with HbA1c 5.5-<6.4% (Mor et al., 2017). Similarly, in a large English cohort there was an increasing risk of infection in parallel with HbA1c for patients with both type 1 and type 2 (Carey et al., 2018). In a Taiwanese study looking at outcomes from a community-based health screening program, the authors found that fasting plasma glucose >200 mg/dL and DM was associated with the highest risk of infection and also a 3-fold higher risk of death than those without DM (Chang et al., 2019). Looking at an older population, the risk of certain infections was significantly higher in those with poor glycemic control HbA1c >8.5% compared with good glycemic control (relative risk infections ranging from 1.28-2.38) (McGovern et al., 2016). Intervening to lower glucose appears to mitigate the risks. Zerr et al assessed incidence of sternal wound infection in patients with and without DM before and after implementation of a postoperative continuous IV insulin protocol to keep blood glucose <200 mg/dL. They found that lower glucose in the first 2 days postoperatively was

associated with a decrease in deep wound infection from 2.4% to 1.5% (Zerr et al., 1997).

From the above discussion, it was evident that pattern of infections in diabetic patients varied between population and different centers. Infections and complications of diabetes differs among geographical regions and among different age groups. In this regard, to provide local evidence for the policymakers, clinicians, and public health professionals, this study was conducted in a Diabetic hospital of Chattogram, Bangladesh, to determine the clinical profile and pattern of infection among diabetic patients.

# Chapter-3: Materials and Methods

Following approval by the Ethical and Research Committee of Chattogram Veterinary and Animal Sciences University (CVASU), an observational study was carried out to explore clinical profile and pattern of infection among diabetic patients attended a diabetic hospital in Chattogram, Bangladesh. Informed consent was obtained from the participants who were included in the study. The study was conducted based on the following methodology:

**3.1. Study design**: This was a descriptive type of cross-sectional study.

**3.2. Study period:** This was a 06 (six) months study commencing from May 2022 to 31st October 2022. The total study period was divided into different parts based on the tasks of the study, including topic selection, ethical approval, questionnaire development, data collection, data analysis, final report, etc., as detailed in appendix A.

**3.3. Place of the study:** Data collection was carried out in the outpatient and inpatient department of Chattogram Diabetic Hospital, Chattogram, Bangladesh.

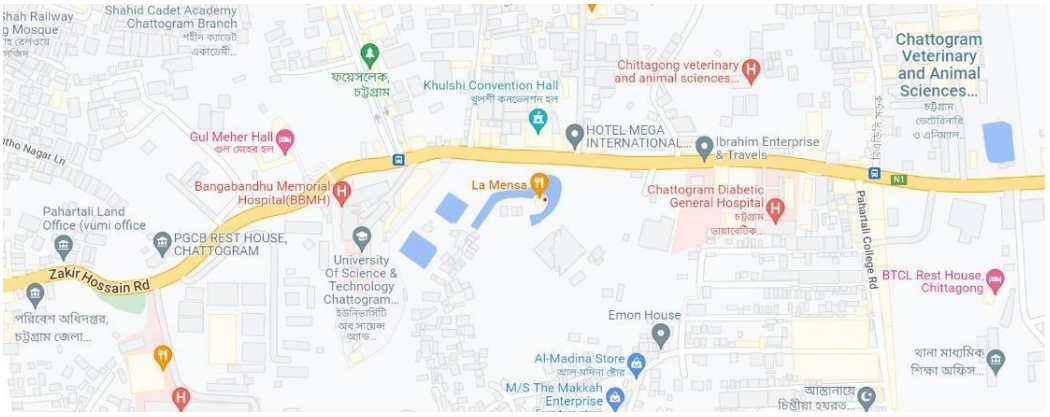


**Figure 2:** Google map showing Chattogram Diabetic General Hospital & Chattogram Veterinary and Animal Science University

**3.4. Reference population**: Diabetic patients attended different hospitals in Bangladesh.

**3.5. Source population**: Diabetic patients attended the Chattogram Diabetic Hospital during the study period.

**3.6. Sample size**: Sample size was determined by the following formula:

$$n = \frac{z^2 \times p \times q}{d^2}$$

Where,

n= Expected sample size

z= 1.96, the standard normal deviation set as1.96 with 95% confidence interval.

p= proportion in the target population estimated to have a particular characteristic (Prevalence of diabetic patients in Bangladesh), 14.2%= 0.142 (IDF-Atlas-10th Edition-2021, pp:94-95)

q=1-p =1- 0.142 = 0.852

d= is degree of accuracy desired or maximum allowable difference from true proportion which was set at 0.05 (5%) at 95% confidence interval.

So, $$n = \frac{(1.96)^2 \times 0.142 \times 0.852}{(0.05)^2} = 187$$

Finally, the sample size was increased by 10% to cover the non-response rate and the final sample size was 206.

**3.7. Sampling technique**: Non-probability type of convenient, purposive sampling was done for the study.

**3.8. Selection criteria**

**3.8.1 Inclusion criteria**

1. Diagnosed case of diabetes
2. Age more than 18 years
3. Received treatment from the Chattogram Diabetic Hospital for last 6 months.

**3.8.2 Exclusion criteria**

1. Known case of malignancy,
2. Severely ill patients.
3. Patients unable to communicate
4. Patients not willing to give written consent.

**3.9. Research Instrument:** The study used structured, pretested, interview-administered questionnaires as its data collection tool.

**3.10. Study variables**

**3.10.1. Sociodemographic variables**

1. Age
2. Sex,
3. Educational status
4. Monthly family income
5. Occupation
6. Marital status

**3.10.2. Variables related to DM**

1. Duration of DM
2. Initial symptoms of DM
3. Risk factors: Smoking, alcohol drinking, physical activity, hypertension, family history of DM, obesity, food habit
4. Therapeutic information: Drug, diet, and drug
5. Complications of DM
6. Infection: Presences and type of infections.

**3.10.3 Biochemical variables:**

1. Blood sugar fasting and 2 hours after breakfast
2. Hemoglobin A1C
3. Lipid profile

### 3.11 Operational definitions:

**Diabetic patient:** A patient who had a diagnosis of diabetes mellitus by a registered physicians and taking medication as per the recommendation of the study hospital was conserved as a diabetic patient.

**Former smoker:** Smoker who had stopped smoking more than six months before data collection.

**Current smoker:** Patient who reported to smoke tobacco within the last six months from data collection.

**Diabetic complications:** Diabetic complications were recorded as coronary artery disease, peripheral vascular disease, stroke, diabetic retinopathy, diabetic nephropathy, and peripheral neuropathy from the medical record.

**Infections:** In the present study only documented infections in the medical records of the diabetic patients were considered as infection associated with DM**.**

### 3.12. Ethical considerations

- This study was conducted after approval from the Research cell and Ethical Committee of Chattogram Veterinary and Animal Sciences University.
- Permission for data collection was taken from the hospital administrator after explaining the study, its objectives, and methodology.
- Written informed consent was taken from each of participants. The participants were not influenced or insisted on responding. Participation in the study was entirely voluntary, and they received no benefit for the same. Participants were briefed about the purpose and procedure of the study in detail, the implications, and detailed study-related information was read out and explained in the local language from a printed handout. All aspects, including confidentiality and rights not to participate or withdraw from the study, were specially communicated. No identifying information was recorded in the questionnaire and kept in a separate file to which only the researchers have access. The

research findings would be presented in sufficiently aggregated form to ensure no participating worker can be identified**.**

**As per the rule of the Ethical Committee of CVASU-**

1. Participation was voluntary.
2. Consent was obtained after a brief study in Bangla, and technical terms were explained to all respondents wherever appropriate.
3. It was clear to them that they are free to take part/ withdraw from the study at any stage.
4. All personal information will be confidential and will not be disclosed. Other responses will be used solely for the study purpose.
5. Interview was taken at a suitable time convenient to the respondents.
6. The researcher did not intervene to establish any desired outcome.
7. The researcher informed the concerned authority when any problem or confusion arose.

### 3.13. Data collection procedure

The researcher herself collected the data by face-to-face interviewing the patientss, detailed physical examination, and reviewing the medical records. Participants were free to stop the discussion anytime and refuse to answer any question they did not want. Participants demographic and clinical information such as gender, age, duration of diabetes, lifestyle, risk factors, onset and pattern of infection, complications will be collected. No intervention or any other invasive procedure would be undertaken. From participant's prescription book, information regarding their height, weight, BMI, blood glucose HbA1C, lipid profile, serum creatinine, complication and infection was gathered.

### 3.14. Study flow chart

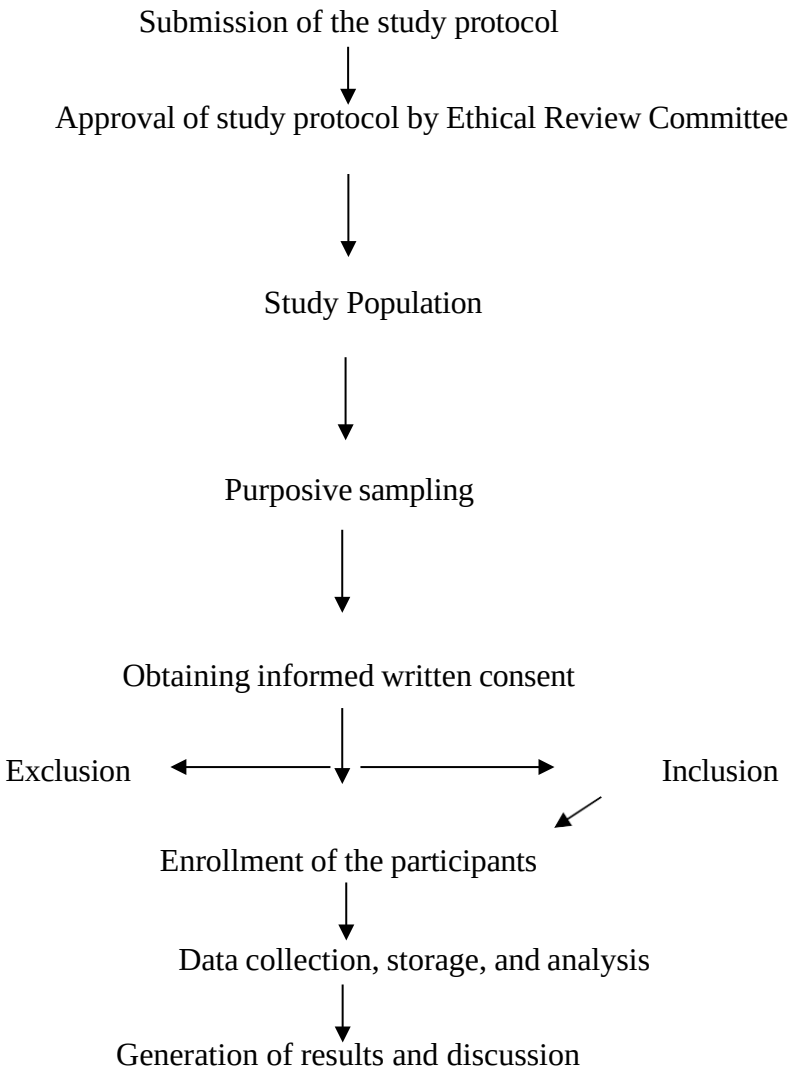


**Figure 3**: Flow chart of the study

### 3.15. Data processing and analysis

After collecting the data, these were checked and rechecked for omission, inconsistencies, and improbabilities. The researcher studied all questionnaires immediately after completion on site of data collection for missing fields. Obtained data were preserved in a secured place with strict confidentiality under the direct responsibility of the thesis applicant. Then data was checked, followed by editing, coding, and entering the computer. Data analysis was performed by statistical package for social science (SPSS), version-25. An appropriate statistical method was used after encoding data. Categorical data were expressed as frequency and percentage. Association between two categorical variables were assessed by Chi-square test. P value <0.05 was considered as statistical significance. The result was presented with appropriate tables and figures.

# Chapter- 4: Results

**Table 3: Sociodemographic characteristics of the diabetic patients (n=206)**

| Variables | Frequency | Percentage |
|---|---|---|
| Age, years | | |
| 20-39 years | 30 | 14.6 |
| 40-59 years | 120 | 58.3 |
| 60-79 years | 56 | 27.2 |
| Mean ±SD | 50.0 ±10.1 | |
| Sex | | |
| Male | 111 | 53.9 |
| Female | 95 | 46.1 |
| Education | | |
| Illiterate | 20 | 9.7 |
| Primary education | 62 | 30.1 |
| Secondary education | 70 | 34.0 |
| Higher secondary and above education | 54 | 26.2 |
| Monthly family income, Tk | | |
| <30,000Tk | 100 | 48.5 |
| ≥30,000Tk | 106 | 51.5 |
| Mean ±SD | 25445±5333 | |
| Marital status | | |
| Married | 178 | 86.4 |
| Single | 28 | 13.6 |

A total of 206 diabetic patients participated in this study. Table 3 shows the sociodemographic characteristics of the study participants. The age of patients was 20 to 79 (50.0±10.1) years and 53.9% were men and 46.1% were female. 34% completed secondary education level and most of the participants (86.4%) were married. 51.5% of the patients had monthly family income of ≥30,000Tk and 48.5% patients had <30,000Tk per month. Most of the patients age was between 40 to 59 years(58.3%).

**Table 4: Distribution of the Diabetic patients according to the presence of risk factors (n=206)**

| Variables | Frequency | Percentage |
|---|---|---|
| Smoking | | |
| Never | 155 | 75.2 |
| Former | 20 | 9.7 |
| Current | 31 | 15.0 |
| Alcohol drinking | | |
| Never | 200 | 97.1 |
| Former (stop >6 months) | 6 | 2.9 |
| Physical activity for 150 min per week (recommended) | | |
| Perform before diagnosis of DM | 15 | 7.3 |
| Practice currently after diagnosis of DM | 155 | 75.2 |
| Hypertension | 112 | 54.4 |
| Family history of diabetes | 124 | 60.2 |
| Body mass index, $kg/m^2$ | | |
| (18.0-25.0)$kg/m^2$ | 82 | 39.8 |
| 25.0-29.9$kg/m^2$ | 102 | 49.5 |
| ≥30.0 $kg/m^2$ | 22 | 10.7 |
| Mean ±SD | 24.8±3.3 | |

Table 4 represented the risk factors of DM. Smoking, alcohol taking, physical activity, hypertension, family history of diabetes and body mass index were studied as risk factors of DM. In case of smoking, 75.2% patients were never smoker. Among the patients studied 15% were current smoker and 9.7% were former smoker. Most of the patients (97.1%) did not take alcohol ever. However, 2.9% of patients reported that they used to take alcohol previously. Recommended physical activity 150 min/week was performed by 75.2% patients after diagnosis of DM. But 7.3% patients performed similar physical activity even before diagnosis of their DM. 49.5% of the patients were overweight and 10.7% obese according to BMI. 60.2% of the participants had a family history of diabetes. 54.4% patients were hypertensive.

**Table 5: Prevalence of pre-diagnostic symptoms of the diabetic patients (n=206)**

| Variables | Frequency | Percentage |
|---|---|---|
| Abnormal thirst | 135 | 65.5 |
| Frequent urination | 112 | 54.4 |
| Unintended weight loss | 56 | 27.2 |
| Fatigue | 130 | 63.1 |
| Visual disturbance | 50 | 24.3 |
| Recurrent skin infections | 5 | 2.4 |
| Recurrent foot ulcer | 4 | 1.9 |
| Others | 5 | 2.4 |

Table 5 represents classic diabetic symptoms such as abnormal thirst(65.5%), frequent urination(54.4%) and weight loss(27.2%) were common. 63.1% patients had fatigue, 24.3% had visual disturbance, 2.4% had recurrent skin infection, 1.9% recurrent foot ulcer. 2.4% of the patients had no sign, symptoms, where diagnosis was made incidentally.

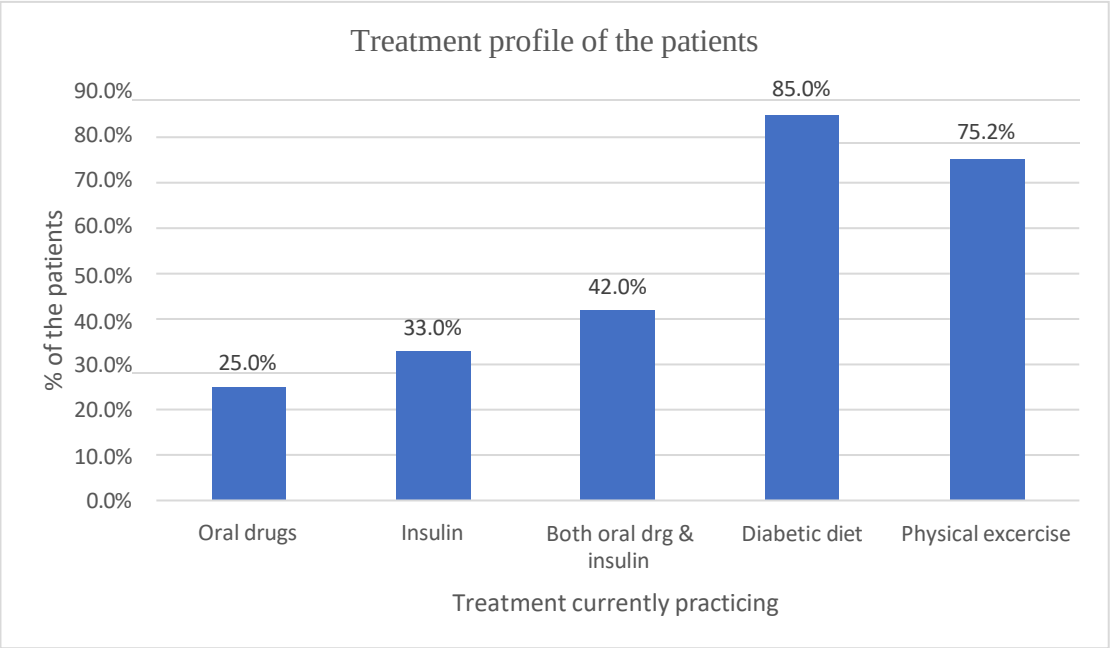


**Figure 4: Treatment profile of the patients**

Most of the patients (85%) reported that they were taking diabetic diet followed by (75.2%) patients were performing physical exercise. 42% patients were taking both oral drugs and insulin and 33% patients were taking only insulin and 25% patients were taking only oral drug

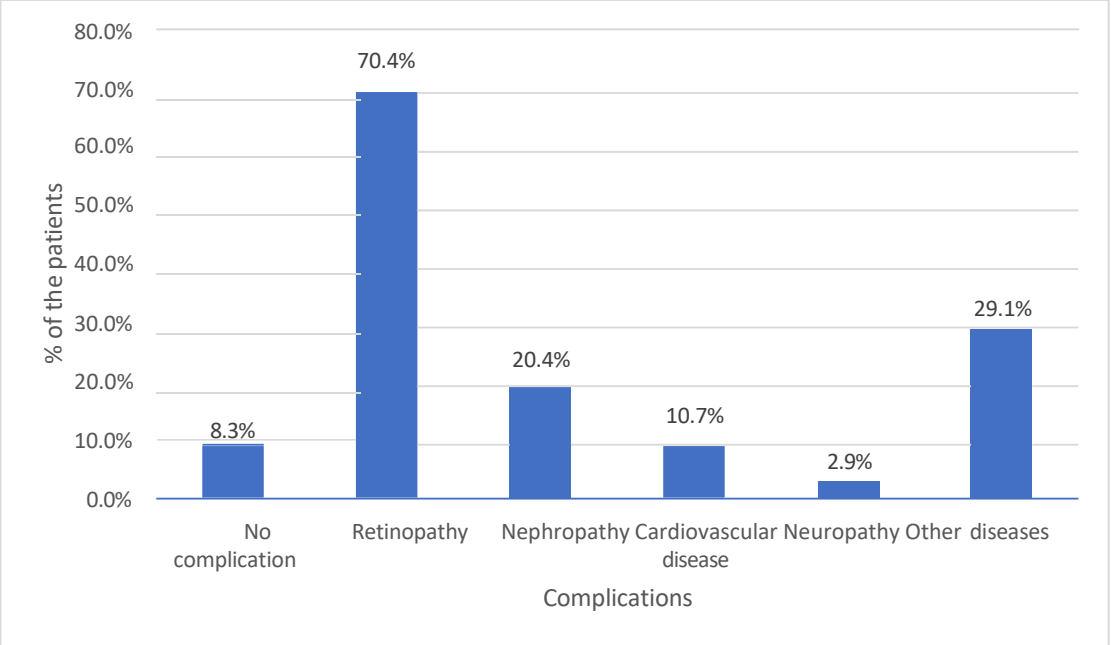


**Figure 5: Prevalence of different complications in the diabetic patients**

Among the 206 patients, only 17 (8.3%) reported to have no known complications. Most of the patients, had retinopathy 145(70.4%), which was followed by nephropathy 42(20.4%), cardiovascular diseases 22(10.7%), neuropathy 6(2.9%). 60 patients (29.1%) reported other chronic diseases such as bronchial asthma, tuberculosis, rheumatoid arthritis. Complications were recorded from patient's self-reported questionnaire and medical records.

**Table 6: Biochemical profile of the diabetic patients at the time of data collection**

| Biochemical parameters | Frequency | Percentage | Mean ±SD |
|---|---|---|---|
| Fasting blood sugar, mmol/L | | | 7.4±3.9 |
| Optimal <6.7 mmol/L | 67 | 32.5 | |
| Fair 6.7-7.8 mmol/L | 68 | 33.0 | |
| Poor >7.8 mmol/L | 71 | 34.5 | |
| Blood sugar 2hours after breakfast | | | 9.8±2.7 |
| Control <10.0mmol/L | 90 | 43.7 | |
| Uncontrolled ≥10.0 mmol/L | 116 | 56.3 | |
| Hemoglobin A1c (%) | | | 7.9±2.2 |
| Optimal <7% | 57 | 27.7 | |
| Fair 7-8% | 53 | 25.7 | |
| Poor >8% | 96 | 46.6 | |
| Total cholesterol, mg/dl | | | 196.2±55.5 |
| Desirable <200mg/dl | 110 | 53.4 | |
| High ≥200 mg/dl | 96 | 46.6 | |
| High density lipoprotein, mg/dl | | | 38.6±9.9 |
| Low <40 mg/dl | 108 | 52.4 | |
| Normal ≥40 mg/dl | 98 | 47.6 | |
| Low density lipoprotein, mg/dl | | | 116.6±34.1 |
| Normal <130 mg/dl | 96 | 46.6 | |
| High ≥130 mg/dl | 110 | 53.4 | |
| Triglyceride, mg/dl | | | 204.3±34.2 |
| Normal <150 mg/dl | 90 | 43.7 | |
| High ≥150 mg/dl | 116 | 56.3 | |

Glycemic status was poor for 34.5%(7.4±3.9), 56.3%(9.8±2.7), and 46.6%(7.9±2.2) of the patients, respectively based on FBS, BS2hrsABF, and HbA1c levels. The abnormal lipid profile was detected individually for TC, HDL, LDL and TG was 46.6%, 52.4%, 53.4% and 56.3%, respectively.

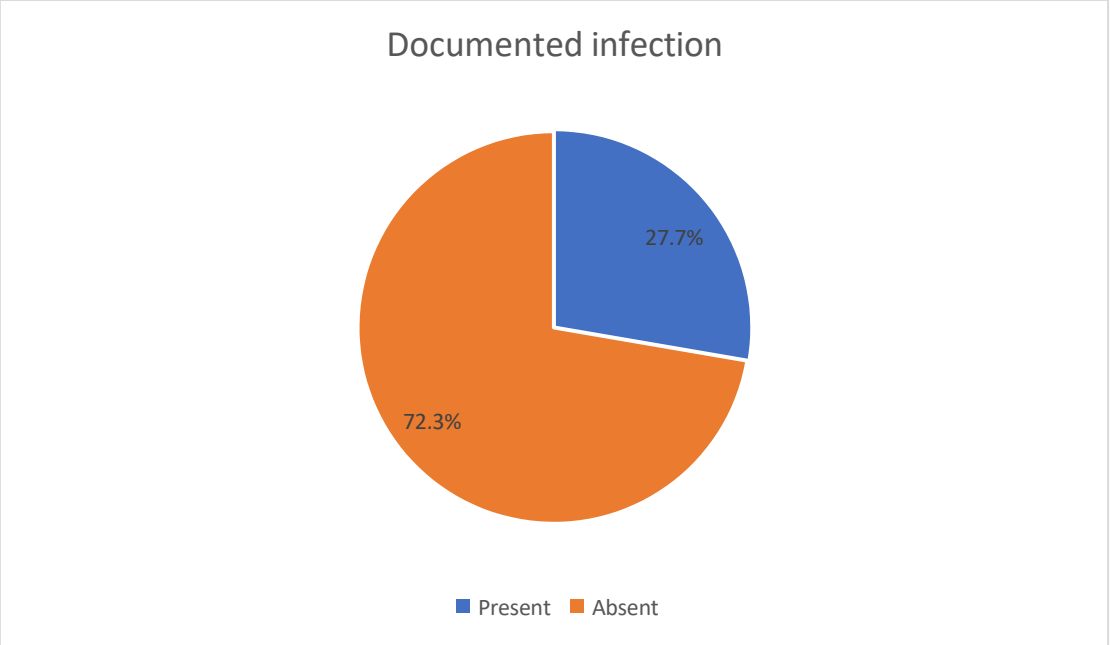


**Figure 6:** Percentage of infections among the studied diabetic patients.

Out of the 206 diabetic patients, 57 (27.7%) had documented infection or evidence of infection on examination (Figure 6).

**Table 7: Different infections in the studied diabetic patients (n=57)**

| Type of infections | Frequency | Percentage |
|---|---|---|
| Urinary tract infection | 19 | 33.3 |
| Pneumonia | 14 | 24.6 |
| Skin and soft tissue infections | 8 | 14.0 |
| Diabetic foot infection | 5 | 8.8 |
| Fungal infections | 3 | 5.3 |
| Tuberculosis | 2 | 3.5 |
| Eye infection | 2 | 3.5 |
| Otitis externa | 2 | 3.5 |
| Bone and joint infection | 2 | 3.5 |

Among the 206 diabetic patients studied 57 had associated infection. Most common of them were UTI (33.3%) followed by pneumonia, skin and soft tissue infections (14%), diabetic foot infection (8.8%). Other less frequently observed infections were fungal infections (5.3%), tuberculosis (3.5%), eye infection (3.5%), otitis externa (3.5%) and bone and joint infection (3.5%).

**Table 8: Association between sociodemographic characteristics and presence of infection in the diabetic patients (n=206)**

| Variables | Diabetic patients | | | | P value |
|---|---|---|---|---|---|
| | With infection (n=57) | | Without infection (n=149) | | |
| | n | % | n | % | |
| Age, years | | | | | |
| 20-39 years | 10 | 17.5 | 20 | 13.4 | |
| 40-59 years | 26 | 45.6 | 94 | 63.1 | 0.069* |
| 60-79 years | 21 | 36.8 | 35 | 23.5 | |
| Mean ± SD | 54.4±6.7 | | 48.8±12.3 | | |
| Sex | | | | | |
| Male | 30 | 52.6 | 81 | 54.4 | 0.824* |
| Female | 27 | 47.4 | 68 | 45.6 | |
| Education | | | | | |
| Illiterate | 12 | 21.1 | 8 | 5.4 | |
| Primary | 20 | 35.1 | 42 | 28.2 | **0.002*** |
| Secondary | 13 | 22.8 | 57 | 38.3 | |
| HSC & above | 12 | 21.1 | 42 | 28.2 | |
| Monthly family income | | | | | |
| <30,000tk | 35 | 61.4 | 65 | 43.6 | **0.028*** |
| ≥30,000tk | 22 | 38.6 | 82 | 55.0 | |
| Marital status | | | | | |
| Married | 51 | 89.5 | 127 | 85.2 | 0.427* |
| Single | 6 | 10.5 | 22 | 14.8 | |

*Chi-square test; †Independent sample t test; Significant values are in bold face.

Table 8 shows that significantly higher proportion of diabetic patients with low level of education, and lower monthly family income had infection than their counterpart. Age, sex and marital status were not influenced to DM. However, 40 to 59 years old age, married and male sex showed comparatively higher incidence of DM than single, female and other range of aged people studied.

**Table 9: Association between risk factors of diabetes and presence of infection in diabetic patients**

| Variables | Diabetic patients | | | | P value |
|---|---|---|---|---|---|
| | With infection (n=57) | | Without infection (n=149) | | |
| | n | % | n | % | |
| Smoking | | | | | |
| Never | 35 | 61.4 | 120 | 80.5 | **0.005*** |
| Former & current | 22 | 38.6 | 29 | 19.5 | |
| Alcohol drinking | | | | | |
| Never | 55 | 96.5 | 145 | 97.3 | 0.753* |
| Former | 2 | 3.5 | 4 | 2.7 | |
| Do exercise | | | | | |
| No | 22 | 38.6 | 29 | 19.5 | **0.004*** |
| Yes | 35 | 61.4 | 120 | 80.5 | |
| Hypertension | | | | | |
| Absent | 20 | 35.1 | 54 | 36.2 | 0.384* |
| Present | 37 | 64.9 | 75 | 50.3 | |
| F/H of diabetes | | | | | |
| Absent | 16 | 28.1 | 66 | 44.3 | **0.033*** |
| Present | 41 | 71.9 | 83 | 55.7 | |
| Body mass index | | | | | |
| Normal | 26 | 45.6 | 56 | 37.6 | |
| Overweight | 24 | 42.1 | 78 | 52.3 | 0.421* |
| Obese | 7 | 12.3 | 15 | 10.1 | |

*Chi-square test; Significant values are in bold face.

Table 9 has shown that, infections were more common among the diabetic patients who reported to smoke currently or in the past ‘P’ value(0.005), who did not perform recommended exercise ‘P’ value(0.004), and diabetic patients with positive family history ‘P’ value(0.033) than their counterpart.

**Table 10: Association between biochemical profile and the presence of infection in the diabetic patients**

| Parameters | Diabetic patients | | | | P value |
|---|---|---|---|---|---|
| | With infection (n=57) | | Without infection (n=149) | | |
| | n | % | n | % | |
| FBS | | | | | |
| Optimal | 13 | 22.8 | 54 | 36.2 | 0.075 |
| Fair | 18 | 31.6 | 50 | 33.6 | |
| Poor | 26 | 45.6 | 45 | 30.2 | |
| BS 2HABF | | | | | |
| Control | 15 | 26.3 | 75 | 50.3 | **0.002** |
| Uncontrolled | 42 | 73.7 | 74 | 49.7 | |
| HbA1c | | | | | |
| Optimal | 10 | 17.5 | 47 | 31.5 | **0.026** |
| Fair | 12 | 21.1 | 41 | 27.5 | |
| Poor | 35 | 61.4 | 61 | 40.9 | |
| TC | | | | | |
| Desirable | 25 | 43.9 | 85 | 57.0 | 0.089 |
| High | 32 | 56.1 | 64 | 43.0 | |
| HDL | | | | | |
| Low | 21 | 36.8 | 87 | 58.4 | 0.058 |
| Normal | 28 | 49.1 | 62 | 41.6 | |
| LDL | | | | | |
| Normal | 31 | 54.4 | 65 | 43.6 | 0.166 |
| High | 26 | 45.6 | 84 | 56.4 | |
| TG | | | | | |
| Normal | 20 | 35.1 | 70 | 47.0 | 0.123 |
| High | 37 | 64.9 | 79 | 53.0 | |

TC: Total cholesterol; HDL: High density lipoprotein; LDL: Low density lipoprotein; *Chi-square test; Significant values are in bold face.

Table 10 shows that, higher proportion of patients with infections had poor glycemic status compared to the diabetic patients without infections (as evident by higher proportion of uncontrolled 2HABF blood sugar(73.7%) and poor level of HbA1c(61.4%)), and the association was significant statistically ($P<0.05$). Lipid profile status had no association with the infection status of the diabetic patients.

**Table 11: Mean difference of different clinical and laboratory parameters between diabetic patients with and without infection**

| Variables | Mean±SD value in diabetic patients | | P value† |
|---|---|---|---|
| | With infection (n=57) | Without infection (n=149) | |
| Age, (years) | 54.4±6.7 | 48.8±12.3 | **<0.001** |
| MFI, (BDT) | 24000.0±3500.0 | 36000.0±4100.0 | **<0.001** |
| BMI, ($kg/m^2$) | 24.2±4.0 | 25.3±3.7 | 0.056 |
| FBS, (mg/dl) | 7.4±3.1 | 7.4±4.1 | 0.145 |
| BS 2HABF(mg/dl) | 13.6±2.4 | 8.4±2.3 | **<0.001** |
| HbA1C, (%) | 9.4±1.1 | 6.9±1.3 | **<0.001** |
| TC, (mg/dl) | 197.8±62.6 | 194.3±46.1 | 0.271 |
| HDL, (mg/dl) | 38.8±7.5 | 38.7±12.1 | 0.884 |
| LDL, (mg/dl) | 113.3±32.5 | 120.5±35.5 | 0.077 |
| TG, (mg/dl) | 208.2±28.5 | 202.4±35.2 | 0.419 |

MFI: Monthly family income, BDT: Bangladeshi Taka; †Independent sample t test. Significant values are in bold face

Table 11 shows that, the mean age, blood sugar 2HABF, and HbA1c levels were significantly higher in diabetic patients with infection than the patients without infection. Monthly family income was significantly lower in diabetic patients with infection group than the patients without infection. The differences in the mean BMI, FBS, and lipid parameters did not reach statistically significant between the two groups.

# Chapter-5: Discussion

Diabetes presents a significant risk factor for all kinds of infections. It has been well described to increase rates of outpatient infection as well as the incidence of infections requiring hospitalization (Zhou and Lansang 2000). The present study was conducted to determine the clinical profile and common infections of the diabetic patients attended to a Diabetic Hospital in Chattogram, Bangladesh. Two hundred and six patients were enrolled in the study and data regarding demographic, socioeconomic, clinical, and biochemical profile were collected by using a structured case record form. The findings of the present study was discussed in relation to other related studies in the following sections.

Sociodemographic characteristics of the studied patients revealed that, the mean age was around 50 years(58.3%), 53.9% were male, 34% completed SSC and most of the participants (86.4%) were married. About half (51.5%) of the patients had monthly family income of ≥30,000tk.

The diabetes epidemic in South Asian countries including Bangladesh is associated with several risk factors including genetic predisposition, unhealthy diet, life-style and other environmental factors (Ramachandran et al., 2014). A study among middle-class population in Dhaka found age and family history of diabetes to be significantly associated with diabetes (Islam et al., 2015). The study reported that 15% of patients with diabetes were 40 years or below which is similar to the present study findings (14.6% below 40 years) and implies that diabetes starts at a much younger age in the Bangladeshi population. 60.2% of the patients had a family history of diabetes. A positive family history was found to be connected with awareness in this study, which is comparable to other studies' findings. A study of siblings found that having a parent with diabetes predicts awareness of the likelihood of developing diabetes strongly and independently (Roberts et al., 2007). According to a study conducted in Pakistan to assess diabetes knowledge,65 percent of those with a positive family history of diabetes were aware of the disease, but just 32 percent of those without a positive family history were (p 0.001) (Rani et al., 2008 ; Mumu et al., 2014).

In this study obesity is measured by BMI which showed 39.8% of participants had normal BMI. Another study in Bangladesh reported 18.1% general obesity, 72.2%

central obesity (Islam et al., 2015). Obesity, lack of physical exercise and unhealthy diet are recognized as important risk factors for T2D inducing insulin resistance, beta cell dysfunction and can eventually lead to uncontrolled diabetes (Kyrou and Kumar, 2010). Although 75.2% of the current study participants mentioned to walk or perform physical activity for at least 150 min per week after diagnosis, only 7.3% reported to do so before the diagnosis of DM. So lack of physical exercise may contribute to the development of diabetes. (80.5%) of diabetic patients without infection performed physical exercise regularly when compared to only (61.4%) of the diabetic patients with infection.

During diagnosis, abnormal thirst(65.5%), frequent urination(54.4%), weight loss(27.2%), fatigue(63.1%) and visual disturbances(24.3%) were common in the present study. A Dutch study from 1999 to 2001 (Spijkerman et al., 2003) found that approximately 75% of diabetic patients newly diagnosed by general practitioners had one or more symptoms typical of diabetes, which suggests that the fraction of symptomatic patients has changed little within the last decade despite changes in diagnostic criteria and increasing focus on the disease. Drivsholm et al. (2005) also found that, in patients newly diagnosed with type 2 DM in family practice, typical diabetic symptoms, signs and complications are common.

Diabetes is associated with different macrovascular and microvascular complications. In the current study, among the 206 patients, only 8.3% of the patients had no complications. Most of the patients, retinopathy(70.4%), which was followed by nephropathy (20.4%), cardiovascular diseases (10.7%), neuropathy (2.9%), which were recorded from patient's self-reported questionnaire and medical records. Globally an estimated 3.8 million excess adult deaths are attributable to diabetes with about one half of premature deaths due to cardiovascular diseases and approximately 10% due to renal failure (Beulens et al., 2010). A study conducted in a large tertiary diabetes hospital in Dhaka in 2003, found 72% patients with diabetes presenting at the OPD with complications including cardiovascular diseases (31.8%), retinopathy (13.8%), nephropathy (5.84%), neuropathy (4.55%) (Islam 2009). A study in China found 12.9%, 38.8% and 2.4% patients with diabetes had retinopathy, nephropathy, and neuropathy, respectively (Kung et al., 2014). In another study, eye problems were the

most frequent complication followed by cardiovascular diseases, chronic kidney disease, neurological problems, and others (Islam et al., 2015).

In the current study, glycemic status was poor for 34.5%, 56.3%, and 46.6% of the patients, respectively based on FBS, BS2hrsABF, and HbA1c levels. In the study of Islam et al. (2015) 71.3% of participants with uncontrolled diabetes failing to maintain the recommended level of < 7%. Similarly, around 37% and 57% of participants recruited in their study did not achieve the target for FBG and 2hAFB levels, respectively (Islam et al., 2015). The findings suggest poor glycemic control and suboptimal diabetes management. Measures to improve clinic attendance, medication adherence, awareness, and ability to manage diabetes are needed.

Out of the 206 diabetic patients, 57 (27.7%) had documented infection or evidence of infection on examination which agreed to another study conducted in a tertiary hospital of Dhaka city of Bangladesh (Chowdhury et al., 2020), where the rate of infection was 25.9%. On the contrary, studies from India which included only admitted patients reported that, 68.6% to 74.8% of the diabetic patients were admitted with infection as the underlying diagnosis in hospital (Chandra et al., 2017; Mohapatra et al., 2019). It is to be noted that, in the present study most of the patients were selected from the outpatient's department, which may be attributable to the comparatively lower rate of infections.

The most common of them were UTI (33.3%), followed by pneumonia (24.6%), skin and soft tissue infections (14%), diabetic foot infection (8.8%). Other less frequently observed infections were fungal infections, tuberculosis, eye, ear and bone infections. Another cross-sectional study which was carried out in Bangladesh Institute of Research and Rehabilitation for Diabetes, Endocrine and Metabolic Disorders (BIRDEM) General Hospital, Dhaka found that, the most common infection was UTI (53.8%), followed by respiratory tract infection (30.0%) (Chowdhury et al., 2020). UTIs are significantly more common in patients with DM with a large UK study showing an incidence of UTI of 46.9 per 1000 person-years among those who had type 2 DM versus 29.9 for those without DM (Hirji et al., 2012). Pneumonia is another frequently-seen infection in those with DM. In a large Danish population-based case-control study of 34,239 patients, the relative risk for hospitalization from community-acquired pneumonia was 1.26 compared with patients without DM. Furthermore, the

risk appeared to be correlated with level of glycemic control with relative risk (RR) for those with HbA1c <7% being 1.22, versus a RR of 1.6 when HbA1c was ≥9% (Kornum et al., 2008). In the present study, higher proportion of patients with infections had poor glycemic status compared to the diabetic patients without infections(2HABF 73.7% versus 49.7%, HbA1c 61.4% versus 40.9%) and the association was significant statistically ($P<0.05$).

# Chapter-6: Conclusion

## 6.1. Conclusion

It is concluded that higher age, low level of education, and lower monthly family income were the sociodemographic risk factors for infection in diabetic patients. Infections were more common among the diabetic patients who reported to smoke currently or in the past, who did not perform recommended exercise, diabetic patients with positive family history and in patients with poor glycemic status than their counterpart. Higher proportion of patients with infection had poor glycemic control compared to the diabetic patients without infections (as evident by higher proportion of uncontrolled 2HABF blood sugar (73.7%) and poor level of HbA1c(61.4%), and the association was significant statistically ($P<0.05$). This study reminds us that we have a long way to go to achieve target glycemic control of our diabetic population. 27.7% of the studied diabetic patients had documented infection. The most common of them were UTI (33.3%), followed by pneumonia (24.6%), skin and soft tissue infections (14%), diabetic foot infection (8.8%). Other less frequently observed infections were fungal infections, tuberculosis, eye, ear, and bone infections. The results of this study can increase the awareness of common infections associated with DM in a specialized hospital in Bangladesh.

## 6.2. Limitations of the study

Results of the present study should be interpreted in the light of the following limitations:

- Data for this study were collected from a single diabetic hospital and thus the finding cannot be generalized to all patients with diabetes in Bangladesh.
- A cross-sectional design without any control group was not suitable for risk factor analysis.
- In addition, there were no specific or defined measurements of the complications and infections reported in this study, and data were obtained from review of records.
- The sample size of the study was small.
- No follow up of the study.

# Chapter-7: Recommendations and Future perspectives

The findings of the current study have important implications from the perspective of health policy. In the light of this research work, the researcher recommended the following

- Measures to improve clinic attendance, medication adherence, awareness, and ability to manage diabetes are needed.
- It is necessary to train and take care to prevent and reduce infections.
- A large-scale community-based study is necessary to get a more realistic picture on this issue.
- Community based Diabetic education program.

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Appendix 1

Director»teofResearch Eflension

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# For Ethics Committee Use

Date of submission of application to the EC of CVASU : 09/09/2021

Title of the prOject: "Clinical profile and pattern of infection among diabetic patients in a diabetic hospital, Chattogram"

EC of CVASU Approval No: Memo no.- CVASU/Dir(R&E)EC/2021/273(8) Date: 22/09/2021

Signature with date ... Director (Research & Extension) Chattogram Veterinary and Animal Sciences University, Khulshi, Chattogram.
LC of'CVASU/Member Secretary

Appendix 2

Directorate Of Research Extension

Chittagong Veterinary and Animal Sciences Universig
Zakir Hossain Road, Khulshi, Chittagong-4225, Bangladesh
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E-mail : drecvasu@gmail.com, Website: www.cvasu.ac.bd

Memo no.- CVASU/Dir(R&E)EC/2021/273/8

Date: 22/09/2021

## *Ethics Committee (EC) of CVASU*

This is to certify that, the project "Clinical profile and pattern of infection among diabetic patientsinadiabetic hospital, Chattogram" beinginvestigated by Dr Suchana Sen, MPH student, Dept. of One Health Institute, CVASU has met the necessary requirements of it's Chattogram Veterinary and Animal Sciences University Ethics Committee to carry out the project activities. The CVASU Ethics Committee approval number for the project is Memo no.- CVASU/Dir(R&E)EC/2021/2 73(8) Date: 22/09/2021.

Director (Research & Extension)
Chattogram Veterinary and Anim...
University, Khulshi, Chattogram

Member Secretary
CVASU-EC

Appendix 3

CJilIa§olg DBOeliC General H0spil8l
Khulsi, C .
S.L.No :
Date : 14.5.22
Slgn
R E ut/B< D""

The President
Chattogram Diabetic General Hospital, Khulshi

**Subject: Seeking permission to conduct a master's study**

Respected Sir,

I am an MPH (One Health) student at Chittagong Veterinary and Animal Sciences University (CVASU). 1 intend to conduct a study on the 'Clinical profile and pattern of infection among diabetic patients' in your esteemed hospital. The study would be conducted on approximately 300 patients for 3 months duration. My supervisor is Professor Dr. Azizunnesa at the Department of Medicine and Surgery, CVASU. I have taken ethical approval for this study from CVASU.

I will be obliged if you kindly grant me the permission to conduct this study at your hospital. 1 am available through my contact number (provided below) should you need further information to approve of this study.

Sincerely,

Suchana Sen
12.5.22.

Dr. Suchana Sen
Contact no: +880 1713-101384
Email: suchana 1968@gmail.com

allowed
16/5/22

Dr. Newshad Ameer Chowdhury
Additional Director (Clinical Services)
Chattogram Diabetic General Hospital

## Appendix 4: Informed Consent form (English Version)

Title of the Study: "**Clinical profile and pattern of infection among diabetic patients in a diabetic hospital, Chattogram."**

Date and Time of Interview-

Name-

Address-

I know all the steps involved in this research. I am well explained the purpose, procedure, and the fate of the research data and also informed about how much time it will need to respond. I have understood the matter very well and am also satisfied with the explanation. I have provided a written information sheet with details of the study.

I have clearly understood that other participants and I will benefit by participating in this research. During any stage of the study, I can withdraw my consent, and this decision will not hamper my job.

I have also clearly understood that the researcher will be there to resolve the issue during the research activity if I have any queries or problems. I also know that my information will be kept confidential and anonymous. I know that only the study's results, not the personal information, will be published.

I have read or heard the paper explaining the research thoroughly and agreed to participate in the study as a respondent with a profound understanding.

_____ _____

Signature of the participant with date Signature of the researcher with date

## Appendix 4: Informed Consent form (Bengali version)

**গবেষণার শিবরানাম: "ডাযাবেটিক হাসপাতাবে ডাযাবেটিক ররাগীবের মবযে শিশনকাে ররাফাইে এেং সংক্রমবণর যরণ, চট্টগ্রাম"**

সাক্ষাৎকারেে তারেখ ও সময়-

নাম-

ঠিকানা-

আরম এই গরেষণা জরিত সে পদরক্ষপ জারন. আরম গরেষণা ডেটাে উরেশ্য, পদ্ধরত এেং ভাগয ভালভারে েযাখযা করেরি এেং উত্তে রদরত কত সময় লাগরে ডস সম্পরকে অেরিত করেরি। আরম রেষয়ঠট খুে ভারলাভারে েুঝি এেং েযাখযায় সন্তুষ্ট। আরম অধ্যয়রনে রেেেণ সি একঠট রলরখত তথ্য শ্ীট প্রদান করেরি।

আরম স্পষ্টভারে েুিরত ডপরেরি ডে অনযানয অংশ্গ্রিণকােীেো এেং আরম এই গরেষণায় অংশ্গ্রিণ করে উপকৃ ত

ি। সমীক্ষাে ডেরকারনা পোরে য়, আরম আমাে সম্মরত প্রতযাি্াে কেরত পারে এেং এই রসদ্ধান্ত আমাে চাকরেরত েোধ্া সৃঠষ্ট কেরে না।

আরম স্পষ্টভারে েুিরত ডপরেরি ডে গরেষণা কাে্রম চলাকালীন আমাে ডকারনা প্রশ্ন েো সমসযা থ্াকরল তা

সমাধ্ারনে জনয গরেষক ডসখারন থ্াকরেন। আরম এটাও জারন ডে আমাে তথ্য ডগাপন ও ডেনামী েোখা িরে। আরম জারন শুধ্ুমাত্র সমীক্ষাে ফলাফল প্রকাশ্ কো িরে, েযঝিগত তথ্য নয়।

আরম গরেষণাঠট পুঙ্খানুপুঙ্খভারে েযাখযা করে ডপপাে্ঠট পরিরি েো শুরনরি এেং গভীে ডোি্াে সারথ্ উত্তেদাতা রিসারে অধ্যয়রন অংশ্ রনরত সম্মত িরয়রি।

| | |
|---|---|
| অংশ্গ্রিণকােীে নামঃ | গরেষরকে নামঃ |
| স্বাক্ষেঃ | স্বাক্ষেঃ |
| তারেখঃ | তারেখঃ |

# Appendix 5: Questionnaire

## Clinical profile and pattern of infection among diabetic patients in a diabetic hospital, Chattogram.

**Title: Clinical profile and pattern of infection among diabetic patients in a diabetic hospital, Chattogram**

**Name of the interviewer:** Dr. Suchana Sen

## Serial Number:

### 1) Particulars of the patients:

Name: Age: Sex: Male / Female

Occupation: Marital status: Educational status:

Monthly income:

Address:

**Height:** **Weight:** **BMI:**

### 2) Duration of Type 2 DM:

### 3) Symptoms of type 2 DM:

| Symptoms | Yes | No |
|---|---|---|
| a. polyuria | | |
| b. polydypsia | | |
| c. polyphagia | | |
| d. weight loss | | |
| e. delayed wound healing | | |
| f. others | | |

### *4) Risk factors:*

| | Yes | No | Former |
|---|---|---|---|
| a) smoking : | | | |
| b) alcoholism : | | | |
| c) Nature of Physical activity:<br>i) Heavy: Equivalent to brisk walk of >90 minutes in 24 hours<br>ii) Moderate: Equivalent to brisk walk of 60-90 minutes in 24 hours | | | |

| | | | |
|---|---|---|---|
| iii) Mild: Equivalent to brisk walk of 30-59 minutes in 24 hours<br>iv) Sedentary: Equivalent to brisk walk of <30 minutes in 24 hours | | | |
| d) Hypertension: | | | |

**5) Family history of type 2 diabetes mellitus:**

| | Yes | No |
|---|---|---|
| a) father | | |
| b)mother | | |
| c) siblings (Brother / sister) | | |

**7. Food habit**

| | Less intake | More intake |
|---|---|---|
| Carbohydrate | | |
| Protein | | |
| Fat | | |

**6) Investigation**: FBS 2hrABF HbA1c TC HDL LDL TG

## *7) Complication:*

| Name of complications | yes | No |
|---|---|---|
| a)Neuropathy | | |
| b)Retinopathy | | |
| c)Nephropathy | | |
| d)Acute Myocardial Infarction | | |
| e)Stroke | | |
| f) Dyslipidemia | | |
| g)Infection | | |
| h)Bone and Joint problem | | |
| i)Thyroid problem | | |
| j)Others | | |

**8) Type of Infection:**

| |
|---|
| 1.Skin and soft tissue infection |
| 2.Diabetic foot: |
| 3.Bone and joint: |
| 4.Urinary tract infection(UTI): |
| 5.Ear,Nose,Throat: |
| 6.Teeth and Gum: |
| 7.Pneumonia: |

**9) Treatment:**

| Types | Name | Dose |
|---|---|---|
| a)Oral drug | | |
| b) Insulin | | |
| | Yes | No |
| c) Diabetic diet: | | |
| d) exercise, walking & other physical activity: | | |

# Appendix 6: Schedule of works

| Activities | 1st month | 2nd month | 3rd month | 4th month | 5th month | 6th month |
|---|---|---|---|---|---|---|
| Ethical Approval | ■ | | | | | |
| Designing the study | ■ | | | | | |
| Sample and Data collection, Microbiological study | | ■ | ■ | | | |
| Data analysis and result generation | | | | ■ | | |
| Writing the manuscript | | | | | ■ | ■ |
| Submission and Presentation of thesis | | | | | | ■ |

## Brief biography

Dr. Suchana Sen passed the Secondary School Certificate Examination from Udayan Bidyalaya, Dhaka in 1983 and Higher Secondary Certificate Examination from Begum Badrunessa Girl's College, Dhaka in 1985. She obtained MBBS from Sher-E-Bangla Medical College, Barisal in 1993. She has been studying Masters of Public Health at the One Health Institute of Chattogram Veterinary and Animal Sciences University, Chattogram, Bangladesh. She has great interested to work in One Health field.