CHAPTER-1

INTRODUCTION

1:1.0 Background

A serious threat to world health is posed by type 2 diabetes (metabolic and non-communicable disease), particularly in developed and developing nations. In developing countries, type 2 diabetes is on the rise and is particularly prevalent in Southeast Asian nations (Rahman et al., 2007).

Diabetes mellitus is a category of metabolic illnesses characterized by hyperglycemia as a phenotype that is caused by inadequate insulin synthesis or a lack of insulin response (Bhuyan and Fardus 2019). Diabetes mellitus etiologies are a complicated mix of genetics, environmental influences, and lifestyle decisions (Hossain et al., 2015). Both developed and developing countries especially South East Asian (SEA) countries including Bangladesh have a high prevalence of diabetes mellitus (Wild et al., 2004). Diabetes was found to be more common in India, Pakistan, and China, with 12.1 percent, 11.1 percent, and 6.1 percent, respectively. This rise has also been noticed among Asian Americans, and it has been hypothesized that it is linked to population aging, urbanization, and rising obesity and physical inactivity rates (Hossain et al., 2015 and Hu et al,2009).

A mix of environmental and genetic risk factors contribute to type 2 diabetes. In type 2 diabetes, there is a substantial genetic link, environmental risk factors, on the other hand, have a larger role in the development of type 2 diabetes. Excess caloric intake, decreased physical activity, smoking and heavy alcohol consumption, internal environmental biomarkers such as inflammatory factors, adipocytokines and hepatocyte factors, and external environmental factors such as environmental endocrine disruptors may all play a role in type 2 diabetes epidemics (Bi et al., 2012).

Diabetes is one of the most common and deadly non-communicable diseases (NCDs) worldwide. It is the biggest cause of death, disability, and economic loss, making it a significant threat to global development. Furthermore, it can cause many problems, including heart disease, stroke, renal failure, and blindness. As a result, it bears a significant healthcare burden around the world. (Chowdhury et al., 2015). Type 2 diabetes and its consequences have contributed significantly to the global burden of mortality and disability. Diabetes mellitus (all kinds) was listed as the ninth leading cause of shortened life expectancy in the Global Burden of Disease Study 2013. In 2015 International Diabetes Federation (IDF) report, this figure was revised to 5.0 million fatalities attributable to diabetes mellitus and its complications, equating to one death every six seconds (Ogurtsova et al., 2017).

According to the International Diabetes Federation (IDF) the SEA area, which includes Bangladesh, India, Sri Lanka, and Nepal, has more than 72 million diabetic adults, with the number anticipated to rise to 135 million by 2035. According to Ogurtsova et al., 2017 it will be increased up to 642 million by the year 2040. Bangladesh is ranked second among adults (aged 20–79 years) with diabetes in the top five Southeast Asian countries. In 2013, 5.10 million people in Bangladesh had diabetes, which is anticipated to rise to 8.20 million (13 percent of the adult population) by 2035 (Chowdhury et al., 2015).

The economic and clinical burden associated with non-communicable illnesses, particularly diabetes, places immense strain on low-income countries' already frail health systems (Miah and Yousuf, 2018). Bangladesh is already overwhelmed with non-communicable diseases, despite the fact that it is still fighting communicable diseases. Bangladesh's total diabetes population is expected to rise from 3.2 million in 2000 to 11.1 million in 2030. In terms of total healthcare costs allocated for a condition, diabetes is already the tenth most expensive disease (Ahasan et al., 2011). Diabetes was always thought to be a disease of the wealthy, but it has now become a major public health issue in low- and middle-income countries, affecting South Asians in particular (Miah and Yousuf, 2018).

The majority of diabetic patients in Bangladesh are type 2 diabetics, and the risk of developing type 2 diabetes mellitus (DM) is determined by both modifiable (obesity, sedentary lifestyle, diet, smoking, physical and emotional stress) and non-modifiable (family history of diabetes, age, race/ethnicity) factors related to rapid urban growth and changing lifestyle (obesity, sedentary lifestyle, diet, smoking, physical and emotional stress) (Hussain et al., 2007). Rapid urbanization and accompanying changes in lifestyle, such as sedentary lifestyles, higher-calorie food intake, and stressed lives, are mostly to blame for the increased prevalence of type 2 diabetes in Bangladesh. Evidence suggests, however, that lifestyle interventions focusing on modifiable risk factors can either prevent or delay the onset of type 2 diabetes (Mumu et al., 2014).

Type 2 DM can harm organs and systems such as the kidneys, eyes, and heart, as well as the vascular system in general. The rising prevalence of type 2 DM suggests that previous preventative measures, such as increasing physical activity and promoting a healthy diet, have not resulted in population-level gains. In recent years, the possible influence of neighborhood and environmental features on health, particularly type 2 DM, has become more recognized and explored (Dendup et al., 2018).

In Bangladesh, several epidemiological studies has been conducted on type 2 DM in adults (Rahman et al., 2007; Bhuyan and Fardus 2019; Hossain et al., 2015; Chowdhury et al., 2015; Ahasan et al., 2011; Hussain et al., 2007; Mumu et al., 2014) but from my understanding no studies have been done at Chattogram.

1:2.0 Rationale

Diabetes mellitus, a metabolic disorder with hyperglycemia, one of the most prevalent and serious non-communicable diseases leads to death, disability, and economic loss (Chowdhury, 2015). It has become the seventh leading disease in South Asian countries (Miah and Yousuf, 2018). Bangladesh will bear an epidemic of Diabetes Mellitus in the 21st century, with 80% of all new cases expected to appear by 2025 (Mumu et al., 2014).

Type 2 diabetes mellitus is caused by a complex interaction of genetic, environmental, and metabolic risk factors. Individuals at the highest risk have a significant family history of diabetes mellitus, and are older, obese, and inactive. Minorities are also at greater risk, not only because of family history and genetics, but also due to adaptation to environmental variables such as poor food and exercise habits. Interventions aimed at changing environmental risk factors, such as obesity reduction and physical activity promotion, are currently being used to prevent and delay type 2 diabetes mellitus. In high-risk populations, awareness of risk factors for type 2 diabetes will improve screening, early detection, and treatment with the goal of reducing both microvascular and macrovascular consequences (Fletcher et al., 2002).

Researchers from different countries agreed that obesity, inactivity, a sedentary lifestyle, family history, fatty foods, fast food, and soft drinks are risk factors for diabetes (Aljoudi and Taha 2009). According to a recent analysis of diabetes in South Asians, physical inactivity, unbalanced diets, abdominal obesity, and excessive hepatic fat are the main risk factors for type 2 diabetes in this community (Sal-sabil et al., 2016). Recent changes in Bangladesh's epidemiology have made it easier for people to adopt Western lifestyles marked by easier availability to food, poor diets, and little physical activity (Karan et al., 2009 and Lim et al., 2013).

The aim of the study was to identify modifiable and non-modifiable risk factors to develop alertness and to modify the lifestyle of the people to reduce the frequency of the disease. Assessment of early and late complications of type 2 DM and help to prevent or less occurrence of complications. Preventive measures are needed to prevent type 2 DM among the general population and necessary steps for public health sectors which will be needed the in implementation of national diabetes control programs.

1:3.0 Research Question

1) What are the available risk factors associated with type 2 diabetes mellitus among the patients of Chattogram Diabetic General Hospital?

2) What are the complications associated with type 2 diabetes mellitus among the patients of Chattogram Diabetic General Hospital?

1:4.0 Research Objectives

General Objective:

A study on available risk factors and complications associated with type 2 diabetes mellitus among the patients of Chattogram Diabetic General Hospital.

Specific Objectives:

1) Demographic profile of respondents. Such as: age, sex, occupation, marital status, address, educational status, monthly income etc.
2) To identify available risk factors related to diabetes among the respondents.
3) To identify complications related to diabetes among the respondents.

CHAPTER-2

LITERATURE REVIEW

2:1.0 Diabetes mellitus

Diabetes mellitus is the most prevalent disease in the world. Diabetes is a metabolic disorder characterized by persistent hyperglycemia and disturbances in carbohydrate, lipid, and protein metabolism, as well as absolute or relative insulin secretion and/or action deficits. Microvascular problems are long-term consequences that damage the retina, kidneys, and nervous system. Diabetes increases the risk of macrovascular problems such as coronary artery disease, cerebrovascular disease, and peripheral vascular disease (Agrawal et al., 2014).

According to the American Diabetes Association, Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels (American Diabetes Association, 2004).

2:2.0 Types of diabetes mellitus

Etiologic classification of diabetes mellitus:

I. Type 1 diabetes (β-cells destruction, usually leading to absolute insulin deficiency)

A. Immune mediated

B. Idiopathic

II. Type 2 diabetes (may range from predominantly insulin resistance with relative insulin deficiency to a predominantly secretory defect with insulin resistance)

III. Other specific types

IIIA. Genetic defects of beta-cells or β -cell function

1. Chromosome 12, HNF-1 alpha-cells or α-cells (MODY3)

2. Chromosome 7, glucokinase (MODY2)

3. Chromosome 20, HNF-4 alpha-cells or α-cells (MODY1)

4. Chromosome 13, insulin promoter factor-1 (IPF-1; MODY4)

5. Chromosome 17, HNF-1 beta-cells or β -cell (MODY5)

6. Chromosome 2, NeuroD1 (MODY6)

7. Mitochondrial DNA

8. Others

IIIB. Genetic defects in insulin action

1. Type A insulin resistance
2. Leprechaunism
3. Rabson-Mendenhall syndrome
4. Lipoatrophic diabetes
5. Others

IIIC. Diseases of the exocrine pancreas

1. Pancreatitis
2. Trauma/pancreatectomy
3. Neoplasia
4. Cystic fibrosis
5. Hemochromatosis
6. Fibrocalculous pancreatopathy
7. Others

IIID. Endocrinopathies

1. Acromegaly
2. Cushing's syndrome
3. Glucagonoma
4. Pheochromocytoma
5. Hyperthyroidism
6. Somatostatinoma

7. Aldosteronoma

8. Others

IIIE. Drug- or chemical-induced

1. Vacor

2. Pentamidine

3. Nicotinic acid

4. Glucocorticoids

5. Thyroid hormone

6. Diazoxide

7. β-adrenergic agonists

8. Thiazides

9. Dilantin

10. α-Interferon

11. Others

IIIF. Infections

1. Congenital rubella

2. Cytomegalovirus

3. Others

IIIG. Uncommon forms of immune-mediated diabetes

1. “Stiff-man” syndrome

2. Anti–insulin receptor antibodies

3. Others

IIIH. Other genetic syndromes sometimes associated with diabetes

1. Down’s syndrome

2. Klinefelter’s syndrome

3. Turner’s syndrome

4. Wolfram’s syndrome

5. Friedreich’s ataxia

6. Huntington's chorea

7. Laurence-Moon-Biedl syndrome

8. Myotonic dystrophy

9. Porphyria

10. Prader-Willi syndrome

11. Others

IV. Gestational diabetes mellitus (GDM) (American Diabetes Association, 2004)

2:3.0 Pathogenesis of DM

Insulin deficit or insulin resistance are symptoms of type 2 DM. Insulin deficiency occurs when the pancreatic β cells are unable to secret insulin sufficiently. Insulin resistance occurs when the body's cells are unable to use insulin properly. Insulin, a hormone generated by the pancreas- β cells, regulates blood sugar levels. Insulin resistance has been linked to hereditary factors, obesity, sedentary lifestyle, and aging process. Obesity and T2DM are strongly linked to the consumption of energy-dense foods and a lack of physical activity. To achieve a normal glucose level, the body produces more insulin at first. However, this response is insufficient to overcome insulin sensitivity, which leads to increased glucose synthesis by the liver in obese people. This results in a condition known as "prediabetes," in which blood glucose levels are elevated but not yet in the T2DM range. As the condition advances, glucose, lipid, and protein metabolism become disrupted. When the -cells fail to compensate for insulin resistance with increased insulin secretion, hyperglycemia (high blood sugar levels) occurs. T2DM is defined by the increasing loss of -cell function and bulk over time as a result of hyperglycemia. Excess calories and physical inactivity cause fat accumulation in the liver, muscles, and pancreas, which leads to -cell dysfunction and insulin resistance. β cell dysfunction is also triggered by inflammation, oxidative and endoplasmic reticulum stress, elevated lipid levels, and amyloid accumulation. Hormones from the gastrointestinal tract and the neurological system, particularly the brain, have an impact on -cells and glucose metabolism. Early detection and treatment with lifestyle measures (exercise, nutrition, and weight loss) and glucose-lowering drugs can decrease complications and vascular illnesses, as well as prevent or delay disease development (Dendup et al., 2018).

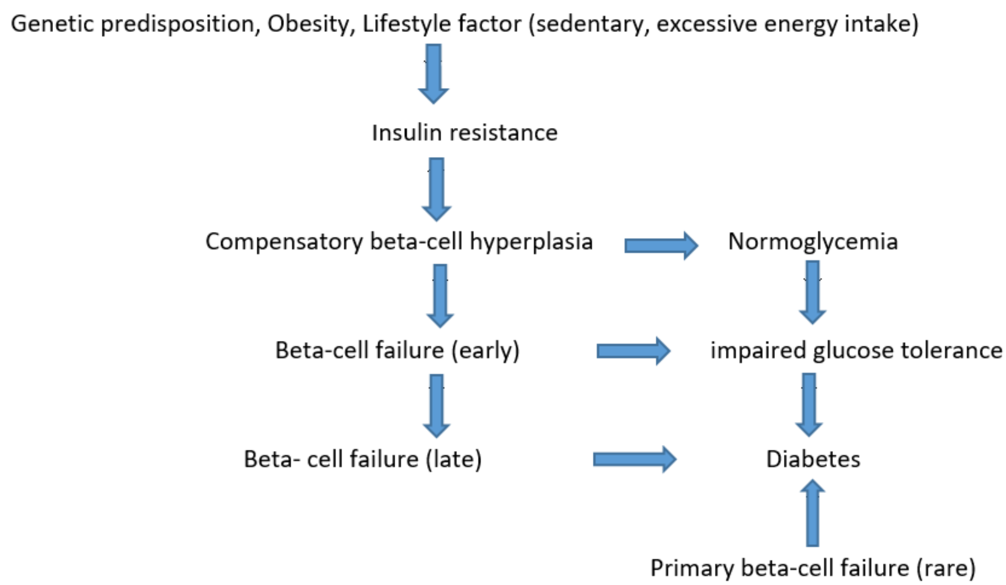

Figure 2.1: Pathogenesis of diabetes mellitus

2:4.0 Risk factors of diabetes mellitus

Obesity and overweight, lack of exercise, previously known glucose intolerance, increased age, high blood pressure and high cholesterol, family history, and an unhealthy diet were all highlighted as risk factors by the IDF and the American Diabetes Association (ADA, 2016).

2:4.1 Modifiable risk factors:

I. Physical inactivity
II. Obesity
III. Hypertension
IV. High cholesterol

2:4.2 Non modifiable risk factors:

I. Age over 45 years
II. Race/ethnicity
III. Family history
IV. History of gestational diabetes.

(Miah and Yousuf, 2018)

Age:

For many years, type 2 diabetes has been referred to as "adult onset" or "maturity-onset," implying that the prevalence of the disease rises with age. Diabetes affects 18.4% of those aged 65 and up. It's worth noting that the age of 45 has been used as a significant cut-off point for calculating diabetes prevalence. However, type 2 diabetes has increased by 70% in younger persons between the ages of 30 and 39 in the last eight years. The next age group, 40–49 years, saw a 40% increase in rates. Current lifestyle trends, which result in increased body weight and decreased physical activity, are responsible for these astonishing results (Harrigan, 2007).

Racial/Ethnic:

Minorities in the United States have a diabetes prevalence that is 2–6 times higher than white people. The prevalence of diabetes was 1.7 times greater among non-Hispanic blacks than in whites of same age, according to the Third National Health and Nutrition Survey (1988–1994). Obesity was not found to be a factor in this elevated risk. Diabetes affects one out of every four black women aged 55 and up. This is twice the rate for white women of the same age. When compared to other minorities, black females had the highest rate of diabetes-related mortality (Harrigan, 2007).

Obesity and physical inactivity:

An estimated 97 million adults in the United States are overweight (BMI 25–29.9 kg/m2) or obese (BMI 30 kg/m2 or higher). Diabetes is becoming more common as people's lifestyles become more sedentary and the population ages. Obesity, particularly abdominal adiposity, is a primary driver of type 2 diabetes development, causing it to emerge at a younger age. When obesity is combined with a lack of physical activity, the risk of type 2 diabetes mellitus. Obese people with insulin resistance can improve their insulin sensitivity by losing weight (Harrigan, 2007).

BMI:

The BMI was divided into four groups. **Underweight** was defined as a weight of less than 18.5 pounds. The **normal BMI** ranged from 18.5 to 23**. Overweight** was defined as a BMI of 23 to 25, while **obesity** was defined as a BMI of 25 or higher (Zahid et al., 2009).

Hypertension:

High blood pressure was defined as **systolic pressure** greater than 140 mmHg and **diastolic pressure** greater than 90 mmHg (Zahid et al., 2009).

2:5.0 Complications of type 2 diabetes mellitus

Type I and Type 2 diabetes are the two most common forms. Type I diabetes is insulin-dependent and may be caused by an autoimmune response. The beta cells of the islets of Langerhans create insulin in the pancreas. Type I diabetes is caused by a complete lack of insulin due to the absence, damage, or death of these cells. Type 2 diabetes is a diverse condition in which patients develop insulin resistance and their beta cells are unable to overcome this resistance. Complications emerge as a result of the disease, regardless of its nature. Acute complications, long-term complications, and complications caused by related conditions are the three major categories of complications.(Bhuyan and Fardus, 2019) According to the International Diabetes Federation (IDF), 75–80 percent of diabetics die as a result of cardiovascular problems (Mohiuddin, 2019).

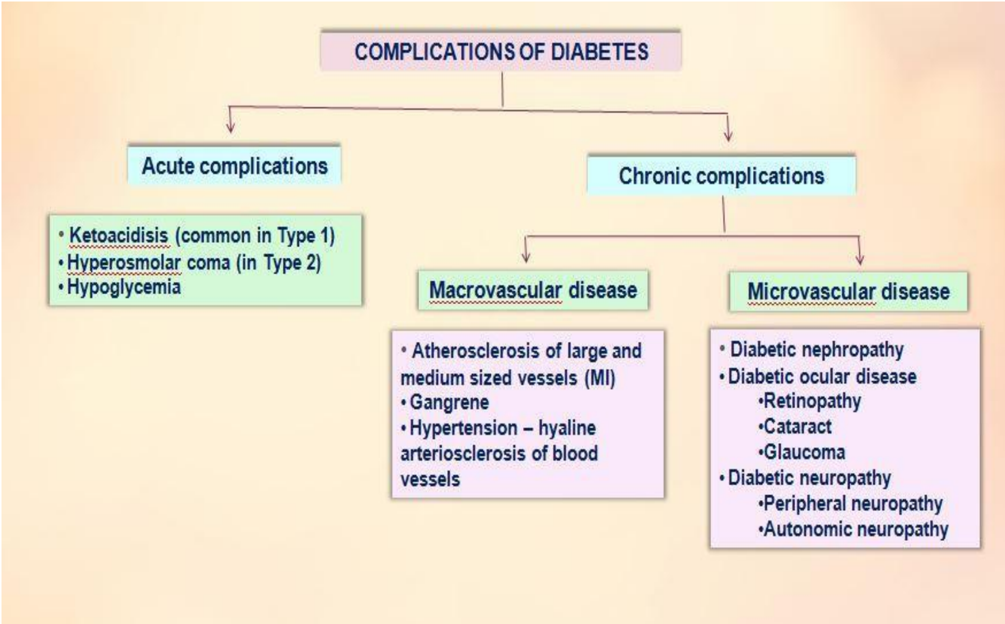

Figure 2.2: Complications of diabetes mellitus (American Diabetes Association, 2004)

2:6.0 Risk factors in different journals/ literatures

Hypertension, particularly high SBP, is a major contributor to T2DM. Some hypertensive patients are insulin resistant, and the prevalence of hypertension in diabetic patients is 3–4 times higher than in non-diabetic people. Most diabetic patients appear to develop hypertension at some point. Obesity has long been thought to be linked to T2DM. Because the increase of adipose tissue is linked to glucose intolerance and hyperinsulinemia, obesity, particularly abdominal obesity, is a key risk factor for diabetes (Hu et al., 2009).

A cross-sectional study was conducted in an urbanizing rural community in Bangladesh to evaluate the prevalence of type 2 diabetes mellitus and its risk variables. Following a simple random technique, two villages were randomly picked from the rural parts of Gazipur district, and a total of 975 subjects (>20 years) were included. The levels of capillary blood glucose, fasting blood glucose (FBG), and 2-hour after a 75-gram oral glucose load (OGTT) were all tested. Height, weight, waist and hip circumferences, as well as blood pressure, were all taken into account. The participants in the study were thin, having a mean BMI of 20.48. The overall prevalence of type 2 diabetes was 8.5 percent, with men having a higher prevalence (9.4%) than women (8.0 %). Growing old and having a higher BMI were discovered to be important risk factors (Rahman et al., 2007).

Type 2 DM is a diverse condition in which patients develop insulin resistance and their beta cells are unable to overcome this resistance. Complications emerge as a result of the disease, regardless of its nature. Acute complications, long-term problems, and complications induced by related autoimmune illnesses are the three major categories of complications. Hypoglycemia, hyperglycemia, and death while diagnosis are examples of acute compilations. People, including the government, are unaware of the complication, and as a result, the variables that cause the condition remain unknown. The goal of this study was to determine the socio-demographic factors that contributed to diabetes in some persons in Bangladesh's rural and urban areas (Talukder and Hossain, 2020)**.**

In underdeveloped countries, diabetes is one of the most serious public health issues. The Bangladeshi public has a poor understanding of diabetes risk factors. The goal of this study was to look at the possible risk factors for type 2 diabetes in Bangladesh. Females were shown to have a higher prevalence of diabetes than males. Increased age, obesity, waist-hip ratio, socioeconomic status, hypertension, family history, and sedentary lifestyle were identified as 14 frequent risk factors for diabetes in Bangladesh. The possible risk variables differed by gender and by urban-rural locations. The rising prevalence of type 2 diabetes is due to a number of risk factors (Sal-sabil et al., 2016).

Type I and Type II diabetes are the two most common forms. Type I diabetes is insulin-dependent and may be caused by an autoimmune response. The beta cells of the islets of Langerhans create insulin in the pancreas. Type I diabetes is caused by a complete lack of insulin due to the absence, damage, or death of these cells. Type II diabetes is a diverse condition in which patients develop insulin resistance and their beta cells are unable to overcome this resistance. Complications emerge as a result of the disease, regardless of its nature. Acute complications, long-term complications, and complications caused by related conditions are the three major categories of complications (Bhuyan and Fardus 2019).

According to a recent meta-analysis, the prevalence of Diabetes among adults has increased dramatically in Bangladesh, a country with 149.8 million inhabitants (according to 2011 statistics). From 1995 to 2000, the prevalence was 4%, and from 2001 to 2005, it was 5%. However, between 2006 and 2010, the disease's frequency among Bangladeshis increased to 9%. Unfortunately, no nationally representative epidemiological analysis of diabetes prevalence and risk factors has been done in Bangladesh. Previous studies were limited to certain rural or urban areas, or focused on a single gender, or had insufficient sample sizes. Furthermore, no previous study has fully quantified the impact of individual, household, and societal factors on diabetes mellitus (Rahman et al., 2020).

Diabetes mellitus has quadrupled in global prevalence during the last three decades, and it is now the ninth leading cause of mortality. Around one in every eleven persons in the globe now has diabetes, with 90 percent of those suffering from type 2 diabetes (T2DM). Asia is a significant hotspot for the global T2DM epidemic, with China and India serving as the top two epicenters. Individual susceptibility to T2DM is partly determined by genetic predisposition, but an unhealthy diet and sedentary lifestyle are major drivers of the current global epidemic; early developmental factors (such as intrauterine exposures) also play a role in susceptibility to T2DM later in life Many cases of T2DM can be avoided by changing one's lifestyle, such as keeping a healthy weight, eating a balanced diet, staying physically active, avoiding smoking, and drinking alcohol in moderation. The majority of T2DM patients experience at least one complication, with cardiovascular problems being the predominant cause of morbidity and mortality. The global epidemiology of T2DM, as well as dietary, lifestyle, and other risk factors for T2DM and its consequences, are updated in this review (Zheng et al., 2018).

CHAPTER-3

MATERIALS AND METHODS

3:1.0 Study design

The study was descriptive, observational and cross-sectional in nature with some analytical components.

3:2.0 Period of study

The study was carried out in Chattogram Veterinary and Animal Sciences University from December 2021 to June 2022. It started with a literature review, developing the questionnaire by December 2021, then a protocol presentation. After necessary modification and correction, data collection was started from the 1st week of January 2022. After collecting data, compilation, processing, analysis, and report writing was done by June 2022.

3:3.0 Place of data collection

Data collection was carried out in the outdoor and indoor of Chattogram Diabetic General Hospital, Chattogram from 1st January, 2022 to 30th January, 2022. The analyses of data were conducted in the Chattogram Veterinary and Animal Sciences University, Chattogram.

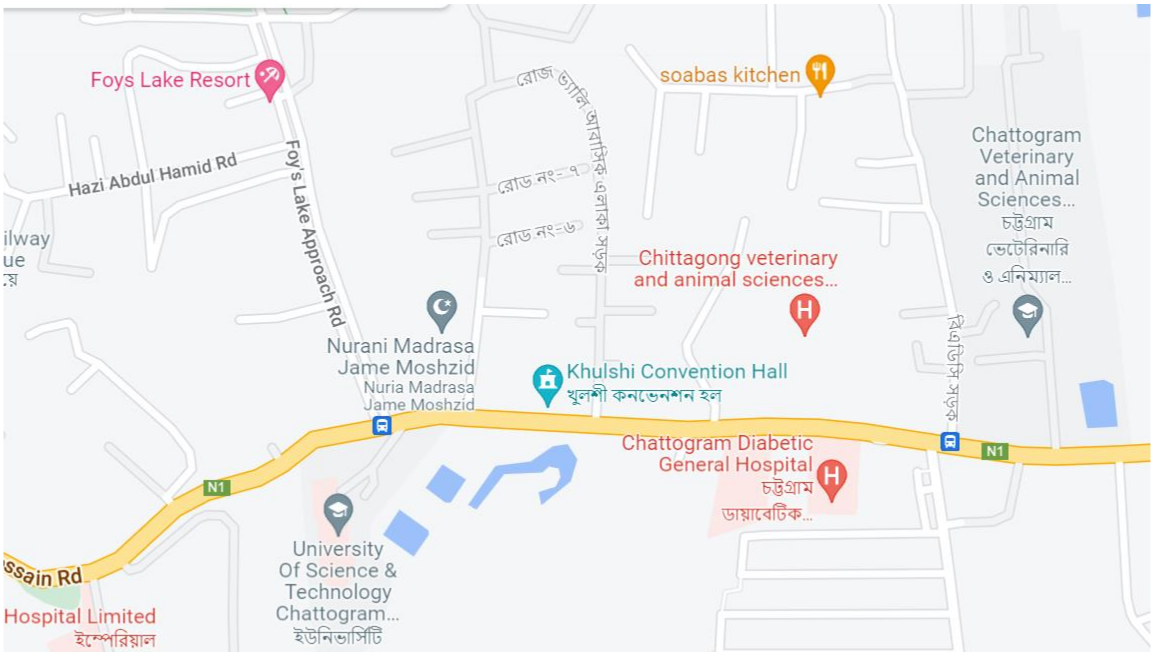

Figure 3.1: Google map showing Chattogram Diabetic General Hospital & CVASU

3:4.0 Study population

Study population is diagnosed case of type 2 diabetes mellitus.

3:5.0 sampling technique

Convenient Purposive sampling.

3:6.0 Method of Estimating Sample Size

Sample size was determined on basis of the following formula

z= 1.96 at 95% confidence level

p= Expected proportion of occurrence, it is 50% (0.5) because it is not known

q= 1-P= 1- 0.5= 0.5

e= 10% of P= 0.05

So calculated sample size(n) was

$n = z^2 pq/e^2$

$= (1.96)^2 \times 0.5 \times 0.5/(0.05)^2 = 384$

Total 400 patients, both male and female were selected from outdoor and indoor of the Chattogram Diabetic General Hospital for the study.

3:7.0 Selection of subjects

3:7.1 Inclusion Criteria

To accomplish the aims of the present study, individuals were invited to participate in the study if they met the following criteria.

a) Age: 45 to 90 years

b) Sex: male & female

c) Bangladeshi by nationality

d) Who gives consent to provide data for this study

e) Diagnosed case of type 2 diabetes mellitus

3:7.2 Exclusion Criteria

The following exclusion criteria were used to screen out the ineligible subjects through history taking:

a) Diagnosed case of type 1 diabetes mellitus and Gestational diabetes mellitus

b) Peoples who were receiving any drug which may impact glucose metabolism (like B-blockers, Steroids, and Thiazide diuretics)

c) Who are not interested in giving data for this study

3:8.0 Operational Definitions

Height:

Height or stature is the measurement of vertical distance from the top of the head (the vertex) to the floor, was shown in Figure 3.2 (Hossain et al. 2011).

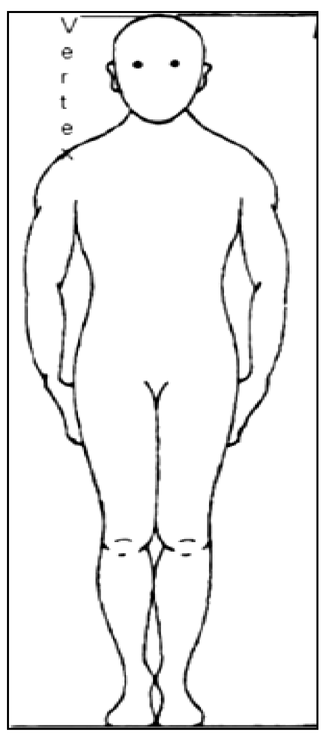

Figure 3.2: Diagrammatic representation of the stature (Kamal & Yadav 2016).

Weight:

A body's relative mass or the quantity of matter contained by it, gives rise to a downward force; the heaviness of a person or thing (CDC, 2007).

BMI:

BMI is a person's weight in kilograms (kg) divided by his or her height in meter squared. (CDC, 2007)

3:9.0 Instruments used for measuring variables

A Self-administered structured questionnaire was used (Appendix – V)

3:10.0 Variables studied

i. Age
ii. Sex
iii. Occupation
iv. Educational Status
v. Duration of type 2 diabetes mellitus
vi. Clinical symptoms of type 2 diabetes mellitus – Polyuria, Polydypsia, Polyphagia, Weight loss/gain, Delayed wound healing, Weakness,
vii. Risk factors – Physical activity
viii. Family history
ix. Food habit – Carbohydrate, protein & fat
x. Height, Weight and BMI
xi. Blood glucose level – Fasting and 2hr post prandial
xii. Complication – Hypertension, Neuropathy, Retinopathy, Nephropathy, MI (Myocardial Infarction), Stroke and CKD
xiii. Medication - Insulin, Oral Drug

3:11.0 Ethical Measures

After submission of protocol of the research, a presentation for the ethical permission was done in front of the Ethical Review Committee of CVASU and permission was given (Appendix IA, IB). After ethical permission, an application was submitted to Chattogram Diabetic General Hospital for collection of data (Appendix II). Permission was given by Chattogram Diabetic General Hospital (Appendix III).

3:12.0 Diagnostic criteria for disease:

According to American Diabetes Association (2022), Pre-prandial capillary plasma glucose 80–130 mg/dL (4.4–7.2 mmol/L) and Peak postprandial capillary plasma glucose <180 mg/dL (10.0 mmol/L) was considered as controlled blood glucose (American Diabetes Association Professional Practice Committee, 2022).

Body mass index was calculated using weight in kg divided by height in meter^2. According to WHO, Underweight (BMI< 18.5), Normal (BMI 18.5-24.9), Overweight (BMI 25-29.9), and Obese (BMI ≥30) (CDC, 2021).

3:13.0 Procedures of Data collection

All subjects were informed about the nature and purpose of the study and confidentiality of data handling. A complete assurance was given to them that all information provided by them would be kept confidential and their names or anything which can identify them would be published or exposed anywhere. Participation was voluntary and written consent was taken from participants (Appendix IVA, IVB). They were informed that they have the right to refuse to respond to any or the entire interview questions and they also have the right to withdraw from an on-going interview. No intervention or any other invasive procedure would be undertaken.

Data was collected through face-to-face interviews from the patients of outdoor and indoor of Chattogram Diabetic General Hospital by using a Self-administered structured questionnaire by the researcher (Appendix V). From participant's prescription book, information regarding their height, weight, blood glucose, HbA1C, lipid profile level & complication was gathered.

3:14.0 Study plan

Following the objectives of the study, a specific study plan was formulated for taking different anthropometric variables and analyzing them. The overall study plan is shown in Figure 3.3.

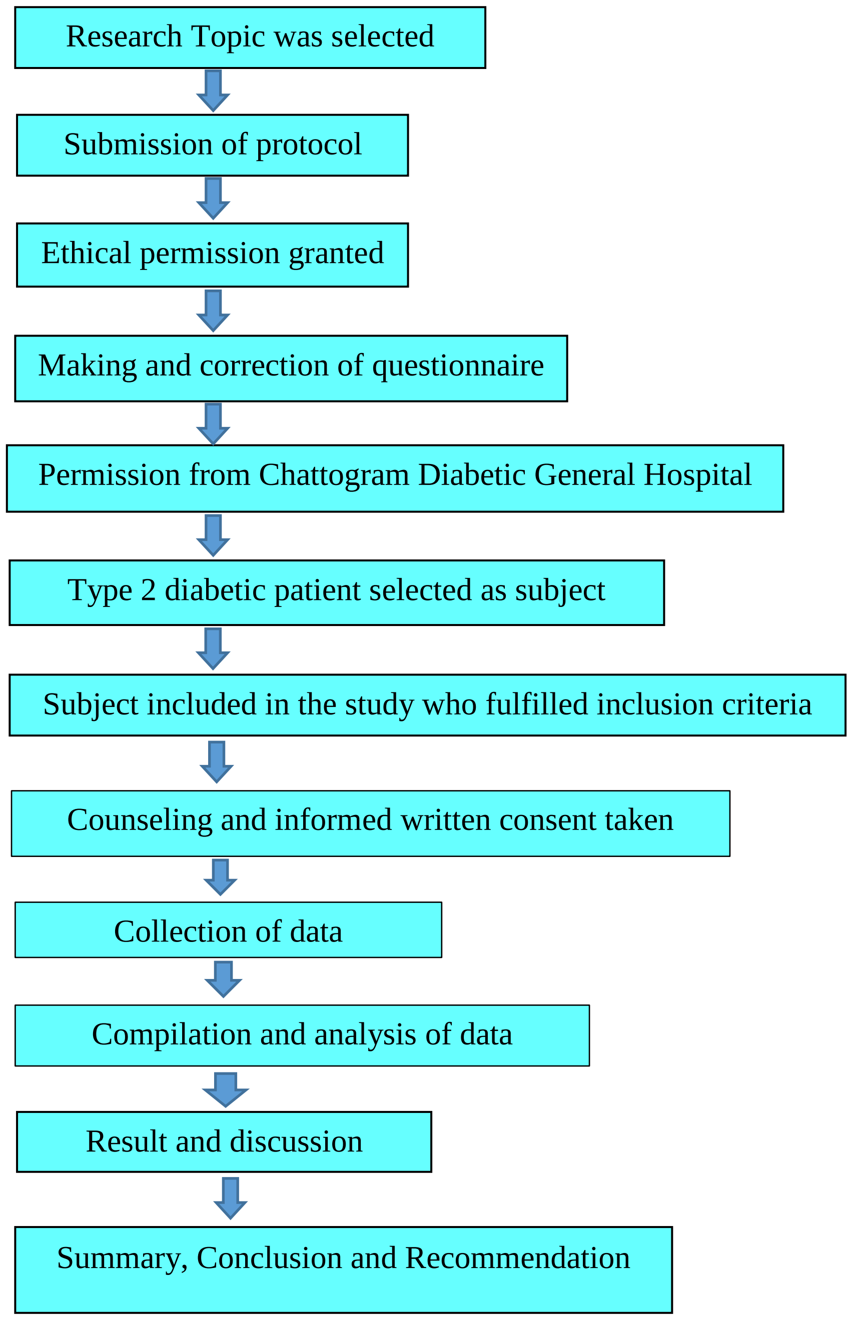

Figure 3.3: Study plan flow chart showing the sequence of study

3:15.0 Data processing & analysis

The collected data were checked, verified, and coding, post coding, and then import into the computer. The analysis was carried out by using descriptive statistics with the help of SPSS (Statistical package for social science) version 20 windows software program. The range, mean and standard deviation of the values of variables were calculated using computer-based programs ‘Statistical Package for Social Science’ (SPSS version-20). ‘t’ test, and Chi-square test, using a statistical software (SPSS). Data was collected by both qualitative and quantitative method. All the collected data were compiled and processed. All quantitative data were compared by unpaired‘t-test, and all qualitative data of study groups were compared by Chi-square test, using a statistical software (SPSS).

CHAPTER-4

RESULT

4:1.0 Age

The range, mean, and standard deviation (SD) of the age of the subjects are shown in Table 4.1. Among 400 participants(male and female), 249 were in the 45-55 years age group were type 2 diabetic, which was 62.3% (Table 4.1 and Figure 4.1). Another 56-65 age group frequency was 102 and the percentage was 25.5%. The frequency of age group 66-75 was 40 and the percentage was 10. The frequency of age group 76 and above was 9 and the percentage was 2.3% (Table 4.1 and Figure 4.1).

Table 4.1: Distribution of study participants according to age (n=400)

Age (years)	Range	Mean ± SD
	45 – 88	54.76 ± 8.806
Age Group	**Frequency**	**Percentage**
45 -55	249	62.3
56 - 65	102	25.5
66 - 75	40	10.0
76 and above	9	2.3

(n = 400)

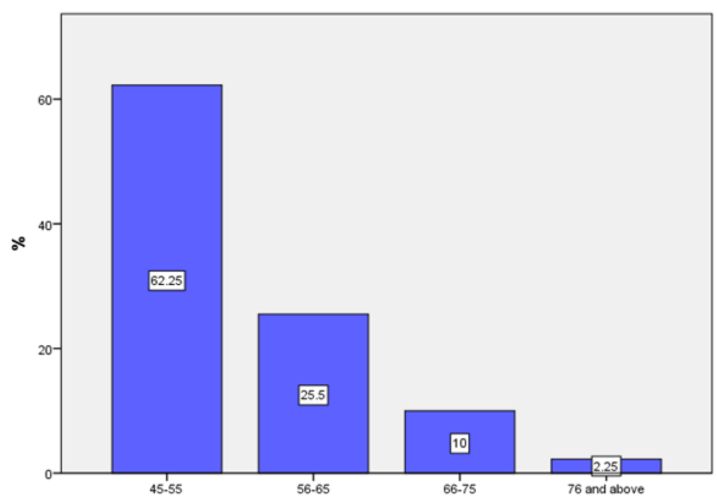

Figure 4.1: Bar Diagram showing the distribution of study participants according to age (n = 400)

4:2.0 Sex

Table 4.2 shows the distribution of the subjects according to sex. Male participants were 199 and the percentage was 49.7%. Female participants were 201 and the percentage was 50.3%. In this study, the male mean age was 55.9 years; the female mean age was 53.63 years.

Table 4.2: Distribution of study participants according to Sex (n=400)

Sex	Frequency	Percentage (%)	Mean age	±SD
Male	199	49.7	55.9	±9.20
Female	201	50.3	53.63	±8.25

(n = 400)

4:3.0 Occupation

Table 4.3.1 and Figure 4.3.1 shows the Occupation of the subjects. Businessmen were 96 which was 24%. Service was 60 and the percentage was 15%. Farmers were 11 in number and 2.7%. The housewife was 176 (44%). Others mean Teachers, Retired officers, Drivers, etc. was 57 in number and 14.3%. In this study among males common in businessmen & among females common in housewives who developed type 2 diabetes mellitus (Table 4.3.2 and Figure 4.3.2). The test was determined with the Chi-square test.

Table 4.3.1: Distribution of study participants according to Occupation (n=400)

Occupation	**Frequency**	**Percentage (%)**
Businessman	96	24.0
Service	60	15.0
Farmer	11	2.7
Housewife	176	44.0
Others	57	14.3

(n = 400)

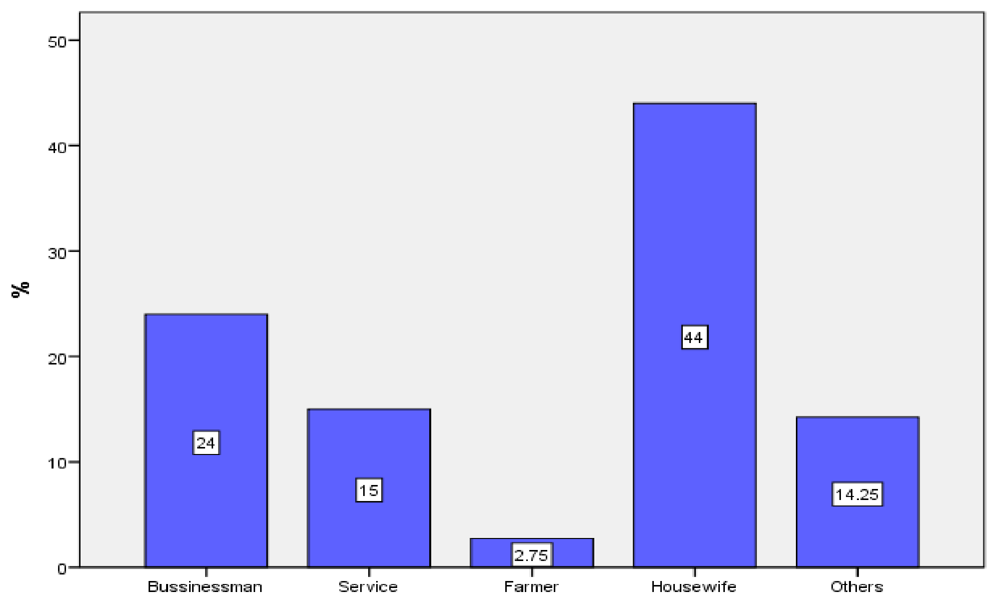

Figure 4.3.1: Bar the Diagram showing distribution of study participants according to Occupation (n = 400)

Table 4.3.2: Distribution of study participants according to Occupation by sex (n=400)

Occupation	Male	Female	P value
Business man	97 (24.3%)	3 (0.8%)	
Service holder	51 (12.8%)	9 (2.3%)	0.00*
Farmer	11 (2.8%)	0	
Housewife	0	172 (43.0%)	
Others	40 (10.0%)	17 (4.3%)	

(n = 400) *p=0.00 highly significant

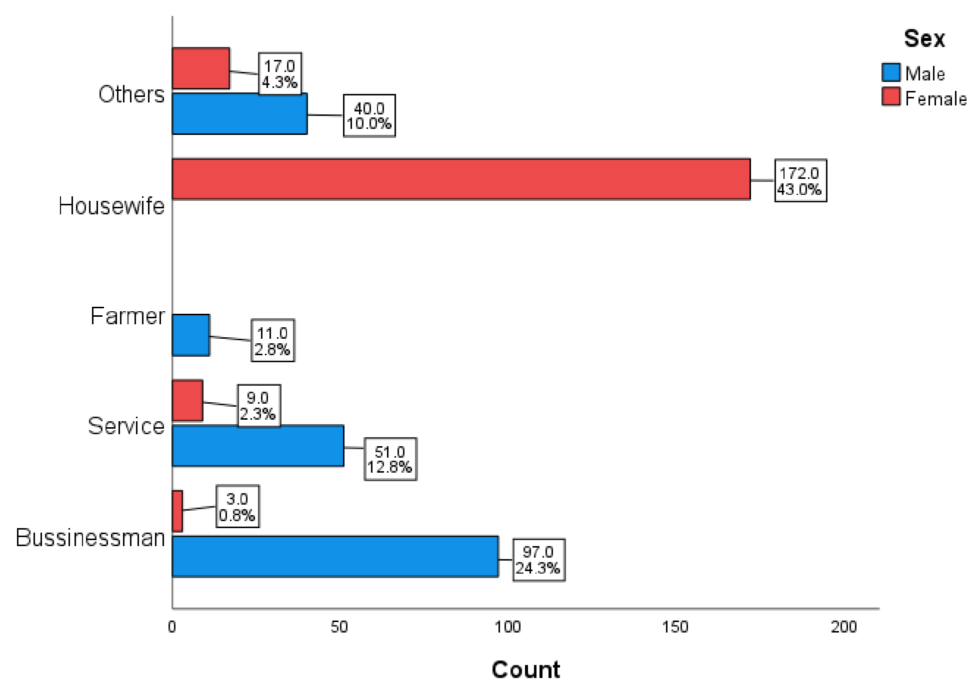

Figure 4.3.2: Distribution of study participants according to Occupation by sex (n = 400)

4:4.0 Educational Status

Table 4.4 and Figure 4.4 shows the educational status of the subjects. From class 1 to SSC was 76 and the percentage was 19%. HSC was 81 and the percentage was 20.3%. Graduates were 152 in number and 38%. Illiterate that 24 (6%) and 67(16.8%) can only do signatures.

Table 4.4: Distribution of study participants according to Educational Status (n=400)

Educational Status	Frequency	Percentage (%)
Class 1 to SSC	76	19.0
HSC	81	20.3
Graduation	152	38.0
Illiterate	24	6.0
Signature	67	16.8

(n = 400)

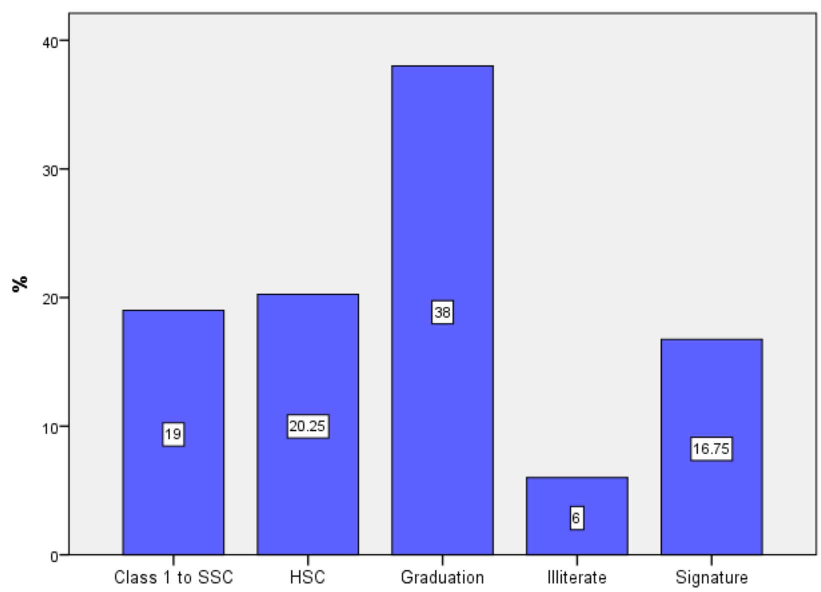

Figure 4.4: Bar Diagram showing distribution of study participants according to Educational Status (n = 400)

4:5.0 Duration of type 2 diabetes mellitus

Table 4.5 and Figure 4.5 shows the duration of type 2 diabetes mellitus. Frequency and percentage of <5 years were 92 and 23%. 5-9 years was 113 and 28.3%. 10-14 years was 102 and 25.5%. 15-19 years was 45 and 11.3%. The frequency of >19 years was 48(12%).

Table 4.5: Distribution of study participants according to duration of type 2 diabetic mellitus (n=400)

Duration	Frequency	Percentage (%)
<5 years	92	23.0
5-9 years	113	28.3
10-14 years	102	25.5
15-19 years	45	11.3
>19 years	48	12.0

(n = 400)

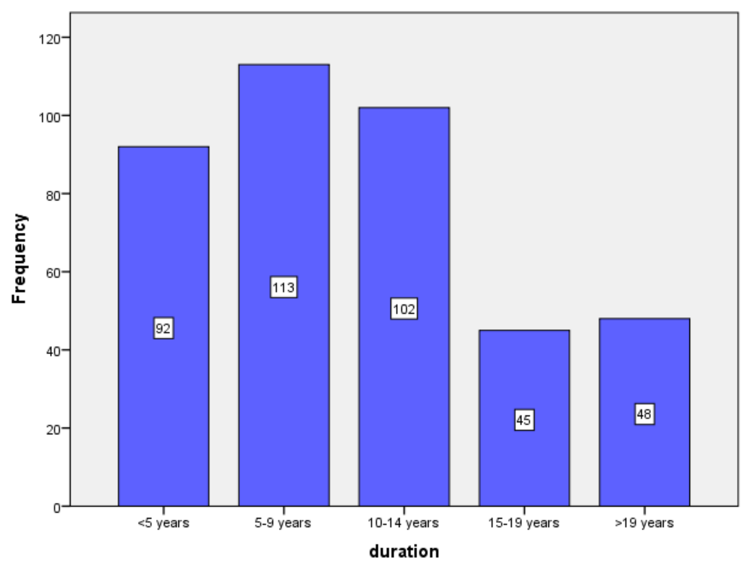

Figure 4.5: Distribution of study participants according to duration (n = 400)

4:6.0 Clinical symptoms of type 2 diabetes mellitus

The frequency and percentage of the clinical symptoms of the subjects are shown in Table 4.6. Among 400 participants, 358 had polyuria which was 89.5%. 337 participants had polydipsia was 84.3%. The frequency of polyphagia was 335 in number and 83.8%. The frequency of weight loss was 214 and the percentage was 53.5 %. The frequency of weight gain was 158 and 39.5. The frequency of delayed wound healing was 209 and the percentage was 52.3 % and the frequency of weakness was 157, the percentage was 39.3%. The Chi-square test shows that among clinical features of type 2 DM Polyuria, polydipsia, polyphagia, weight loss, and weakness were more common in females (Table 4.6). Weight gain and delayed wound healing was more common in male (Table 4.6 and Figure 4.6.1 to 4.6.7).

Table 4.6: Distribution of study participants according to clinical symptoms by sex

Clinical Features	Total	Male	Female	P value
Polyuria				
Yes	358 89.5%	174 (43.5%)	184 (46.0%)	0.18
No	42 10.5%	25 (6.3%)	17 (4.3%)	
Polydipsia				
Yes	337 84.3%	160 40.0%	177 44.3%	0.03*
No	63 15.8%	39 9.8%	24 6.0%	
Polyphagia				
Yes	335 83.8	159 39.8%	176 44.0%	0.03*
No	65 16.3%	40 10.0%	25 6.3%	

(n = 400)

(contd.)

(n = 400)

Clinical Features	Total	Male	Female	P value
Weight loss				
Yes	214 53.5%	96 24.0%	118 29.5%	0.03*
No	186 46.5%	103 25.8%	83 20.8%	
Weight gain				
Yes	158 39.5%	94 23.5%	64 16.0%	0.00*
No	242 60.5%	105 26.3%	137 34.3%	
Delayed wound healing				
Yes	209 52.3%	114 28.5%	95 23.8%	0.04*
No	191 47.8%	85 21.3%	106 26.5%	
Weakness				
Yes	157 39.3%	42 (10.5%)	115 (28.7%)	0.00**
No	243 60.8%	157 (39.3%)	86 (21.5%)	

*p value=0.03, significant

*p value=0.04, significant

**p value=0.00, highly significant

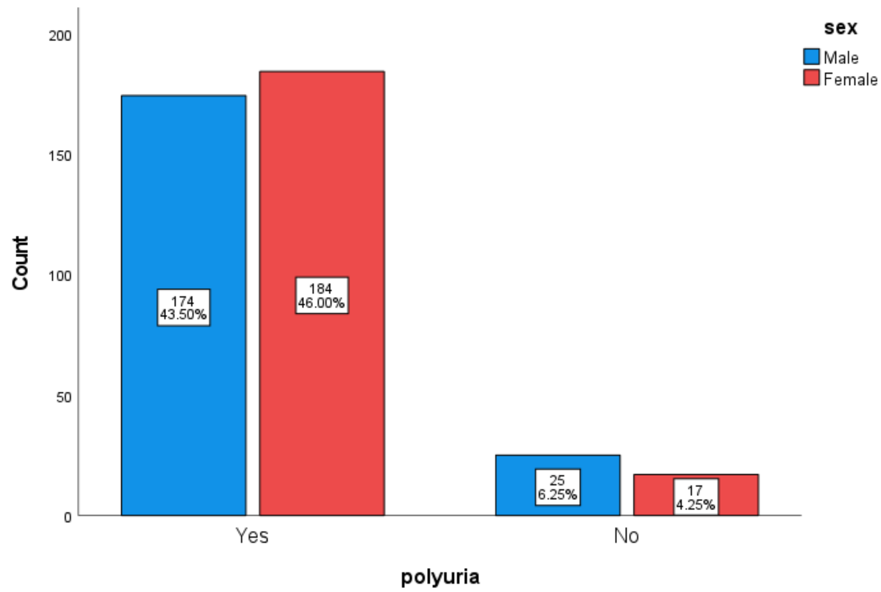

Figure 4.6.1: Distribution of study participants according to clinical symptoms (polyuria) by sex (n=400)

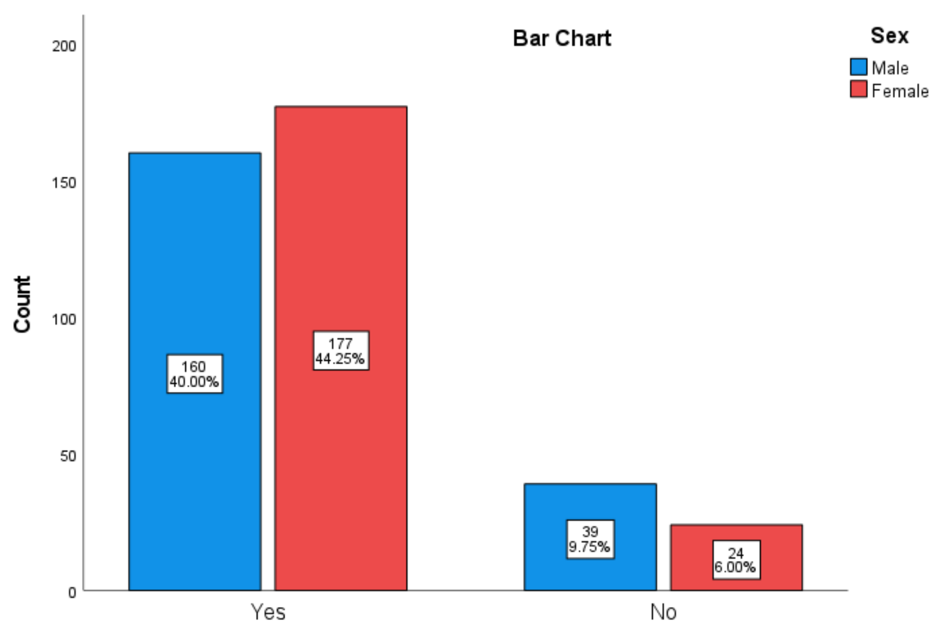

Figure 4.6.2: Distribution of study participants according to clinical symptoms (polydipsia) by sex (n=400)

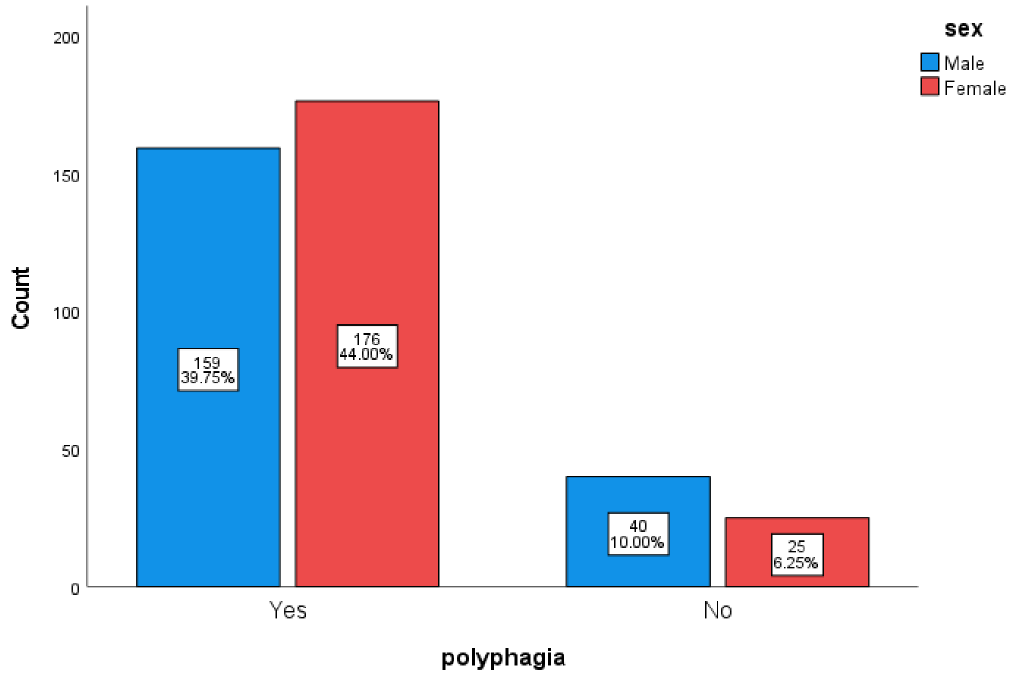

Figure 4.6.3: Distribution of study participants according to clinical symptoms (polyphagia) by sex (n=400)

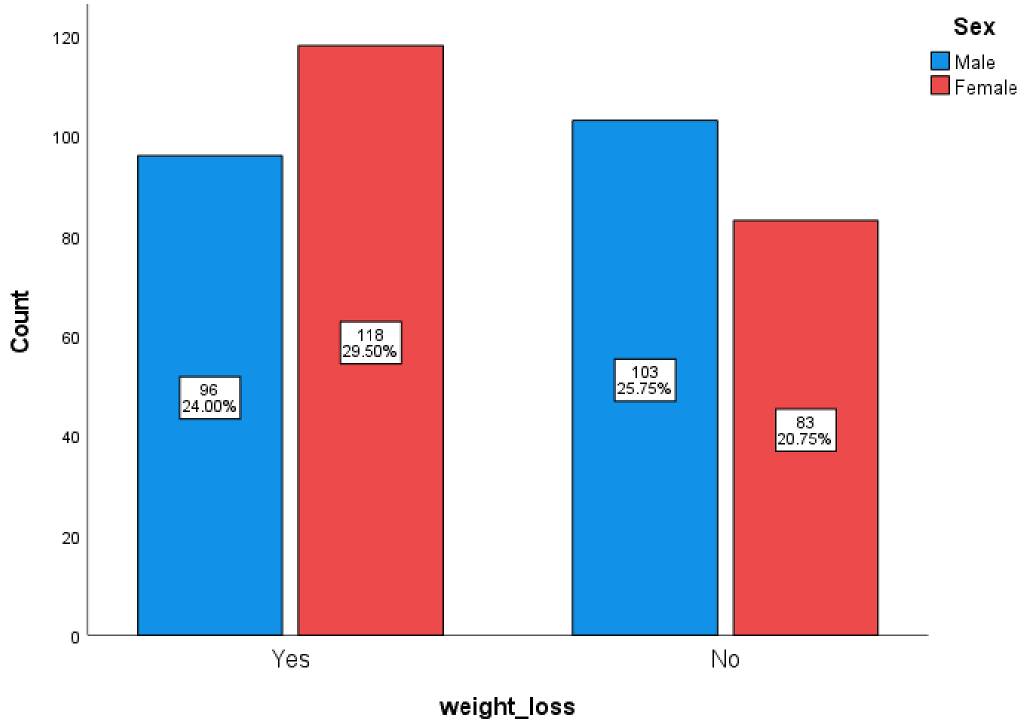

Figure 4.6.4: Distribution of study participants according to clinical symptoms (weight loss) by sex (n=400)

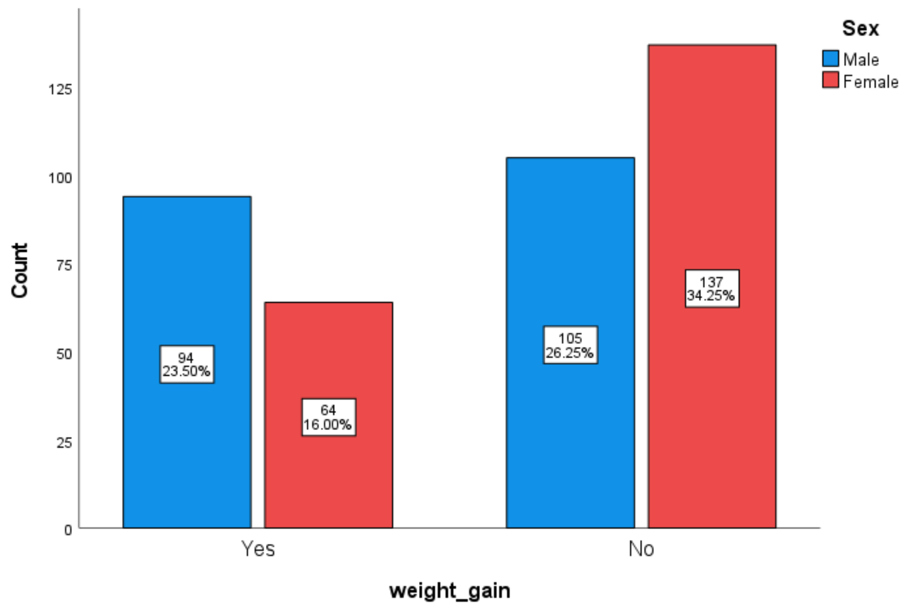

Figure 4.6.5: Distribution of study participants according to clinical symptoms (weight gain) by sex (n=400)

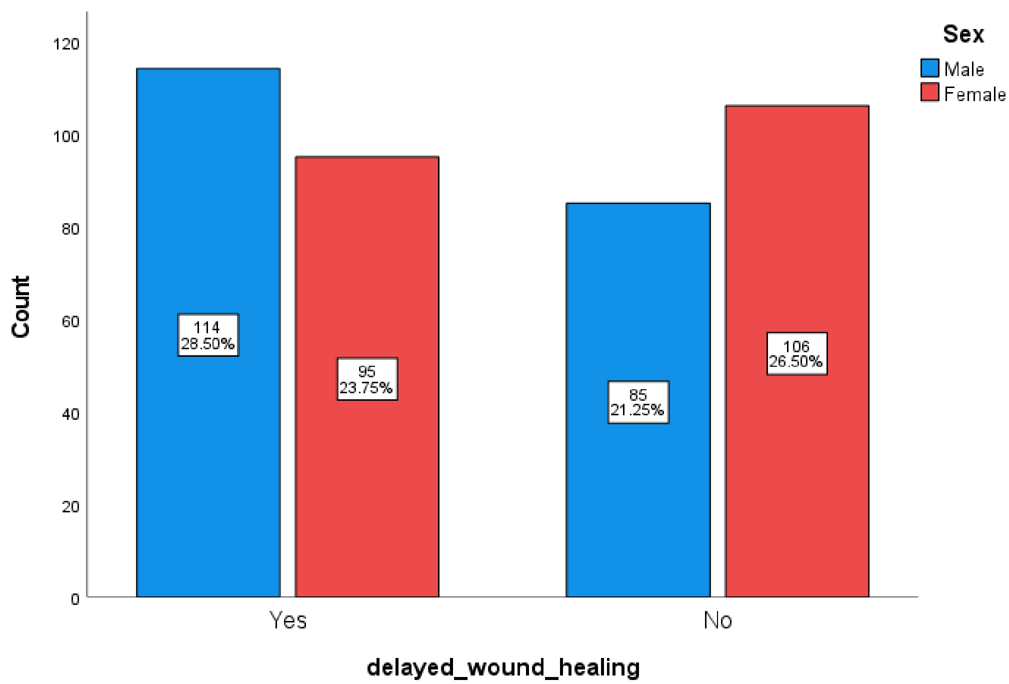

Figure 4.6.6: Distribution of study participants according to clinical symptoms (delayed wound healing) by sex (n=400)

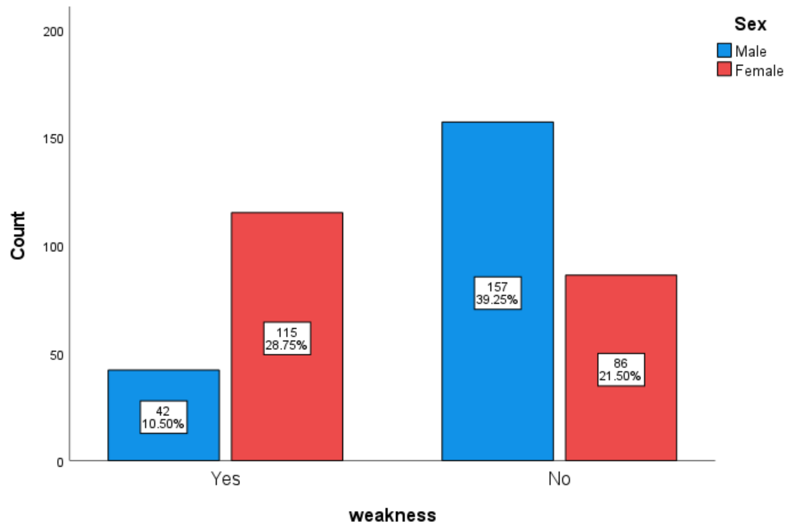

Figure 4.6.7: Distribution of study participants according to clinical symptoms (polyuria) by sex (n=400)

4:7.0 Physical activity

Table 4.7 shows that the frequency of physical activity was 101 and the percentage was 25.3. In the Chi-square test male and females who had less physical activity, had more chance to develop type 2 DM. Between males and females, females had more chances to develop type 2 DM due to less physical activity (Table 4.7 and Figure 4.7.1).

Table 4.7: Distribution of study participants according to physical activity by sex (n = 400)

Physical activity	Total	Male	Female	P value
Yes	101 (25.3%)	73 (18.3%)	28 (7.0%)	0.00*
No	299 (74.8%)	126 (31.5%)	173 (43.3%)	

*p value= 0.00, highly significant

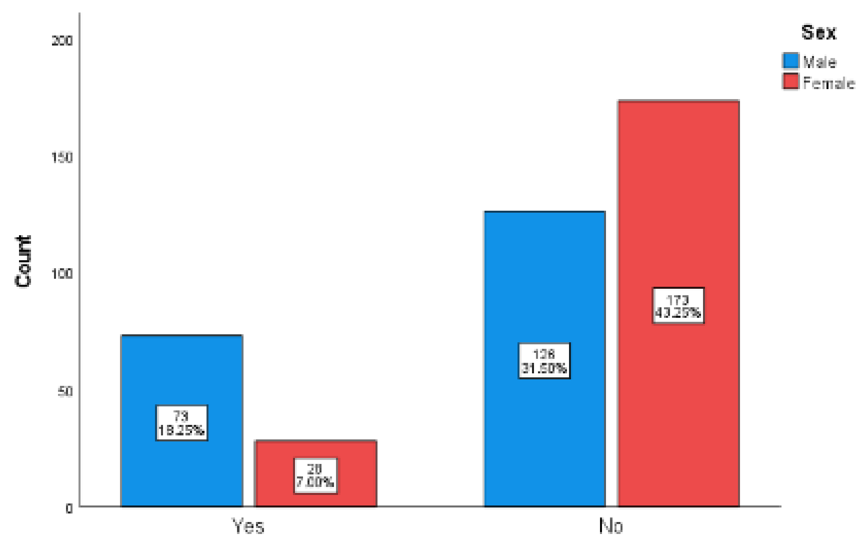

Figure 4.7.1: Distribution of study participants according to risk factors (Physical activity) by sex (n = 400)

4:8.0 Family history

The Chi-square test shows positive family history leads to type 2 DM and it is common in females (Table 4.8 and Figure 4.8.1).

Table 4.8: Distribution of study participants according to family history by sex (n=400)

Family history	Total	Male	Female	P value
Yes	197 49.2%	86 42.8%	111 55.8%	0.00*
No	203 50.8%	115 57.2%	88 44.2%	

(n = 400) *p value= 0.00, highly significant

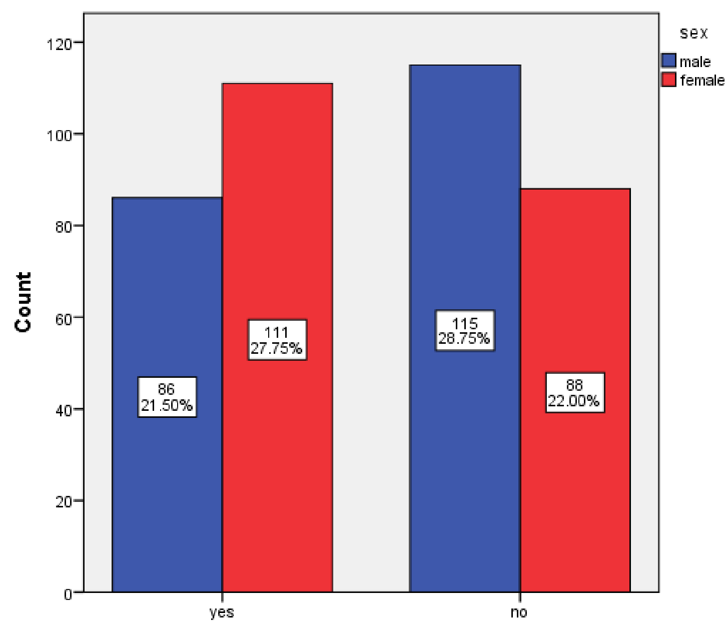

Figure 4.8.1: Distribution of study participants according to family history by sex (n = 400)

4:9.0 Food Habit

Frequency and percentage of carbohydrate 305 and 76.3% Frequency of protein 217 and percentage 54.3%. The frequency and percentage of fat are 170 and 42.5% (Table 4.9 and Figure 4.9.1 to 4.9.3). In this study males and females who take more carbohydrates had more chance to develop type 2 diabetes mellitus and it is done by Chi-square test (4.9.1).

Table 4.9: Distribution of study participants according to Food Habit (n=400)

Food Habit	Total	Male	Female	P value
Carbohydrate				
More intake	305 76.3%	143	162	0.05*
Less intake	95 23.8%	56	39	
Protein				
More intake	217 54.3%	107	110	0.99
Less intake	183 45.8%	92	91	
Fat				
More intake	170 42.5%	82	88	0.48
Less intake	230 57.5%	117	113	

(n = 400) *p value=0.005, significant

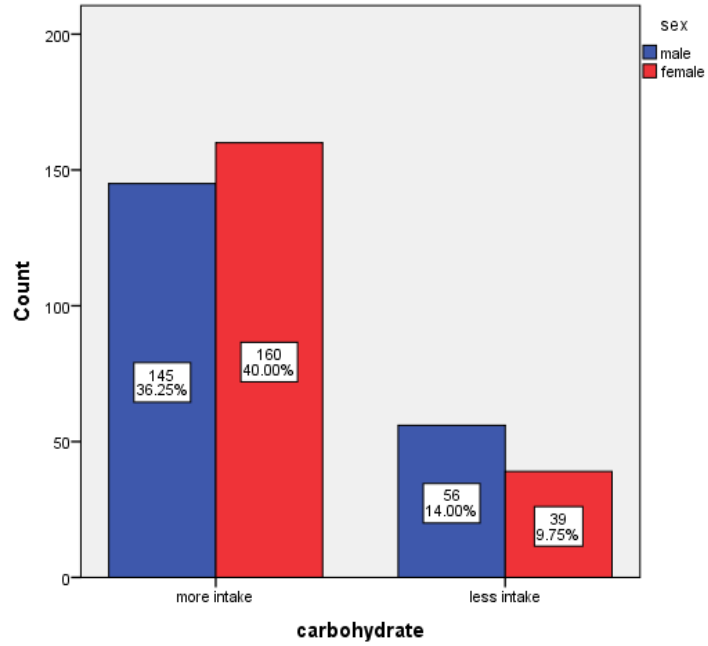

Figure 4.9.1: Distribution of study participants according to Food habit (Carbohydrate) by sex (n = 400)

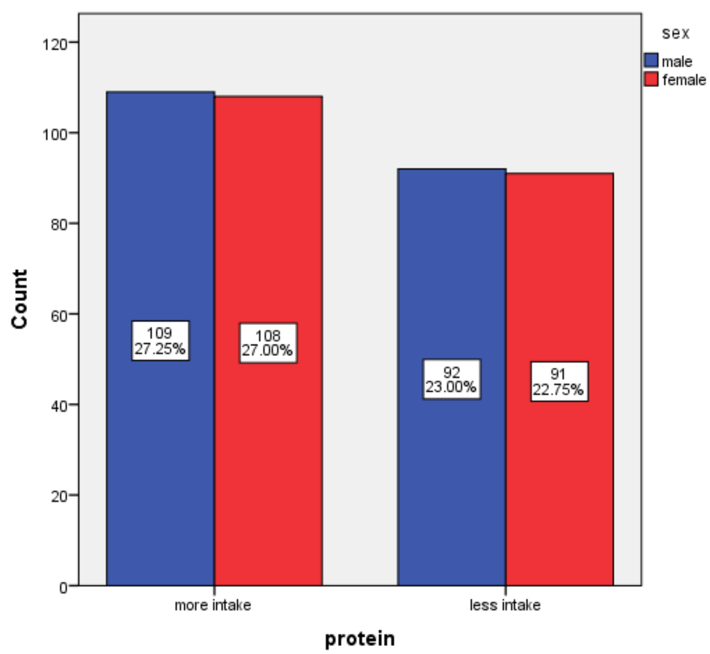

Figure 4.9.2: Distribution of study participants according to Food habit (Protein) by sex (n = 400)

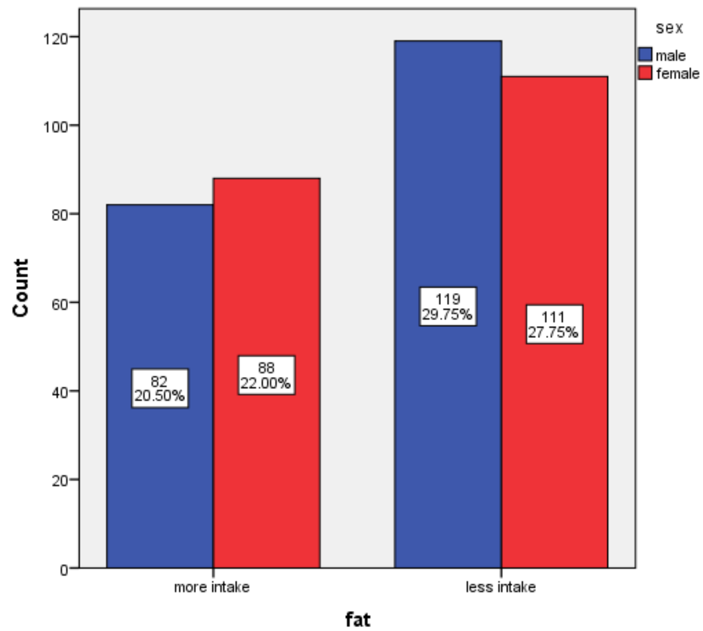

Figure 4.9.3: Distribution of study participants according to Food habit (Fat) by sex (n = 400)

4:10.0 Height, Weight and BMI (Body mass index)

The range, mean and SD of the height, weight, and BMI of the subjects are shown in Table 4.7.1. Range of height 127 to 188 cm, mean 162.48 and SD 7.752. Range of weight 46-96 kg, mean was 69.81 and SD 8.583. Range of BMI 18.17 to 48.36, mean 26.55, and SD 3.76. 37.50% 0f participants were having normal weight, 45.00% were overweight and 17.50% were obese (Table 4.10.1 and Figure 4.10.1 to 4.10.3). Table 4.10.2 shows that in this study, the male mean BMI was 25.62 kg/m2 and the female mean BMI was 27.59kg/m2. The female had a higher chance to develop type 2 diabetes mellitus due to being overweight ($p = 0.00$). It was done by the student T-test/ unpaired T-test.

Table 4.10.1: Distribution of study participants according to height-weight (n = 400)

Characteristics	**Range**	**Mean ± SD**
Height(cm)	127-188	162.48 ± 7.75
Weight(kg)	46-96	69.81 ± 8.58
BMI(kg/m^2)	18.17- 48.36	26.55 ± 3.76

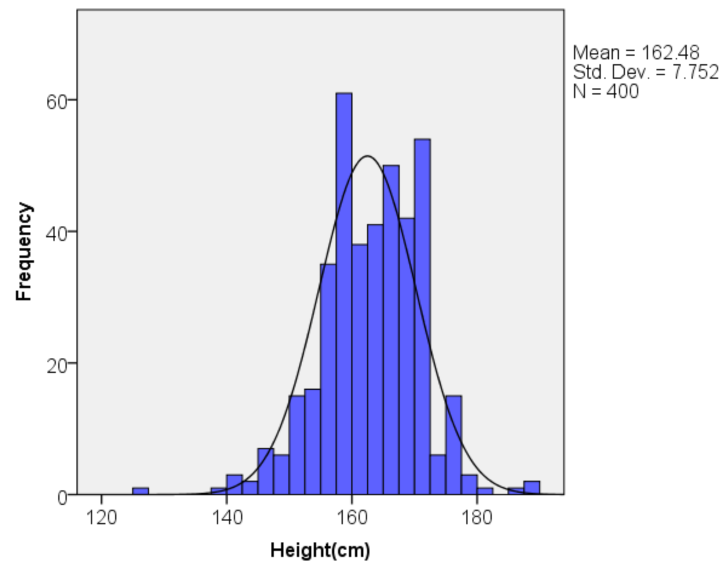

Figure 4.10.1: Distribution of study participants according to height (n = 400)

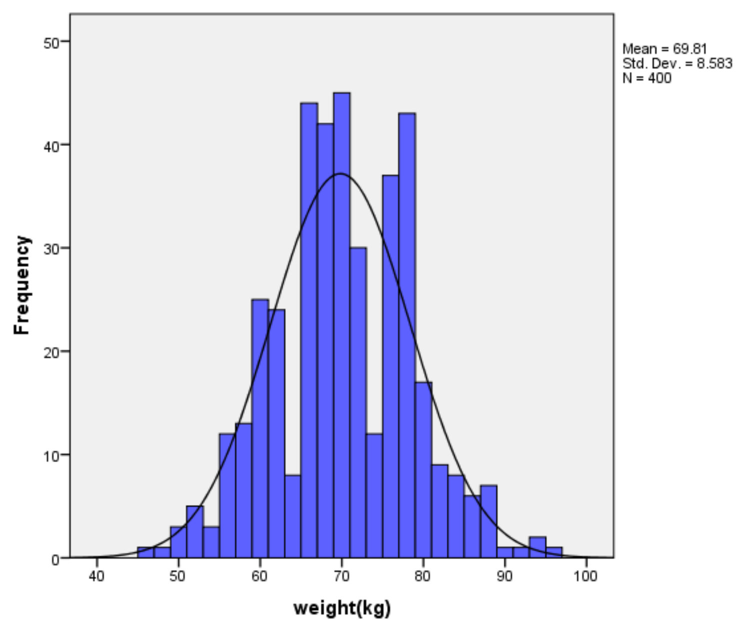

Figure 4.10.2: Distribution of study participants according to weight (n = 400)

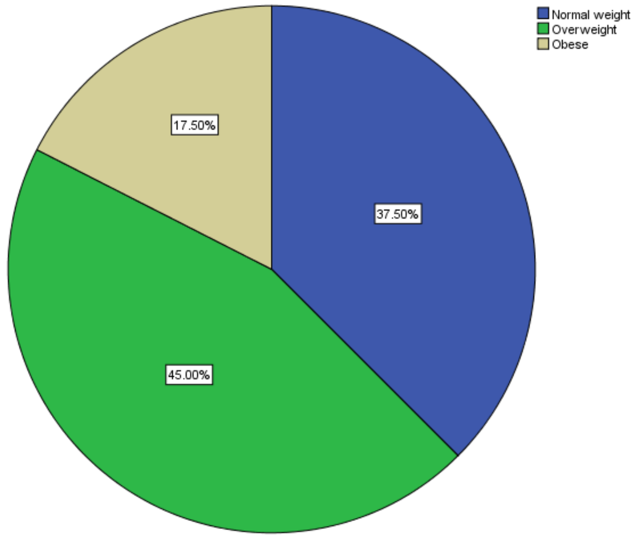

Figure 4.10.3: Distribution of study participants according to BMI group (n = 400)

Table 4.10.2: Distribution of study participants according to BMI (body mass index) by sex (n=400)

Sex	**Number**	**Mean**	**±SD**	**P value**
Male	199	25.62	±2.83	0.00*
Female	201	27.59	±4.21	

(n = 400) *p value=0.00, highly significant

4.11.0 Blood glucose level

The frequency and percentage of blood sugar are given in Table 4.11. Fasting blood sugar was controlled in 76 persons and it was 19%. 2hr postprandial blood sugar control in 56 and percentage was 14%.

Table 4.11: Distribution of study participants according to Blood Sugar Level (n = 400)

	Frequency	Percentage (%)
Fasting Blood Sugar		
Controlled	76	19
Uncontrolled	324	81
2hr Post prandial Blood Sugar		
Controlled	56	14
Uncontrolled	344	86

(n = 400)

4:12.0 Complications

Frequency and percentage of complications were given Table 4.12.1. Frequency of hypertension was 271 with 67.8%. Frequency of neuropathy was 284 with 71%. Retinopathy was 232 and 58%. Nephropathy was 95 and 23.8%. MI was 71 and 17.8%. Stroke was 32 and 8% and CKD was 28 and 7%.

Table 4.12.2 shows that ages 45-55years had more chances to develop hypertension. Retinopathy, nephropathy and MI and at the age 56 to 65 years more chances to develop CKD. Female had more chance to develop neuropathy than male. It is done by Chi-square test.

Table 4.12.1: Distribution of study participants according to Complications (n = 400)

Complications	Frequency	Percentage (%)
Hypertension		
Yes	271	67.8
No	129	32.3
Neuropathy		
Yes	284	71.0
No	116	29.0
Retinopathy		
Yes	232	58.0
No	168	42.0
Nephropathy		
Yes	95	23.8
No	305	76.3
MI		
Yes	71	17.8
No	329	82.3
Stroke		
Yes	32	8.0
No	368	92.0
CKD		
Yes	28	7.0
No	372	93.0

(n = 400)

Table 4.12.2: Distribution of study participants according to Complications by age and sex (n=400)

Characteristics n = 400	Complications						
	Hypertension	**Neuropathy**	**Retinopathy**	**Nephropathy**	**MI**	**Stroke**	**CKD**
Age							
45 -55years	157 57.9%	173 60.9%	133 57.3%	45 47.4%	39 54.9 %	17 53.1 %	10 35.7 %
56-65years	72 26.6%	72 25.4%	61 26.3%	32 33.7%	20 28.2 %	10 31.3 %	14 50.0 %
66-75years	34 12.5%	34 12.0%	32 13.8%	14 14.7%	9 12.7 %	4 12.5 %	2 7.1 %
≥76years	8 3.0%	5 1.8%	6 2.6%	4 4.2%	3 4.2%	1 3.1%	2 7.1 %
P value	0.01*	0.16	0.01*	0.00*	0.37	0.74	0.00*
Sex							
Male	142 52.4%	132 46.5%	118 50.9%	54 56.8%	41 57.7%	18 56.3 %	17 60.7%
Female	129 47.6%	152 53.5%	114 49.1%	41 43.2%	30 42.3%	14 43.8 %	11 39.3%
P value	0.12	0.04*	0.60	0.11	0.13	0.44	0.22

(n = 400) *p value=0.01 significant
*p value=0.04 significant
*p value=0.00 highly significant

4:13.0 Medication

The frequency and percentage of medication were given Table 4.13.1. Frequency of Oral drug 366 and percentage was 91.5 % frequency of Insulin was 163 and frequency was 40.8%. Among them 80 male takes insulin and 184 takes oral drug. 83 female takes insulin and 182 female takes oral drug. (Table 4.13.2).

Table 4.13.1: Distribution of study participants according to medication (n=400)

Medication	Frequency	Percentage (%)
Oral Drug		
Yes	366	91.5
No	34	8.5
Insulin		
Yes	163	40.8
No	237	59.3

(n = 400)

Table 4.13.2: Distribution of study participants according to Medication by sex (n=400)

Sex	Insulin		Oral Drug	
	Yes	No	Yes	No
Male	80	121	184	17
Female	83	116	182	17

(n = 400)

CHAPTER – 5

DISCUSSION

5:1.0 Age

The Prevalence of type 2 DM is higher in 45-88 years age range where mean age was 54.76 years which is similar with the result of Koopman et al., 2005 who found type 2 diabetes mellitus was diagnosed at an average age of 52.0 years. Using data from the National Health and Nutrition Examination Survey (NHANES) from 1999 to 2000, the average age of diagnosis of type 2 diabetes was reduced to 46.0 years. The age at diagnosis did not differ substantially according to race/ethnicity (P =.58 for whites vs. blacks or Hispanics) (Koopman et al., 2005). Participants of 55-59 years had a higher chance to develop type 2 DM compared to 35-39 years found by Chowdhury et al., 2015 which is not coincide with my study (Chowdhury et al., 2015).

5:2.0 Sex

In this study, male mean age was 55.9 years; female mean age was 53.63 years and females were significantly younger than male ($p < 0.010$) to develop type 2 DM. The female had a higher chance to develop type 2 diabetes mellitus in younger age than male which coincide with Meisinger et al., 2002 and Hussain et al., 2005.

Type 2 diabetes mellitus (T2DM) and its consequences are on the rise, and there is emerging evidence of clinically significant sex and gender disparities. T2DM is more commonly diagnosed in women when they are younger and have a lower BMI; nevertheless, the most significant risk factor, obesity, is more prevalent in women (Meisinger et al., 2002).

In both urban and rural settings, it has shown a higher prevalence of diabetes in females across all age groups. The majority of earlier research conducted in Bangladesh have found that women predominate (Sayeed et al.,1995 and Sayeed et al 1997). In a recent study in India, women had a non-significantly greater prevalence of Type 2 diabetes

(Ramchandaran et al 1999). In contrast to my findings, communities in Europe have a higher prevalence of Type 2 diabetes in males (Hussain et al., 2005).

According to Bhuyan and Fardus, 2019 male had higher chance to develop type 2 DM which is dissimilar with my study (Bhuyan and Fardus, 2019).

5:3.0 Occupation

In this study among male common in businessmen & among females common in housewives who developed type 2 diabetes mellitus. The current investigation found a link between growing T2DM prevalence and occupation. Other research in India has revealed similar results (Agardh et al., 2011). This link between diabetes and occupation could be due to a combination of employee inactivity, housewife stress, and work-related stress among people who work in agriculture (Bhalerao et al., 2014). According to Bhuyan and Fardus, 2019 farmers had higher chance to develop type 2 DM which is dissimilar with my study (Bhuyan and Fardus, 2019).

5:4.0 Educational Status, Duration of type 2 diabetes mellitus, Clinical symptoms of type 2 diabetes mellitus

From the available literature, no information about individual educational status, duration and clinical features of type 2 diabetes mellitus had been observed yet.

5:5.0 Physical activity

The frequency of physical activity was 101 and the percentage was 25.3. In Chi- square test male and female who had less physical activity (sedentary lifestyle), more chance to develop type 2 DM. Between male and female, females had more chances to develop type 2 DM due to less physical activity which is completely matched with Coakley et al., 1998.

Increased physical activity (such as walking, aerobic exercise, strength training, flexibility exercises, and so on) lowers the risk of diabetes, while sedentary behaviors (such as sitting, watching TV and less working, etc.) raise the risk (Coakley et al., 1998).

5:6.0 Family history

Chi- square test shows positive family history leads to type 2 DM and it is common in females.

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 and Mumu et al., 2014).

5:7.0 Food Habit

Frequency and percentage of carbohydrate 305 and 76.3% Frequency of protein 217 and percentage 54.3%. Frequency and percentage of fat 170 and 42.5%. In this study male and female who take more carbohydrate had more chance to develop type 2 diabetes mellitus and it is similar with Bi et al., 2012.

The Nurses' Health Study (NHS) found that diet quality is crucial in the development of diabetes, regardless of BMI or a number of other risk factors. Higher dietary glycemic load and trans-fat intake are linked to an increased risk of diabetes (Hu et al., 2001). According to the NHS, higher sugar-sweetened beverage consumption is associated with a greater magnitude of weight gain and an increased risk of type 2 diabetes development. (Bi et al., 2012)

5:8.0 Height, Weight and BMI (Body mass index)

In this study, Male mean BMI was 25.62 kg/m2 and the female mean BMI was 27.59kg/m2. The female had a higher chance to develop type 2 diabetes mellitus due to being overweight ($p = 0.00$) which is coincide with Wang et al., 2015.

Men were responsible for 28.3% (95 percent confidence interval [CI]: 20.1, 36.2) of incident T2DM, while women were responsible for 31.3 percent (95 percent CI: 25.5, 36.9). Obesity had a PAR of 10.1 percent (95 percent confidence interval: 6.0, 14.2) in males and 16.8 percent (95 percent confidence interval: 12.0, 21.6) in women. In 2010, overweight and obesity were responsible for approximately 3.32 million (95 percent CI: 2.47, 4.24) incident T2DM cases in Chinese people aged 35 to 74(Wang et al., 2015).

5:9.0 Blood Sugar

Fasting blood sugar was controlled in 76 persons, and it was 19%. 2hr post prandial blood sugar controlled in 56 and percentage was 14%.

In this investigation, there was also a link between increased FBS and age, family history, BMI, and high blood pressure. Lower age groups had the lowest prevalence of diabetes in this investigation. Given the high prevalence of diabetes in Iran's central areas, a comprehensive educational program to prevent the disease is critical, and screening FBS tests, particularly for obese subjects and those with a family history of diabetes, should be considered (Sadeghi et al., 2007)

5:10.0 Complications

Frequency of hypertension was 271 and the percentage was 67.8%. Frequency of neuropathy was 284 and the percentage was 71%. Retinopathy was 232 and 58%. Nephropathy was 95 and 23.8%. MI was 71 and 17.8%. Stroke was 32 and 8% and CKD was 28 and 7%.

45-55years age group had more chances to develop hypertension. Retinopathy, nephropathy and MI and at the age 56 to 65 years more chances to develop CKD. Females had more chances to develop neuropathy than male.

Retinopathy was found in 3621 participants (32.5 percent) in the current investigation. Our findings are in line with those of Ramchandran et al,.1999 who discovered retinopathy in 714 (or 23.7%) of 3010 type-2 diabetics at a diabetes facility in Chennai. In Perth, Western Australia, Knuiman et al., 1986 observed a prevalence of retinopathy of 28%. Retinopathy was shown to be prevalent in 34.1 percent of type-2 diabetic patients, according to Rema et al. Because this center provides retinal treatment, it could be due to referral bias. Multiple regression analysis revealed a favorable relationship between patient age, diabetes duration, blood pressure, fasting blood sugar, and HbA1C and diabetic retinopathy. (Agrawal et al., 2014)

Evidence of nephropathy was found in 3369 individuals (30.2 percent) in this study (containing both microalbuminuria and overt nephropathy).

In this study, Kleinet colleagues discovered that microalbuminuria was identified in 29.2 percent of insulin users and 22.0 percent of non-insulin users. Ramchandran et al.,1999 discovered a decreased prevalence of proteinuria (19.7%) in south Indian diabetes patients in their study. According to Gupta et al, 26 percent of people have microalbuminuria. Schonitz of Denmark reported a prevalence of 27.4%, but the WHO multicentric study of vascular disease in diabetics found a broad geographic variance in nephropathy prevalence. It ranged from 2.4 percent in Hong Kong to 23% in Delhi to 37% in Mumbai (Oklahoma, USA). (Agrawal et al., 2014)

Diabetic neuropathy is one of the most common long-term consequences of diabetes. Neuropathy was found in 2991 (26.8%) of the patients in this study. Ramchandran et al., 1999 found a 27.5 percent prevalence of neuropathy in southern India, while Shobhana et al,.2000 identified a 70 percent incidence of neuropathy. Knuiman et al.,1986 (West Australia) discovered a much lower prevalence of neuropathy, 14 percent, which could be related to true ethnic difference and variable genetic predisposition to develop neuropathy in the presence of hyperglycemia. (Agrawal et al., 2014)

5:11.0 Medication

The frequency of Oral drugs was 366 and the percentage was 91.5 %, the frequency of Insulin was 163 and the frequency was 40.8%. Among them 80 males take insulin and 184 take oral drugs. 83 females take insulin and 182 females take oral drugs.

In the somatic and environmental areas, patients treated with oral hypoglycemic drugs scored higher than those treated with insulin, while in the psychological domain, patients treated with insulin scored higher. When compared to patients on oral hypoglycemic medicines, insulin-treated patients appear to have a higher quality of life and are less sensitive to most disease-related factors (comorbidity, obesity etc.). Regular checks, regardless of treatment strategy, are a crucial positive feature for diabetic patients (Fal et al., 2010).

CHAPTER-6

CONCLUSION

6.1.0 Conclusion

The present study was designed to identify modifiable and non-modifiable risk factors of type 2 diabetes mellitus among the patients of Chattogram Diabetic General Hospital.

The female had a higher chance to develop type 2 diabetes mellitus at a younger age than males. Type 2 diabetes mellitus was common in businessmen among males and in housewives in females. Regarding clinical features of type 2 DM- polyuria, polydipsia, polyphagia, weight loss, and weakness were more common in females; weight gain and delayed wound healing were more common in males. Being overweight, less physical activity, and positive family history lead to type 2 DM, which was common in females. More carbohydrate intake was also identified as a risk factor to develop type 2 diabetes mellitus.

Participants who were 45-55 years of age had more chance to develop hypertension. Retinopathy, nephropathy, and MI; and who were 56 to 65 years of age had more chance to develop CKD. Females were more prone to develop neuropathy.

Fasting blood sugar and 2hr postprandial blood sugar was uncontrolled in most of the participants.

CHAPTER-7

RECOMMENDATIONS AND FUTURE PERSPECTIVES

7:1.0 Recommendations

This study will help to identify modifiable and non-modifiable risk factors of type 2 diabetes mellitus. Modifiable risk factors like obesity, less physical activity, high carbohydrate intake. By changing it (weight reduction, changing lifestyle, doing physical activity, taking protein and fibers instead of more carbohydrate), educating people and by creating awareness type 2 diabetes mellitus can be prevented.

Non-modifiable risk factors like positive family history cannot be changed. But early diagnosis and properly controlled type 2 diabetes mellitus by maintaining healthy lifestyle and regular medical check-ups can prevent early complications, which causes many sufferings and may cause death.

7:2.0 Limitations

In the present study, several limitations could be identified. Such limitations should be taken into consideration when the results are analyzed. The major limitations may be summarized as follows:

- Participants were selected through a convenience sampling technique. Moreover, the sample size was also relatively small. So, the results obtained from the present study may not be fully representative of the normative values.
- Due to time and resource limitation the study was conducted on a small scale.
- In future, the study can be conducted involving a higher sample size.

7:3.0 Suggestions for further studies:

On the basis of the understanding of the present research problems, and considering the experience gained from it, the following suggestions regarding the further studies can be made:

- Larger sample should be used for developing standard normative values of the study.
- The research may be expanded by including participants selected from different parts of Bangladesh for making the study fully representative of the normative values for the whole population.
- There are further scope for studying risk factors that have not been covered in this study.
- Study may be done to detect association between age, blood sugar and complication of type 2 DM.
- Association between genetic factors related to development of DM can be studied.

REFERENCES

Agardh E, Allebeck P, Hallqvist J, Moradi T and Sidorchuk A. 2011. Type 2 diabetes incidence and socio-economic position: a systematic review and meta-analysis. International Journal of Epidemiology. 40(3): 804-18.

Agrawal RP, Ola V, Bishnoi P, Gothwal S, Sirohi P, Agrawal R. J. 2014. Prevalence of Micro and Macrovascular Complications and their Risk Factors in Type-2 Diabetes Mellitus. Journal of the association of physicians of india. 62: 44-48.

Ahasan HAMN, Islam MZ, Alam MB, Miah MT, Nur Z, Mohammed FR, Khan MAI, Hossain HT, Mahbub MS. 2011. Prevalence and Risk Factors of Type 2 Diabetes Mellitus Among Secretariat Employees of Bangladesh. J Medicine. 12: 125-130.

Aljoudi AS, Taha AZA. 2009. Knowledge of diabetes risk factors and preventive measures among attendees of a primary care center in eastern Saudi Arabia. Annual Saudi Medicine. 29(1): 15–19.

American Diabetes Association Professional Practice Committee, 2022. Glycemic Targets: Standards of Medical Care in Diabetes—2022. Diabetes Care. 45(1): 591.

American Diabetes Association. 2004. Diagnosis and Classification of Diabetes Mellitus. Diabetes Care. 27 (1): 5-10.

American Diabetes Association. 2016. Diagnosis and Classification of Diabetes Mellitus. Diabetes Care. 39(1):1-46.

Bhalerao DS, Somannavar M, Vernekar SS, Ravishankar R. and Goudar SS. 2014. Risk factors for type 2 diabetes mellitus in rural population of north karnataka: a community-based cross-sectional study. International Journal of Pharma Medicine & Biological Science. 3(1): 1-14.

Bhuyan KC, Fardus J. 2019. Factors Responsible for Diabetes Among Adult People of Bangladesh. American Journal of Biomedical Science & Research. 2(4): 147-142.

Bi Y, Wang T, Xu M, Xu Y, Li M, Lu J, Zhu X, Ning G. 2012. Advanced research on risk factors of type 2 diabetes. Diabetes Metabolism Research and Reviews. 28(2): 32–39.

Center for Disease Control and Prevention. 2007. National Health and Nutrition Examination Survey, 1650 Research Boulevard, Rockville.

Centers for Disease Control and Prevention 2021, Defining Adult Overweight & Obesity, Adult Body Mass Index, Viewed 9 April 2022.

Chattogram Veterinary and Animal Sciences University, Viewed 9 April 2022. Https://Www.Google.Com/Maps/Place/22%C2%B021'40.5%22n+91%C2%B048'08.7%22e/@22.3631478,91.799899,16.35z/Data=!4m6!3m5!1s0x0:0xcb2f116a5d84242b!4b1!8m2!3d22.3612559!4d91.8024069?Hl=En-Us.

Chowdhury MAB, Uddin MJ, Khan HMR, Hoque MR. 2015. Type 2 diabetes and its correlates among adults in Bangladesh: a population based. BMC Public Health. 15(1070): 1-11.

Coakley EH, Rimm EB, Colditz G, Kawachi I, Willett W. 1998. Predictors of weight change in men. International Journal of Obesity Related Metabolic Disorder 22(2): 89–96.

Dendup T, Feng X, Clingan S, Astell-Burt T. 2018. Environmental Risk Factors for Developing Type 2 Diabetes Mellitus: A Systematic Review. International Journal of Environmental Research and Public Health. 15 (78): 1-25.

Fal AM, Jankowska B, Uchmanowicz I, Sen M, Panaszek B, Polanski J. 2011. Type 2 diabetes quality of life patients treated with insulin and oral hypoglycemic medication. Acta Diabetol. 48: 237-242.

Fletcher B, Gulanick M, Lamendola C. 2002. Risk factors for type 2 diabetes mellitus. The Journal of Cardiovascular Nursing. 7(19): 17- 23.

Gupta DK, Verma LK, Khosla PK, Dash SC. 1991. The prevalence of microalbuminuria in diabetes: a study from North India. Diabetes Research and Clinical Practice 12: 125-128.

Harrigan N. 2007. Risk Factors for Type 2 Diabetes. US Pharmacist. 32(10):61-63. [Cited 2022 April 10]; Available from: Risk Factors for Type 2 Diabetes (uspharmacist.com) https://www.uspharmacist.com/article/risk-factors-for-type-2 diabetes.

Hossain S, Begum JA, Akhter Z. 2011. Measurement of Stature from Arm-span Anthropometric Study on Garo Tribal Bangladeshi Females. BJA. 9(1): 5-9.

Hossain SM, Gulshan J, Khanam PA. 2015. International Journal of Diabetes in Developing Countries. 36: 174- 178.

Hu D, Sun L, Fu P, Xie J, Lu J, Zhou J, Yu D, Whelton PK, He j, Gu D. 2009. Prevalence and risk factors for type 2 diabetes mellitus in the Chinese adult population: The Inter ASIA Study. Diabetes Research and Clinical Practice. 84 (3): 288-295.

Hu FB, Manson JE, Stampfer MJ, Colditz G, Liu S, Solomon CG, Willett CW. 2001. Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. The New England Journal of Medicine. 345(11): 790–7.

Hussain A, Claussen B, Ramachandran A, Williams R. 2007. Prevention of type 2 diabetes: A review. Diabetes Research and Clinical Practice. 76(3): 317-326.

Hussain A, Rahim MA, Khan AKA, Ali SMK, Valler S. 2005. Type 2 diabetes in rural and urban population: diverse prevalence and associated risk factors in Bangladesh. Diabetic Medicine. 22(7): 931-936.

Kamal R, Yadav P.K. 2016. Estimation of stature from different anthropometric measurements in Kori population of North India. Egypt J Forensic Sci. 6 (4): 468-477.

Karar ZA, Alam N, Streatfield PK. 2009. Epidemiological transition in rural Bangladesh, 1986–2006. Global Health Action. 2.

Klein R, Klein BK, Moss SE. 1996. Prevalence of microalbuminuria in older-onset diabetes. Diabetes Care (American Diabetes Association).16: 1325-1330.

Knuiman MW, Welborn TA, McCann VJ, Stanton KG, Constable IJ. 1986 Prevalence of diabetic complications in relation to risk factors. Diabetes (American Diabetes Association) 35: 1332-39.

Koopman RJ, Mainous AG, Diaz VA, Geesey ME. 2005. Changes in Age at Diagnosis of Type 2 Diabetes Mellitus in the United States, 1988 to 2000. Annals of Family Medicine. 3 (1): 60-63.

Lim SS, Vos T, Flaxman AD, Danaei G, Shibuya K, Adair-Rohani H. 2013. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. The lancet. 380(9859): 2224-2260.

Meisinger C, Thorand B, Schneider A, Stieber J, Doring A, Lowel H. 2002. Sex Difference in Risk Factors for Incident Type 2 Diabetes Mellitus. American Medical Association. 162: 82-89.

Miah MBA, Yousuf MA. 2018. Analysis the significant risk factors on type 2 diabetes perspective of Bangladesh. Diabetes & Metabolic Syndrome Clinical Research & Reviews. 1-6.

Mohiuddin AK. 2019. Diabetes Fact: Bangladesh Perspective. International Journal of Diabetes Research. 2(1): 14-20.

Mumu SJ, Saleh F, Ara F, Haque MR, Ali L. 2014. Awareness regarding risk factors of type 2 diabetes among individuals attending a tertiary-care hospital in Bangladesh: A Cross-Sectional Study. BMC Research Notes. 7(599): 1-9.

Ogurtsova K, Fernandes JDDR, Huang Y, Linnenkamp U, Guariguata L, Cho NH, Cavan D, Shaw JE, Makaroff LE. 2017. IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. Diabetes Research and Clinical Practice. 128: 40-50.

Rahman MM, Rahim MA, Nahar Q. 2007. Prevalence and risk factors of Type 2 diabetes in an urbanizing rural community of Bangladesh. Bangladesh Medical Research Council Bulletin. 33: 48-54.

Rahman MN, Alam SS, Zobayed A, Hasan MM, Nisha S, Hossian M, Hasan MM, Islam K. 2020. Prevalence of Diabetes Mellitus and Associated Risk Factors among Adult Individuals in Selected Areas of Bangladesh. American Journal of Public Health Research. 8(6): 209-213.

Ramachandran A, Snehalatha C, Latha EM, Manoharam Vijay V. 1999. Impacts of urbanization on lifestyle and on the prevalence of diabetes in native Asian Indian population. Diabetes Research Clinical Practice. 44: 207–213.

Ramachandran A, Snehalatha C, Satyavani K, Latha E, Sasikala R, Vijay V. 1999. Prevalence of vascular complications and their risk factors in type-2 diabetes. The Journal of the Association of Physicians of India. 47: 1152-1156.

Rani PK, Raman R, Subramani S, Perumal G, Kumaramanickavel G, Sharma T. 2008. Knowledge of diabetes and diabetic retinopathy among rural populations in India, and the influence of knowledge of diabetic retinopathy on attitude and practice. Rural Remote Health. 8: 838.

Rema M, Ponnaiya M, Mohan V. 1996. Prevalence of retinopathy in non-insulin dependent diabetes mellitus at a diabetes center in Southern India. Diabetes Research Clinical Practice. 34: 29-36.

Roberts KB, Gary TL, Beckles GLA, Gregg EW, Owens M, Porierfield D, Engelgam MM. 2007. Family history of diabetes, awareness of risk factors, and health behaviors among African Americans. American Journal of Public Health. 97(5): 907.

Sadeghi M, Roohafza H, Shirani S, Poormoghadas M, Kelishadi R, Baghaii A, Sarraf-Zadegan N. 2007. Diabetes and Associated Cardiovascular Risk Factors in Iran: The Isfahan Healthy Heart Programme. Annals of Family Medicine. 36(3): 175-180.

Sal-sabil T, Islam A, Islam SMS. 2016. Risk Factors for Type 2 Diabetes in Bangladesh: A Systematic Review. Journal of Diabetology, 2(5): 1-12.

Sayeed MA, Hossain MZ, Banu A, Rumi MAK, Khan AK. 1997. Prevalence of diabetes in a suburban population of Bangladesh. Diabetes Research Clinical Practice. 34: 149–155.

Sayeed MA, Khan AR, Banu A, Hussain MZ. 1995. Prevalence of diabetes and hypertension in a rural population of Bangladesh. Diabetes Care. 18: 555–558.

Shobhana R, Ramarao P, Lavanya A, Vijay VV, Ramchandran A. 2000. Cost burden to diabetic patients with foot complications – A study from Southern India. JAPI 48(12): 1147-1150.

Talukder A, Hossain MZ. 2020. Prevalence of Diabetes Mellitus and Its Associated Factors in Bangladesh: Application of Two-level Logistic Regression Model. Scientific Reports. 10:1-7.

Wang C, Li J, Xue H, Li Y, Huang J, Mai J, Chen J, Chao J, Wu X, Guo D, Yu L, Gu D. March 2015. Type 2 diabetes mellitus incidence in Chinese: Contributions of overweight and obesity. Diabetes Research and Clinical Practice. 107(3): 424-43.

Wild S, Roglic G, Green A, Sicree R, King H. 2004. Global Prevalence of Diabetes: Estimates for the year 2000 and projections for 2030. Diabetes Care. 27 (5): 1047–1053.

Zahid N, Shi Z, Claussen B, Hussain A. 2009. Prevalence and risk factors for diabetes, comparison of rural populations in Bangladesh, China, and Pakistan. Diabetes & Metabolic Syndrome: Clinical Research & Reviews**.** 3(2): 109-112.

Zheng Y, Ley SH, Hu FB. 2018. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. Nature Reviews Endocrinology. 14(2): 88-98.