KNOWLEDGE, ATTITUDE AND PRACTICE REGARDING DIABETES AMONG TYPE 2 DIABETIC PATIENTS IN BARAHAKSHETRA MUNICIPALITY, SUNSARI

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Knowledge, Attitude and Practice Regarding Diabetes Among Type 2 Diabetic Patients in Barahakshetra Municipality, Sunsari

A dissertation submitted to the Department of Nutrition and dietetics, Central Campus of Technology, Tribhuvan University, in partial fulfillment of the requirements for the degree of B.Sc. Nutrition and Dietetics

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Approval Letter

This ***dissertation*** entitled **Knowledge, Attitude and Practice regarding Diabetes Among Type 2 Diabetic Patients in Barahakshetra Municipality, Sunsari** presented by **Asmita Tamang** has been accepted as the partial fulfillment of the requirement for the **B.Sc. Nutrition and Dietetics**

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Abstract

A hospital based cross-sectional study was carried out to assess the knowledge, attitude and practice regarding diabetes among type 2 diabetic patients(T2DM) in Barahakshetra Municipality, Sunsari. A total of 150 T2DM patients aged 20-79years were selected by convenience sampling method visiting the OPD of Barahakshetra Nagar hospital during the period of one month from 19th February to 18th March. A face-to-face interview was carried out using structured questionnaire which included socio-demographic, behavioral characteristics and validated knowledge, attitude and practice (KAP) questions. Anthropometric measurement was taken to obtain overweight and obesity status. The collected data were analyzed using chi-square test and correlation analysis.

The study showed that majority of participants were female 78 (52%) while male were 72 (48%). Most participants were in the age group 46-55 year 46 (30.7%). Majority were housewife 60 (40.0%) and majority had overweight and obesity 110 (73.3%). 64.7% respondents had normal blood glucose level. 17.3% respondents consumed alcohol and 10% had smoking habit. The study revealed that 76% of the participants had good knowledge, 24% had poor knowledge regarding diabetes. 75.3% of the participants had good attitude and remaining others 24.7% had poor attitude towards lifestyle modification. 74.7% of the participants had good practice, 25.3% had poor practice for management of diabetes. Smoker patients had significantly higher fasting blood glucose levels. Positive correlation was found between KAP. Significant association was found between level of knowledge and sociodemographic variables such as age, gender, ethnicity, education, occupation, history of diabetes. Similarly, monthly income and fasting blood glucose levels of the participants were significantly associated with attitude level. Only fasting blood glucose levels was found statistically associated with practices related to management of diabetes. This finding highlights the need for the targeted educational interventions to improve awareness, attitude and practice among type 2 diabetic patients for better health outcomes and quality of life.

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List of Abbreviations

Abbreviations	Full form
ADA	American Diabetes Association
BMI	Body Mass Index
CI	Confidence interval
CKD	Chronic kidney disease
CVD	Cardiovascular disease
DASH	Dietary Approach to Stop Hypertension
DCM	Diabetic Cardiomyopathy
DKA	Diabetic Ketoacidosis
DM	Diabetes mellitus
DR	Diabetic retinopathy
ESRD	End-stage of renal disease
FBGL	Fasting blood glucose level
FPG	Fasting Plasma Glucose
GFR	Glomerular Filtration Rate
GIT	Gastro intestinal tract
GL	Glycemic load
HDL	High Density Lipoprotein
HHS	Hyperosmolar hyperglycemic state
HTN	Hypertension
IDDM	Insulin dependent diabetes mellitus
IDF	International Diabetes Federation
KAP	Knowledge, attitude and practice
NCDs	Non-Communicable Diseases
NDA	Nepal Diabetes Association
NGSP	National glycohemoglobin standardization program
NHS	Nurse Health Study
NICE	National Institute for Health and Care Excellence
NIDDM	Noninsulin dependent diabetes mellitus
OGTT	Oral Glucose Tolerance Test
OPD	Outpatient Department

T1DM	Type 1 diabetes mellitus
T2DM	Type 2 diabetes mellitus
VIGF	Vascular endothelial growth factor
WHO	World Health Organization

Part I

Introduction

1.1 General Introduction

Diabetes Mellitus (DM) is a group metabolic disorders characterized by hyperglycemia. It is associated with abnormalities in carbohydrate, fat and protein metabolism, which results in chronic complications including microvascular, macrovascular, neuropathic disorders (Ismaeil and Ali, 2013). DM is due to either the pancreas unable to produce insulin or the body cell which cannot respond to insulin (Alberti and Zimmet, 1998). Persistent hyperglycemia over the years damages various vital organs, including eyes, heart, kidneys, blood vessels and nerves (Peter, 2020).

Diabetes mellitus has been classified into two types i.e. insulin dependent diabetes mellitus (IDDM) and noninsulin diabetes mellitus (NIDDM). Type 1 is an auto-immune disease characterized by a local inflammatory reaction in and around the islets that is followed by selective destruction of insulin secreting beta cells whereas Type 2 diabetes mellitus is characterized by inadequate insulin secretion or improper insulin utilization (Arora *et al.*, 2009). A large proportion of diabetes cases worldwide are classified as T2DM which can be influenced by modifiable risk factors like poor diet, being obese or overweight, physical inactivity and smoking. These factors can be modified through lifestyle changes (Bollu *et al.*, 2015).

The management of DM is largely depend on patients ability to do self-care in their daily lives and therefore, patients education is always considered an essential element of DM management. Studies have consistently shown that improved glycemic control reduces the rate of complications and evidence suggests that patients, who were knowledgeable about DM self-care, have better long-term glycemic control. Thus, it is indispensable to ensure that patients knowledge, attitude and practice are adequate (Al-Maskari *et al.*, 2013). A series of cost-effective interventions can improve health outcomes (IDF, 2016). This involves use of appropriate diet, engaging in physical activity, health education and use of medication and knowledge provision (Kurnia *et al.*, 2017).

The greatest weapon in the fight against diabetes mellitus is knowledge. Information can help people to assess their risk of diabetes, motivate them to seek proper treatment and care, and inspire them to take charge for their disease for their lifetime (Moodley and Rambiritch, 2007). Since diabetes is a silent disease, many people are unaware until they develop one of its complications. Hence, it is crucial to have knowledge of diabetes mellitus at an early stage of life, facilitated by early detection. Obtaining information about the level of awareness about diabetes in a population can be the initial step in formulating a prevention program for diabetes (SK *et al.*, 2018). KAP related to diabetes could be helpful for early detection, prevention and minimize the consequences. KAP related studies reveals that the very poor or low level of knowledge, attitude and practice among diabetic patients (Gautam *et al.*, 2015).

1.2 Statement of the Problem statement and justification

The rising burden of T2DM is a major public health issue in worldwide with considerable impact on human life and health expenditures (Onyango and Onyango, 2018). The global prevalence of T2DM is driven by an increasing number of aging individuals, enhanced economic development and urbanization which results in sedentary lifestyle and consumption of unhealthy diet (Basu *et al.*, 2013). These trends have been attributed to increased consumption of unhealthy diets and sedentary lifestyles, which result in elevated BMI and fasting plasma glucose levels (Lone *et al.*, 2017). In particular, individuals with higher BMI, are more likely to have type 2 diabetes (Mahanta *et al.*, 2013).

Nepal is a low-income country in South Asia. While communicable diseases remain an important public health issue in Nepal, there is also a rapidly rising burden of non-communicable diseases (NCDs) including type 2 diabetes., posing an additional burden on a resource-poor health systems (Gyawali *et al.*, 2015). However, there is a limited knowledge of T2DM and its risk factors among population. Therefore, the high incidence (the new cases) of NIDDM was found in Nepal due to lack of public awareness regarding problem and poor medical services (Karki *et al.*, 2000). The prevalence of diabetes and its complications are rapidly increasing in Nepal, limited health care facilities high costs associated with treatment inadequate awareness about diabetes in patients and lack of specific guidelines for diabetes management for the prevention and treatment of diabetes and all pose challenges to effective

diabetes management. In Nepal, diabetes is among the top ten causes of years lived with disability (YLDs) and death in 2017. There is 2.8% life loss in total due to non-communicable diseases contributed to DM in Nepal 2009 (Baral *et al.*, 2022). Our resent examination identified several factors in Nepal that contribute to the risk T2DM both modifiable and non-modifiable. These include factors like elevated socio-economic status, increased BMI, insufficient physical activity hypertension and the use of alcohol and tobacco (Gyawali *et al.*, 2016).

Positive knowledge, Attitude and practice are important for DM patients, elements of knowledge, attitude and practice are interrelated and dependent on each other. If one element is higher, the other two factors should be affected positively. KAP regarding diabetes very greatly depending on socio economic conditions, cultural beliefs, education, religion and personal habits. Understanding of these variables is important for in designing prevention and management strategies for diabetes (Fatema *et al.*, 2017). Similarly, a significant change in the level of knowledge and attitude among diabetic patients may lead to change in behavior and thus effectively improved patients glycemic control (Ahmed *et al.*, 2015). Low level of knowledge however, may lead to poor diabetes management and eventually poor glycemic control (Assunção *et al.*, 2017). Helping patients improve their knowledge of diabetes may have a greater impact on treatment compliance thus reduce the occurrence rate of complications related with the disease (El-Khawaga and Abdel-Wahab, 2015).

There have been limited hospital-based studies was conducted on the knowledge of diabetes among diabetic patients in Nepal. Such types of studies in Nepal are significant for the use of control and prevention of consequences strategies in resource. The primary aim of the study is to identify significant knowledge gaps that need to be addressed, thereby providing valuable data for the development of targeted prevention and education programs. Understanding patients characteristics in terms of their knowledge, attitude and practice towards diabetes significantly enhance the effectiveness of educational interventions, ultimately leading to better disease management and improved health outcomes for diabetic patients. Therefore, the study was conducted to evaluate Knowledge, Attitude and Practice regarding diabetes of type 2 diabetic patients.

1.3 Objective of the study

1.3.1 General objective

The general objective of the study was to assess knowledge, attitude, practices regarding diabetes among type 2 diabetic patients in Barahakshetra municipality, Sunsari.

1.3.2 Specific objectives

a) To assess the knowledge, attitude and practice regarding diabetes among type 2 diabetic patients.
b) To assess the correlation between knowledge, attitude and practice.
c) To assess behavioral factors and its association with FBG.
d) To assess the association of knowledge, attitude and practice with socio-demographic characteristics of the patients.
e) To assess the association between knowledge, attitude and practice with BMI and FBG.

1.4 Research questions

a) What is the level of knowledge and attitude of type 2 diabetic patients regarding Diabetes?
b) What is the practice status of diabetic patients about the care of type 2 diabetes?
c) How do socio-demographic factors influence knowledge, attitude and practice regarding diabetes among type 2 diabetic patients?
d) What association exists between behavioral factors and FBG?
e) What association exists between knowledge, attitude and practice with BMI and FBG?

1.5 Significance of the study

This study was conducted to gather the information on demographic and socio-economic features of type 2 diabetic patients and on current status of their knowledge, attitude and practices related to the condition. The findings of the study will have following implications:

i. Useful in informing the health sector and the public health planners in the mobilization and allocation of resources for the control and prevention of type 2 diabetes.

ii. Helpful in creating awareness about diabetes and identifying its primary contributing factors.
iii. It will provide type 2 diabetes improved insights and guidance for effectively managing their conditions of Barahakshetra Municipality.
iv. Helpful in developing strategies to improve outcomes of patients.
v. It can contribute as reference in the future for evaluating quality of type 2 diabetic care for community people and provide insight related to type 2 diabetic patients health action at local and district level.

1.6 Limitations of the study

i. The study enrolled the patients only from one hospital in one municipality and hence cannot be generalized to the type 2 diabetic population of Nepal.

Part II

Literature review

2.1 Background of the study

Diabetes was first documented by the Egyptians and is characterized by weight loss, and polyuria. However, it was the Greek physicians Aertaeus who coined the term diabetes mellitus. In Greek diabetes means to pass through and mellitus is the Latin word for honey (referring to sweetness). Diabetes is an important cause of ill health and pre mature mortality (Kaul *et al.*, 2013). Dietary habits and sedentary lifestyles are the major factors for rapidly raising incidence of DM in developing countries (Sami *et al.*, 2017). In adults the prevalence of diabetes globally has risen from 4.7% in 1980 to 8.5% in 2014. Type 2 DM is becoming increasingly prevalent in children and adolescents as a result of the global obesity epidemic (Dunning, 2013). Type 2 DM has become a global epidemic with significant disability, premature death, and enormous medical costs (Herath *et al.*, 2017).

In 2021, IDF estimates that 537 million adults had diabetes worldwide and this number is projected to reach 643 million by 2030 and 783 million by 2045. It is also estimates that over 6.7 million people aged between 20-79 years will die from diabetes-related causes in 2021(Magliano and Boyko, 2022). According to WHO, number of people with diabetes has increased by about four times from 108 million in 1980 to 422 million in 2014. In the year 2014, diabetes caused 4.9 million deaths and has been most important cause of kidney diseases, eye complications, cerebrovascular accident, cardiac failure and amputation. About 422 million people worldwide have diabetes, the majority living in low- and middle-income countries and 1.5 million deaths are directly attributed to diabetes each year. Both the number of cases and the prevalence of diabetes have been steadily increasing over the past few decades. In south-east Asia, an estimated 90 million people (20-79yrs) were affected by DM. This number is expected to reach 133 million by 2030 and 151 million by 2045 (Sun *et al.*, 2022).

Currently, South Asia is experiencing an increasing burden of type 2 diabetes and its complications (Ambady Ramachandran and Chamukuttan Snehalatha, 2010). Possible reasons for the steady increase in the prevalence of DM in Asian countries may include poor lifestyle,

rapid westernization, lack of knowledge, and unsatisfactory attitude and practices towards DM among general population and diabetic patients. Moreover, there also exists an apparent gap between knowledge and attitude towards diabetes among diabetic patients (Upadhyay *et al.*, 2008). In developing countries majority of diabetes patients fall within the range of 45-64 years, while in developed countries, they are aged 65 years or older (Ramachandran, 2007). According to NDA, approximately 15% of people more than 20-years old and then 19% of people more than 40-years of age are affected with diabetes in Urban areas. As per the WHO estimation, more than 436,000 people are affected with diabetes in Nepal and the number is expected to increase to 1,328,000 by 2030. The prevalence of type 2 DM and pre-diabetes in Nepal was estimated to be 10% and 19 % respectively (Shrestha *et al.*, 2021).

Lifestyle modifications are considered the corner stone of DM and include the prescription of healthy diet, regular exercise and avoidance of tobacco (Adem *et al.*, 2014). Unhealthy lifestyle, rapid westernization, poor knowledge, negative attitude and poor practices towards DM contributes to the rising prevalence of DM in developing countries. There is a large gap between the knowledge, attitude and practices towards diabetes among patients with diabetes. Diabetes knowledge is vital in developing diabetes related healthful attitudes which enhance the self-care skills of patients (Shrestha *et al.*, 2015). Understanding diabetes, having a positive attitude and following good practices are crucial in reducing the risks and complications associated with the disease (Hossain *et al.*, 2007). Moreover, complications of diabetes also increase among obese diabetic patients. However, changes in lifestyle that lead to weight loss reduce the incidence of diabetes and onset of its complications. since socio-economic and cultural perspectives are strong determinants of KAP (Khan *et al.*, 2019), these studies need to be conducted in specific communities. Very few studies have been performed on these issues particularly in Nepal. The aim of the study is to assess the knowledge, attitude and practices of patients having T2DM.

2.2 Diabetes Mellitus

Diabetes is defined by American Diabetes Association as “a group of disorders characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic

hyperglycemia is associated with long-term damage, dysfunction, and failure of different organs, especially the eyes, the kidneys, nerves, heart and blood vessels'' (ADA, 2015).

Diabetes is a metabolic disorder in which the body's capacity to utilize glucose, fat and protein is disturbed due to insulin deficiency or insulin resistance. Both states lead to hyperglycemia and glycosuria. The body is unable to utilize glucose in absence of insulin and draws on fats and proteins in an effort to supply fuel for energy. Insulin is necessary for the complete metabolism of fats, however, and when carbohydrate metabolism is disordered fat metabolism is incomplete and intermediate products (ketone bodies) can accumulate in the blood leading to ketosis, especially in type 1 diabetes. Protein breakdown also occurs and leads to weight loss and weakness and contributes to the development of hyperglycemia and lethargy (Dunning, 2013). Hyperglycemia, if left untreated or unchecked over the long term, can cause damage to various body organs and leading to development of disabling and life-threatening complications such as cardiovascular disease, neuropathy, nephropathy and eye disease leading, to retinopathy and blindness (IDF, 2017).

2.3 Symptoms of Diabetes

The classic symptoms of T2DM are polyuria, polydipsia, and polyphagia. Other common symptoms are blurred vision due to osmotic changes in the fluid levels in the eyes (Casey, 2011), weight loss, fatigue due to metabolic changes, irritability, numbness in the feet and hands (Lawal, 2008). Patients with diabetes may note more frequent urinary tract or genitourinary infections and/or delayed healing of skin infections or ulcers. With insulin deficiency, patients become catabolic and experience weight loss. Some patients report feeling agitated or confused, although this is not common (Wang and Zaman, 2019).

According to Li *et al.* (2013) T2DM has a high symptom burden; however, Brown and Heeley-Creed (2013) report that many patients with T2DM are often asymptomatic and some are living with the disease for up to12 years before being diagnosed.

2.4 Diagnostic criteria for diabetes

Diabetes may be diagnosed based on plasma glucose criteria either the fasting plasma glucose (FPG) or the 2-h plasma glucose value during a 75-g oral glucose tolerance test (OGTT) or A1c criteria. The same test may be used to screen for and diagnose diabetes and to detect individuals with prediabetes. Diabetes may be identified anywhere along the spectrum of clinical scenarios: in seemingly low-risk individuals who happen to have glucose testing, in individual tested based on diabetes risk assessment, and in symptomatic patients (ADA, 2018).

i. A1C ≥ 6.5%: The test should be performed in a laboratory using a method using a method that is National Glycohemoglobin Standardization Program (NGSP) certified and standardized to the Diabetes Control and Complications Trial reference assay (DCCT).
ii. FPG ≥ 126mg/dL (7.0 mmol/L): Fasting is defined as no caloric intake for at least 8 hour.
iii. 2-h PG ≥ 200mg/dL (11.1 mmol/L) during OGTT: The test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.
iv. In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥ 200mg/ (11.1 mmol/L)

In the absence of unequivocal hyperglycemia, results should be confirmed by repeat testing.

2.5 Types of diabetes

There are different categories of DM; but the two broad categories are type 1 and type 2 DM. Both forms of diabetes are preceded by a period of abnormal glucose classified as impaired fasting glucose or impaired glucose tolerance (Adem *et al.*, 2014).

2.5.1 Type 1 Diabetes

Type 1 diabetes mellitus (Juvenile diabetes) is characterized by beta cell destruction caused by an autoimmune process, usually leading to absolute insulin deficiency. Type 1 is usually characterized by the presence of anti-glutamic acid decarboxylase, islet cell or insulin antibodies which identify the autoimmune processes that lead to beta cell destruction (Baynes, 2015). Type

1 diabetes mellitus also is also characterized by insulin deficiency and a tendency to develop ketosis; however, individuals with type 1 diabetes mellitus lack the immunologic marker indicative of an autoimmune destruction process of b cells. People with type 1 diabetes must take exogenous insulin for survival to prevent the development of ketoacidosis. Affected persons are usually children and young adults, although it can occur at any age and it accounts for 5% to 10% of all diagnosed cases of diabetes. Its frequency is low relative type 2 diabetes, which accounts for over 90% of case globally (Tripathi and Srivastava, 2006).

2.5.2 Tye 2 Diabetes

Type 2 diabetes mellitus, previously referred to as non-insulin-dependent diabetes or adult-onset diabetes, accounts for 90-95% of all diabetes. This form encompasses individuals who have relative (rather than absolute) insulin deficiency and have peripheral insulin resistance. At least initially, and often throughout their lifetime, these individuals may not need insulin treatment to survive (ADA, 2018). Affected persons are often older than 30 years at diagnosis, although it is now occurring frequently in young adults and children. In addition, hypertension and dyslipidemia often are present in these individuals. This is the most common form of diabetes mellitus and is highly associated with a family history of diabetes, older age, obesity and lack of physical activity (Baynes, 2015).

2.6 Risk factors of Type 2 diabetes

Diabetes risk factors can be divided into two categories – modifiable (those we can change) and non-modifiable (those we cannot change) (Nazarko, 2023).

2.6.1 Non modifiable risk factors

Age

Aging is associated with a decrease in glucose tolerance, which appears to be due to a decline in both insulin sensitivity and insulin secretion (Chen *et al.*, 1985). However, aged related factors such as reduced physical activity and increased fat accumulation are at least in part responsible for this phenomenon. In developed countries more than half of the people with type 2 diabetes mellitus are older than 65 years and only 8% are less than 44 years of age. In

developing countries, 75% of diabetic patients are 45 years and above and 25% of adults with diabetes mellitus are under 44 years old (Asiimwe *et al.*, 2020).

Genetics

Family history of diabetes reflects both genetic as well as environmental factors and can lead to better prediction of incidence of type 2 diabetes than only genetic factors and environmental factors alone. They said that 90% of all chronic diseases can be influenced by lifestyle choice, especially diet and exercise. A person's genome is a strong determinant of the chance of developing type 2 diabetes. for instance, if a dizygotic (fraternal) twin develops type 2 diabetes, there is a 25% chance the other twin might also get it. The disease risk is even higher for monozygotic (identical) twin – if one twin gets type 2 diabetes there's a 50% chance the other twin might too. But even with these genetic factors, not everyone with them will develop diabetes. It seems like other health issues need to come into play trigger or worsens the problems with insulin and beta cells that lead to develop type 2 diabetes (Long, 2024).

Gender

Gender affects diabetes risk, and middle-aged men are at greater risk of developing T2DM than middle-age women with a higher BMI. This is thought to be because men and women carry fat in different ways. Men tend to have central obesity and higher levels of fat around the abdominal organs (visceral fat). Women tend to deposit more fat around the hips and have lower levels of visceral fat (Kautzky-Willer *et al.*, 2016). The study was done in semi-urban area in Nepal with sample size 2,310 of which 1,574 (68%) were females and 736 (36%) were males (Gyawali *et al.*, 2016) with type 2 diabetes.

Ethnicity

People of South-Asians Chinese origin have a lower muscle mass than white populations and are a greater risk of developing T2DM White European populations (Jenum *et al.*, 2019). The prevalence of type 2 diabetes varies considerably among populations of different ethnic origins living in apparently similar environments (King *et al.*, 1993). In Singapore the frequency of diabetes in 1992 was 8.5-7.7% in Chinese men and women aged 18-69 compared with 13.3-12.3%, respectively, among the Asian Indians and Malays (Tan *et al.*, 1999).

High prevalence rates of diabetes have also been found among Asian Indians compared with the indigenous populations in the United Kingdom, Fiji, South Africa and in the Caribbean (Steyn *et al.*, 2004). While all ethnic groups are affected, the prevalence of T2DM in South Asians, both in their home countries and abroad, is extremely high and is continuing to rise rapidly (Abhilash and Augustine, 2014).

Considerable differences in the prevalence of diabetes have also been described among the multi-ethnic populations of Hawaii and New Zealand, where the Native Hawaiians and Maori populations, both of Polynesians origin, have higher prevalences than other ethnic groups. While environmental factors undoubtedly account for some of these differences, they are likely also to reflect inherent ethnic differences in susceptibility to the disease (Steyn *et al.*, 2004).

2.6.2 Modifiable risk factors

Overweight/Obesity

The World Health Organization defines overweight and obesity as abnormal, or excessive fat accumulation that presents risk to health. Body Mass Index (BMI) is a simple index of weight for height that is commonly used to classify overweight and obesity in adults. It is defined as a person's weight in kilograms divided by the square of his/her height in meters (kg/m^2).

Those with higher BMI have much higher incidence rates of type 2 diabetes at earlier ages than those with lower BMI among whom the incidence rises in the older age groups (Steyn *et al.*, 2004). Obesity is closely linked with premature Onset of T2DM and cardiovascular disease. In South-Asia lifestyle factors, such as poor diet, increased sedentary behaviors with limited physical activities have contributed to the rise of overweight and obesity (Shrestha *et al.*, 2021).

Table 2.1 WHO categorization of BMI based on recommendation for Asia-Pacific regions

Categories	**BMI (Kg/m^2)**
Underweight	<18.5
Normal	18.5-22.9
Overweight	23-24.9
Obesity I	25-29.9
Obesity II	≥30

Diet

Diet play a important role in the development of T2DM, and it is considered as a modifiable risk factor for T2DM (Wu *et al.*, 2014). Excessive calorie intake is a major driving force behind escalating obesity and type 2 diabetes epidemics worldwide, but diet quality has also independent effects. In the Nurses' Health Study (NHS), we found that the quality of fats and carbohydrates play an important role in the development of diabetes, independent of BMI and other risk factors (Hu *et al.*, 2001).

In a meta-analysis , it was found that a 2-serving/day increment in whole-grain intake was associated with a 21% lower risk of diabetes (De Munter *et al.*, 2007). In particular, higher dietary glycemic load (GL) and trans-fat are associated with increased diabetes risk, whereas greater consumption of cereal fiber and polyunsaturated fat is associated with decreased risk (Hu, 2011). Several dietary patterns such as Mediterranean diet, low glycemic index, moderately low carbohydrate, and vegetarian diets may be adjusted individually with the appropriate calorie intake to control body weight and thus prevent the occurrence of diabetes (De Munter *et al.*, 2007).

Smoking

Smoking leads to more than 8 million deaths per year (WHO, 2023). This is from both active and passive uses i.e. non-smokers exposed to smokers. Smoking can cause damage of beta

pancreatic cells, leading to disruption of insulin production. (Ridwanto *et al.*, 2020). Furthermore, when an individual smoker, the level of nicotine increases in his/her body. This leads to a reduction in muscle glucose intake, developing insulin resistance and leading to type 2 diabetes (Bajaj, 2012). Wannamethee *et al.* (2001) revealed that an individual smoking pipe/cigar is 2.15 times more likely to develop type 2 diabetes and an individual smoking cigarette is 1.6 times more likely compared to non-smokers. Kowall *et al.* (2010) showed that risk of incidence type 2 diabetes is significantly high in active/passive prediabetic smokers compared to active/passive smokers without prediabetes.

Physical activity

Lack of activity can reduce insulin sensitivity over time, resulting in diminished glucose tolerance and ultimately type 2 diabetes (Ismail *et al.*, 2021). It is demonstrated that physical activity may contribute to 30-50% reduction in the development of T2DM (Bassuk and Manson, 2005). Regular exercise improves glycemic control and reduces the risk of developing cardiovascular complications in people with type 2 diabetes. "Furthermore, regular exercise may prevent type 2 diabetes in high risk individuals" (ADA, 2015). Exercise improves blood glucose control of patients with T2DM and reduces the cardiovascular risk factors, contributes to weight loss, and promotes well-being (Colberg *et al.*, 2016). Regular exercise can reduces the free fatty acid load to the liver; there by, reduces the hepatic insulin resistance (Adem *et al.*, 2014).

Alcohol use

There is reduced risk of diabetes among light to moderate alcohol consumers with reported 30-40% reduced risk among those consuming 1-2drinks per day compared with heavy drinkers/ abstainers. However, the risk of diabetes among those who consumed three or more drinks/ day was similar to that of abstainers. Possible mediators of beneficial effects of moderate alcohol consumption include improved insulin sensitivity, increased HDL cholesterol and adiponectin, and the anti-inflammatory effect of alcohol. On the other hand, heavy alcohol intake has multiple deleterious metabolic effects, including excess calorie intake and obesity, increased triglyceride levels, pancreatitis, disturbance of carbohydrate and glucose metabolism, and impairment of liver function (Hu *et al.*, 2001; Koppes *et al.*, 2005).

Hypertension

Hypertension commonly present among people with metabolic syndrome, including obesity, elevated blood sugar levels, insulin resistance and low high-density lipoprotein (HDL) cholesterol levels. These co-morbidities along with other risk factors, significantly increase the risk of developing diabetes (by over 2-fold) (Williams, 2013). Around 75% individuals with type 2 diabetes experience hypertension. In part, this correlation is a direct complication of diabetes. Long-term high blood sugar levels lead to the thickening and stiffening of arterioles walls, resulting in hypertension. As with dyslipidemia, hypertension puts a person with type 2 diabetes at higher risk for CVD (ADA, 2015).

2.7 Complications of T2DM:

There are two types of diabetes complications: serious ones that build up over time called chronic complications and ones that can happen at any time called acute complication (UK., 2023).

2.7.1 Acute complications of T2DM

In patients with type 2 diabetes. Either extremely high or extremely low blood glucose can cause an acute diabetic emergency.

- Too much circulating glucose leads to a hyperosmolar hyperglycemic state (HHS) or diabetic ketoacidosis (DKA).
- Too little circulating glucose cause hypoglycemia.

Hyperglycemic crises

Uncontrolled hyperglycemia lead to a physiologic crises of dehydration, electrolyte imbalance and confusion and coma. Hyperglycemic crisis are typically triggered by physical stress, such as an illness, injury, stroke, or myocardial infraction, which causes a sudden persistent hyperglycemia. Without the help of knowledgeable caregiver, this sudden hyperglycemia can evolve to become life-threatening for a patient with diabetes.

A hyperglycemic crisis occurs when patients do not have sufficient circulating insulin. The form taken by the crises depends on whether there is any circulating insulin at all. When there

is a total lack of insulin, such as for type 1 diabetes patients who rely on insulin injections. A hyperglycemic crisis will take the form of diabetic ketoacidosis (DKA). DKA is characterized by hyperglycemia, metabolic acidosis, ketonemia, dehydration and loss of electrolytes(Long). At the other end of the spectrum, when there is a relative lack of insulin, such as with type 2 diabetes, patients have enough circulating glucose to avoid metabolic acidosis and ketonemia, so a hyperglycemic crisis will take the form of hyperosmolar hyperglycemic state (HHS). HHS is characterized by hyperglycemia that can be twice as high as in DKA, plus dehydration and loss of electrolytes, only mild ketonemia and acidosis, and notable mental status changes or coma (Kitabchi *et al.*, 2006). Symptoms of both DKA and HHS can include dehydration, loose skin turgor, dry mucus membranes, tachycardia, deep slow breathing (kussmaul respirations in diabetic ketoacidosis), hypotension, mental confusion, and possibly coma (Long, 2024).

Hypoglycemic crises

Hypoglycemia occurs when a person's blood glucose is too low, usually below 70mg/dL. People with hypoglycemia become pale, shaky, sweaty, weak and hungry. If the hypoglycemia is prolonged, they will become confused, and possibly comatose. Symptoms can often mimic intoxication. Patients who have type 2 diabetes and who take insulin or insulin secretagogues, such as the sulfonylureas, can become hypoglycemia, if:

- ✓ Too much insulin or secretagogues is taken.
- ✓ The secretagogue was not discontinued when insulin was added.
- ✓ Too few carbohydrates are eaten.
- ✓ Circulating glucose is depleted too quickly (for example, during exercise).
- ✓ Alcohol intake occurs without eating.
- ✓ Kidney disease exists.

The treatment for hypoglycemia in a conscious person is 15 to 20 gm of oral glucose. After blood sugar returns to normal, regular meal with protein can be eaten within the next hour (Long, 2024).

2.7.2 Chronic complications of T2DM

Chronic complications of DM affect many organ systems and are responsible for the majority of morbidity and mortality. Chronic complications can be divided into vascular and non-vascular complications. The vascular complications are further subdivided into microvascular and macrovascular complications. Non vascular complications include problem such as gastroporesis, sexual dysfunction and skin changes.

As a consequence of its chronic complications, DM is the most common cause of adult blindness, a variety of debilitating neuropathies cardiac and cerebral disorders. Early in the course of diabetes, intracellular hyperglycemia, causes abnormalities in blood flow and increased vascular permeability this reflects increased the activity of vasodilators such as nitric oxide, increased activity of vasoconstrictors such as angiotensin II an, endothelin-1 and elaboration of permeability factors such as vascular endothelial growth factor (VIGF). In diabetic arteries, endothelial dysfunction seem to involve both insulin resistance to the phospotydillinosito-3-OH kinase pathway and hyperglycemia (Tripathi and Srivastava, 2006).

Overall, 292 patients were enrolled (165 South Asians), macrovascular disease was more prevalent in South Asias as compared to Europeans (15.7% vs 9.4% , P = <0.001), as was microvascular disease (27.3% vs 16.5% , P = <0.001), including retinopathy (17.5% vs 7.9%, P = <0.001), and nephropathy (18.1% vs 7.8%, P = <0.0010) (Chowdhury and Lasker, 2002).

2.7.2.1 Microvascular Complication

Microvascular complication of diabetes include retinopathy, nephropathy and peripheral or autonomic neuropathy (Seaquist, 1998). These complications are primarily due to glucose, and the effect of hyperglycemia on the vasculature. Hyperglycemia leads to high glucose flux across endothelial cell membranes, which overwhelms the mitochondrial electron transport system (leading to the release of reactive oxygen species) (Nishikawa *et al.*, 2000). increase oxidative stress reduces the bioavailability of nitric oxide by converting available nitric oxide into peroxynitrate, eventually resulting in endothelial dysfunction (Deedwania and Fonseca, 2005).

Diabetic retinopathy

It is a highly specific of neurovascular complication of both type 1 and type 2 diabetes, with prevalence strongly related to both the duration of diabetes and level of glycemic control. It is the most frequent cause of new cases of blindness among adults age between 20-79 years in developed countries. Glaucoma, cataracts, and other disorders of the eye occur earlier and more frequently in people with diabetes (Solomon *et al.*, 2017). Diabetic retinopathy is responsible for 2.1% of global blindness (Bourne *et al.*, 2013). A muscular condition that may affect each of the peripheral retina, macula, or both is characterized by diabetic retinopathy is a serious cause of vision loss and blindness in diabetes. Vitreous hemorrhage or retinal objectivity may cause a total or partial loss of vision (Alqahtani *et al.*, 2020). It is known to progress from a mild non-proliferative DR to a severe proliferative DR. As retinopathy progress, patient may invariably experience vision loss. Globally the number of people with DR is estimated to grow from 126.6 million in 2010 to 191.0 million by 2030. It is recognized as one of the most prevalent complications of both Type 1 and Type 2 diabetes and is a leading cause of vision impairment (Herat *et al.*, 2018).

Diabetic Nephropathy

Nephropathy is a chronic complication characterized by increased urinary albumin excretion (proteinuria) or reduced kidney glomerular filtration rate (GFR) in both forms of diabetes mellitus, T1DM and T2DM (Alicic *et al.*, 2017) . Proteinuria was seen in about 30% of type 1 diabetes patients and 40% of type 2 diabetes patients. It's also the major source of end-stage renal disease (ESRD) development in the world., accounting for about 40 % of new renal replacement therapies (Ritz *et al.*, 2011). This includes the creation of basement membrane thickening and growth of micro-aneurysms. In addition, the development of extracellular matrix and the progression of tubular and glomerular sclerosis are consistent with glomerular hyperfiltration (ADA, 1998). Recently more and more evidence indicates that inflammation is involved in development of DM (Mezil *et al.*, 2018). A major obsessive discovery of DN in expansion of that could be glomerulosclerosis. Diabetic glomerulosclerosis is distinguished by the set of mesangial developing extracellular network proteins and tubulointerstitial fibrosis (Mauer *et al.*, 1984).

Diabetic Neuropathy

Diabetic neuropathy may be associated with foot ulcers, amputations, sexual dysfunction and non-healing skin wounds (Sanghera and Blackett, 2012). The neuropathy leads to loss of protective sensation in the feet, which become prone to callous formation, ulceration and other injury. This, in turn, leads to infection of the skin (cellulitis) and/or bones of the feet (osteomyelitis) and gangrene (Vigersky, 2011). Peripheral neuropathy is the major complication of chronic diabetes, which can lead to a sensory or sensorimotor neuropathies that increase the risk of ulceration of foot or amputation. Autonomic neuropathy may include GIT dysfunction, the patient may present with symptoms such as bloating, vomiting, early satiety, abdominal pain and heartburn (Alqahtani *et al.*, 2020). Today, T2DM is a major cause of lower limb amputations (Shawahna *et al.*, 2021).

2.7.2.2 Macrovascular complication

Diabetes mellitus is complicated and persistent condition that includes lifelong medical treatment, consisting of coronary artery disease cerebrovascular disease and peripheral artery disease, with a high risk of disease on patients with multiple macrovascular complications associated with it. Among diabetic cases, the frequency of acute myocardial infraction is 2.13 times greater in males 2.95 times higher in females than non-diabetic groups (Vergès, 2015).

Diabetic Cardiomyopathy

Diabetic cardiomyopathy is defined by the existence of abnormal myocardial structure and performance in the absence of other cardiac risk factors, such as coronary artery disease, hypertension and significant valvular disease in individuals with diabetes mellitus. Hyperglycemia, systematic insulin resistance, and impaired cardiac insulin metabolic signaling are major clinical abnormalities in diabetes mellitus, and are involved in the pathogenesis of diabetic cardiomyopathy (Jia *et al.*, 2018).

Diabetic Foot

Diabetic foot ulcers are lacerations that usually occur on the soles of the feet in patients with diabetes mellitus due to peripheral neuropathy or peripheral arterial disease on all skin layers, necrosis or inflammation, around 15 to 25% of diabetic patients will grow foot ulcers during

their lives, the leading cause of non-traumatic subtraction worldwide (Delgado, 2018). Endothelial cell inflammation and smooth cell imperfections are caused by hyperglycemia in peripheral arteries. Endothelial dysfunction is the most serious condition causing microcirculation, due to developments in endothelial cell differentiation, thickening of the vault membrane, reduced nitric oxide secretion, elevated blood viscosity, improvements in microvascular tone and decreased blood volume (Atlas, 2015).

Includes these steps in your foot care plan

- Check your feet every day.
- Wash your feet every day
- Wear shoes and socks at all the time.
- Keep the blood flowing to your feet.
- Smooth corns and calluses gently
- Trim your toenails straight across.
- Protect your feet from hot and cold.
- Get a foot check at every health care visit.

Infection

Individuals with diabetes mellitus exhibit a greater frequency and severity of infection the reason for this include incompletely defined abnormalities in cell-mediated immunity and phagocyte function associated with hyperglycemia as well as diminished vascularization secondary to long-standing diabetes. Many common infections are more frequent and severe in the diabetic population, whereas several rare infections are seen almost exclusively in the diabetic population (e.g. rhinocerebral mucormycosis, and malignant otitis externa, which is usually secondary to P. aeruginosa infection in the soft tissue surrounding the external auditory canal). Pneumonia, urinary tract infection, and skin and soft tissue infections are all more common in the diabetic population. Gram negative organisms, e.g. S. aureus and Mycobacterium tuberculosis, are more frequent pathogens in patients of DM. Diabetic patients have an increased the rate of colonization of S. aureus in skin folds and nares and also have a greater risk of postoperative wound infections (Tripathi and Srivastava, 2006).

2.8 Lifestyle modification in the management of T2DM

Lifestyle intervention is a key factor intreating individuals with type 2 diabetes. Apart from preventing or delaying the progression to type 2 DM among those at risk, it does reduce the risk of developing complications among those already diagnosed with T2DM. The proposed lifestyle interventions often include educational support, improvement in diet and level of physical activity (Peter, 2020).

Educational support

Lifestyle modification which focuses on diet and physical activity, forms the basis of T2DM self-management. Together with these lifestyle interventions regular monitoring of blood glucose levels, blood pressure and blood lipids levels is recommended to prevent or delay the onset of T2DM-related complications (Le Roux, 2016).

Individuals with DM are advised to participate in diabetes self-management education programs to gain the necessary knowledge, skills, abilities for effective self-care. Also, diabetes self-management support to assist with implementing and sustaining skills, behaviors needed for continuous self-management, from diagnosis and as needed afterward. Diabetes self-management education and support should be patient centered, respectful, and responsive to individual patient preferences, needs and values. It should help guide clinical decision. The need for diabetes self-management education and support should be evaluated by the medical care provider at four critical time points: with the diagnosis; annually for assessment of education, nutritional and emotional needs; when we complicating factors arise; and when transition occurs. Diabetes self-management education is linked with enhanced DM knowledge and self-care behaviors. It also interconnected with the increased use of primary care and preventive services and less frequent use of acute care and in-patient hospital services (ADA, 2017).

Dietary intervention

Dietary intervention plays an important role in the management of T2DM. However, many people with diabetes frequently struggle with choosing the right foods and sticking to a meal plan (ADA, 2017). Because of the association between body weight and insulin resistance, weight loss has long been recommended for adults with diabetes (ADA, 2014). A variety of

eating pattern has also been shown to be modestly effective in managing diabetes: Low fat, lower carbohydrate pattern, Mediterranean, hypertensions improving diet (DASH) and plant based diets (Barnard *et al.*, 2006).

Previously, certain guidelines advised macronutrient quantity goals, such as the European or Canadian recommendation of 45-60% of total energy as carbohydrate, 10-20% as protein, and less than 35% as fat. The more recent guideline from the American Diabetes Association (ADA) state that there is no ideal percentage of calories from fat, protein and carbohydrate for all people with diabetes. Macronutrients distribution should be determined from each individual's assessment of current eating pattern, preferences such as tradition, culture, religion, economics and metabolic goals. Therefore, it is essential for every person with Type 2 diabetes to receive educational support from a dietitian or trained medical personnel who should also assist in creating a dietary plan for patient (Evert *et al.*, 2014).

Physical activity

Engaging a regular physical activity is usually encouraged among patient with Type 2 DM as it plays a vital role in the management of blood glucose. Planned and structured physical activity enhances blood control in Type 2 DM, reduction cardiovascular factors, contribute to weight loss, and improve well-being. All adults, and particularly with type 2 diabetes, should decrease the amount of time spent in daily sedentary behavior. Prolonged sitting should be interrupted every 30 min for blood glucose benefits, particularly in adults with Type 2 diabetes. Most adults with type 1 and type 2 diabetes should engage in 150 min or more of moderate-to-vigorous intensity physical activity per week (ADA, 2017).

2.9 Literature review on knowledge, attitude and practice of diabetes

The similar research has been conducted previously that aimed at evaluating the knowledge, attitude and practices about type 2 diabetes patients. A questionnaire- based, study was conducted to assess KAP among diabetes patients from rural area in India. The study was conducted at Community Health Centre, Ranbir Singh Pura and Jammu in the period of 1st October to 31st December 2014. A total of 230 patients were enrolled during the study period comprising of 128 males and 102 females. The mean age of the subjects was 54.7 years. Majority

of these diabetic patients belonged to Hindu religion. It was found that the mean ± SD knowledge, attitude and practice score was 10.13 ± 2.09, 3.13 ± 1.26 and 2.86 ± 1.39 out of the maximum possible scores of 14, 6 and 5 for knowledge, attitude and practice respectively. 86.95% of correct responses for knowledge regarding questions, 65.32% had a positive attitude towards the disease and only 47.82% had a good practice. The outcome of the study shows that the level of knowledge regarding diabetes mellitus in diabetic patients was fairly good but attitude and practice needed improvements. This study showed a significant association between knowledge and attitude and between knowledge and practices (Gupta *et al.*, 2015).

The KAP study conducted in Kuala Mudha District, Kedah, Malaysia with aimed to assessed the level of diabetes KAP among Type 2 diabetic patients. Majority of respondents possessed above the cut-off points for poor levels in knowledge (63.21%), attitude (62.69%) and practice (58.03%). Knowledge level is significantly associated with both as attitude and practice level (Abbasi *et al.*, 2018). A similar study conducted among type 2 diabetic patients in JMC, Ethiopia showed majority 63.3%, 59.6% and 54.2% of the respondents had good knowledge, positive attitude and good self-care practice (Mekonnen and Hussien, 2021).

An institutional based, cross-sectional study was conducted in Diabetes, Thyroid and Endocrinology center at Kathmandu metropolitan city of Nepal among 244 diabetic patients in 2014. American diabetic association's criteria were followed for diagnosis. Majority (56.6%) of the respondents represented the age group 40-60 years and 31.1 % were above 60 years. One fifth (18%) of the respondents were illiterate. One fourth (24.6%) of the respondents were from rural areas and one third (32%) of the respondents were housewife. Majority (90.6%) of the respondents followed Hindu religion and 37.7% were from Brahmin ethnicity. This study reveals the poor level of overall knowledge, attitude and practice (KAP) among diabetic patients and thus notifies the necessity to improve education strategies and develop modern tools that improve diabetes related consequences and hazards. For this improvement and efforts, further intervention would require to focus on health-related knowledge, attitude and practices among diabetic patients (Gautam *et al.*, 2015).

The similar study was done in the past that aimed to evaluate knowledge, attitude and practice among T2DM regarding their disease. The cross-sectional observational study was conducted in primary health care facilities frequently visited by patients with T2DM across the West Bank of Palestine. Out of 300 patients, 220 (73.3%) patients responded. In this study more than half of the participants (52.2%) had good knowledge, 58.7 had positive attitude and only 36.4% had good practice. The study also reported that patients who were younger than 55 years, never married, employed, and had university degree and had higher income and had usual fasting blood glucose level of less than 140mg/dL tended to score more than 50% in the knowledge items. Similarly, patients who had higher income tended to have higher positive attitude towards disease. Patients who had younger than 55 years, employed, had university degree, diagnosed less than 7 years ago and had usual fasting blood glucose level of less than 140 tended to score more than 80% in the practice items. Finding of this study highlighted the gaps in knowledge, attitude and practice with regard to T2DM among patients (Shawahna *et al.*, 2021).

A cross-sectional hospital based KAP study was done by Asmelash *et al.* (2019) revealed that out of total 403 participants, 62% of the participants had good knowledge, 67.2% had good attitude and 74.4% had good practice towards glycemic control among diabetic patients. The study results showed that occupation and marital status were significantly associated with knowledge. Similarly, occupation, education and marital status were significantly associated with attitude and practice level.

An institutional based cross-sectional study was conducted to evaluate KAP and factors associated with KAP among randomly selected 248 T2DM aged ≥30 years old attending Ambo University Referral Hospital, Oromia, Ethiopia. The study reported that 44.8%, 47.2% and 48.8% participants had poor knowledge, poor positive attitude and poor practice towards DM respectively. Age, level of education, average monthly income, history of diabetes and duration of diabetes Knowledge level were factors affecting KAP towards diabetes. Both sex and occupational status were affecting knowledge level but not attitude and practice. Both the attitude and practice level of participants in the study area. This study found that there was a gap in KAP between among T2DM patients (Daba and Yazew, 2020)

Part III

Materials and method

3.1 Research design

A descriptive cross-sectional study was conducted in the outpatient department of Barahakshetra Nagar Hospital in the Sunsari district of Nepal to assess the level of knowledge, attitude and practice on type 2 Diabetes Mellitus. Each participant information was collected by administrating the standardized and pretested questionnaire and anthropometric measurements were conducted using standardized instruments.

3.2 Location of the study

The study was conducted in Baraha Nagar Hospital of Barahakshetra Municipality of Sunsari district of Koshi province. The study location was chosen because there is a good flow of diabetic patients for their treatment and follow up, made it an ideal site for gathering relevant data and achieving the study objectives. Additionally, it was convenient for the researcher.

3.3 Target Population

The target population of the study were all adult patients aged 20-79 years and with T2DM who were attending the outpatient department of hospital during the period from 19th February to 18th March were enrolled in the study after getting their consent.

Inclusion criteria:

a) All adult patients of both genders who were 20-79 years and diagnosed with T2DM for at least 6 months were included in the study.

Exclusion criteria:

a) Diabetic patients who were critically ill and hearing impairments were excluded from the study.
b) Patients with type 1 and gestational DM were excluded from the study.
c) Patients who did not consent to participate in the study were excluded from the study.

3.4 Study Variables

Dependent variables: Knowledge, attitude and practice of diabetic patients

Independent variables:

- Demographic variables: Religion, ethnicity, income, occupation.
- Individual/ sample characteristics: Age, sex, marital status, education level
- Clinical Behavioral characteristics: Co-morbidities, duration of diabetes, family history of diabetes, alcohol consumption and smoking habits
- BMI and FBGL

3.5 Sampling technique

The samples of the respondents were selected by convenience sampling method. All type 2 diabetic patients visiting the OPD of Barahakshetra Nagar Hospital during the period of one month from 19th February to 18th March were recruited in the study.

3.6 Sample size calculation

The sample size of the study was calculated by using form a single population proportion formula assuming the prevalence rate of type 2 diabetes mellitus is to be 10% (Shrestha *et al.*, 2021), 95% confidence interval (CI), 5 % margin of error (d) 10% non-response rate is added to the calculated sample size.

Calculation of sample size for infinite population:

$n = Z^2 \times p (1 - p) / d^2$

n= sample size, p= estimated prevalence (10%) and 10% non-response rate

Z = Confidence interval at 95% (standard value of z is 1.96)

Sample size (n)= $Z^2 \times p (1 - p) / d^2$

Now,

$n = (1.96)^2 \times 0.1 (1 – 0.1) / (0.05)^2 = 138$

The calculated sample size was adjusted for non-response. So, Considering, non-response rate as 10%, the adjusted sample size was calculated to be 150.

3.7 Research instruments

The materials used for data collection were:

a) Questionnaire

The KAP questionnaire was adopted from P and T Journal, Medimedia USA, Inc, which was developed by Palaian *et al.* (2006). The questionnaire has been used in previous KAP studies among diabetic patients and has proven to be reliable. The questionnaire had a total of 25 questions (knowledge-14, attitude-5, practice-6) and each correct answer was given a score of "one" and the wrong answer was given of "zero". A semi-structured questionnaire was used to obtain socio-demographic, clinical and behavioral characteristics of patients with T2DM. The questionnaire had four sections.

Section A: Socio-demographic and behavioral factors

Section B: Questions related to knowledge related to diabetes

Section C: Questions related to attitude of patients towards lifestyle modification

Section D: Questions related to practices towards diabetes management

The self-administered questionnaire in English and later translated to Nepali language was used to collect the information from participants.

b) Stadiometer

A well calibrated stadiometer to measure the height with minimum and maximum measuring capacity of 1cm and 196 cm respectively was used.

c) Weighing balance

A digital weighing balance manufactured by Microlife, USA to measure the weight with minimum to maximum measuring capacity of 0.1kg and 180kg respectively was used.

3.8 Data collection techniques

3.8.1 Questionnaire

Data was collected using a structured questionnaire based on objectives of the study. Interview was conducted with the Type 2 Diabetic patients of Barahakshetra Municipality to fill the

questionnaire. The information on demographic, socio-economic aspects and knowledge, attitude and practice of type 2 diabetic patients were collected. Patients current fasting blood glucose data obtaining from same clinic was collected.

3.8.2 Height.

According to the WHO (2008) STEPS Surveillance, the following steps were carried out for measurement of height.

a) Height of the respondents was measured to the nearest 0.1cm by using well calibrated stadiometer.
b) Stadiometer was placed on a hard surface and flat surface and check that the stadiometer was properly calibrated and in good working condition.
c) Participants were requested to remove their shoes, any hat or hair ties and stand straight barefoot on the base of stadiometer ensuring that the back of the head, shoulder, hips and legs touching the wall of stadiometer.
d) It ensured that their arms hanging loosely at the sides and head in the Frankfort position.
e) Then measurement of height was noted.

3.8.3 Weight

According to the WHO (2008) STEPS Surveillance, the following steps were carried out for measurement of weight.

Following step were carried out for the measurement of weight:

a) Weighing balance was placed on a hard surface.
b) Asked the participant to step on middle of the scale without their slipper and removes heavy outer clothing and could not hold onto anything.
c) Make sure the scale reads zero before the person steps on.
d) The weight was then measured accurately to the nearest 0.1kg.

3.9 Pretesting

Initially the prepared sets of questionnaires and anthropometric tools were pre-tested among a small group of Type 2 diabetic patients according to the sampling plan. Pretesting should be

conducted in order to maintain accuracy and clarity of questionnaire, to check the consistency in interpretation of questions by respondents and to identify ambiguous item. The interview was conducted in simple Nepali language. When pretesting was done all the ambiguous, misleading and wrongly interpreted questions were eliminated and questionnaire were revised in accordance with the finding of pretesting.

3.10 Validity and Reliability

To ensure the study validity and reliability, the research proposal and the development of tools were carried out under the guidance of supervisors. To ascertain the degree to which the data collection instruments will measure what they purposed to measure, the instruments were validated at Central Campus of Technology, Central Department of Nutrition and Dietetics. The expected tests in the questionnaire were developed based on available literature knowledge, attitude and practice of type 2 diabetic patients. The questionnaire was also pre-tested before data collection to ensure content and face validity.

Reliability involves quality control of the collected data. Prior to data collection, a detailed study was done based on the objectives of the study and on data collection techniques. The questionnaire was checked daily for completeness, consistency and clarity as previously mentioned.

3.11 Data analysis

First the data was checked for completeness and consistency. Then it was coded and entered into IBM SPSS version 25 for statistical analysis. A descriptive analysis was done in the form of frequency, percentage, Mean, standard deviation. Frequency and percentages were used to describe the categorical data along with pie and bar charts, wherever necessary. Variables were subjected to correlation test to find out the correlation between knowledge and attitude; knowledge and practice; and attitude and practice at 95% CI and level of significance at p-value <0.05. For inferential statistics such as chi-square test was used to assess the association between knowledge, attitude and practice with socio-demographic factors of the type 2 diabetic patients for categorical at 95% CI and level of significance at p-value <0.05.

The study used a KAP questionnaire had total 25 questions. The knowledge, attitude and practice questions were coded as correct answer = 1 and incorrect answer = 0. The maximum possible score for knowledge, attitude and practice were 14, 5 and 6. For scoring of KAP were done as per previous studies, scoring more than 50% in the knowledge questionnaire was considered as having good knowledge and scoring more than 50% in the attitude questionnaire was considered as having good attitude. Similarly, scoring more than 50% in the practice questionnaire was considered as having good practice with regard to T2DM (Nagar *et al.*, 2018; Asmelash *et al.*, 2019; Niguse *et al.*, 2019).

3.12 Logistical and Ethical consideration

The approval of the study was done by Department of Nutrition and Dietetics, Central Campus of Technology, Dharan so as to precede it. The letter of permission and support was gained from health director of Barahakshetra Nagar Hospital. Informed written and verbal consent was obtained from all the respondents after full explanation of the purpose of the study. Assurance about confidentiality of the collected data. Privacy and confidentiality of the respondents were maintained throughout and after the study period.

3.13 Conceptual framework of the study

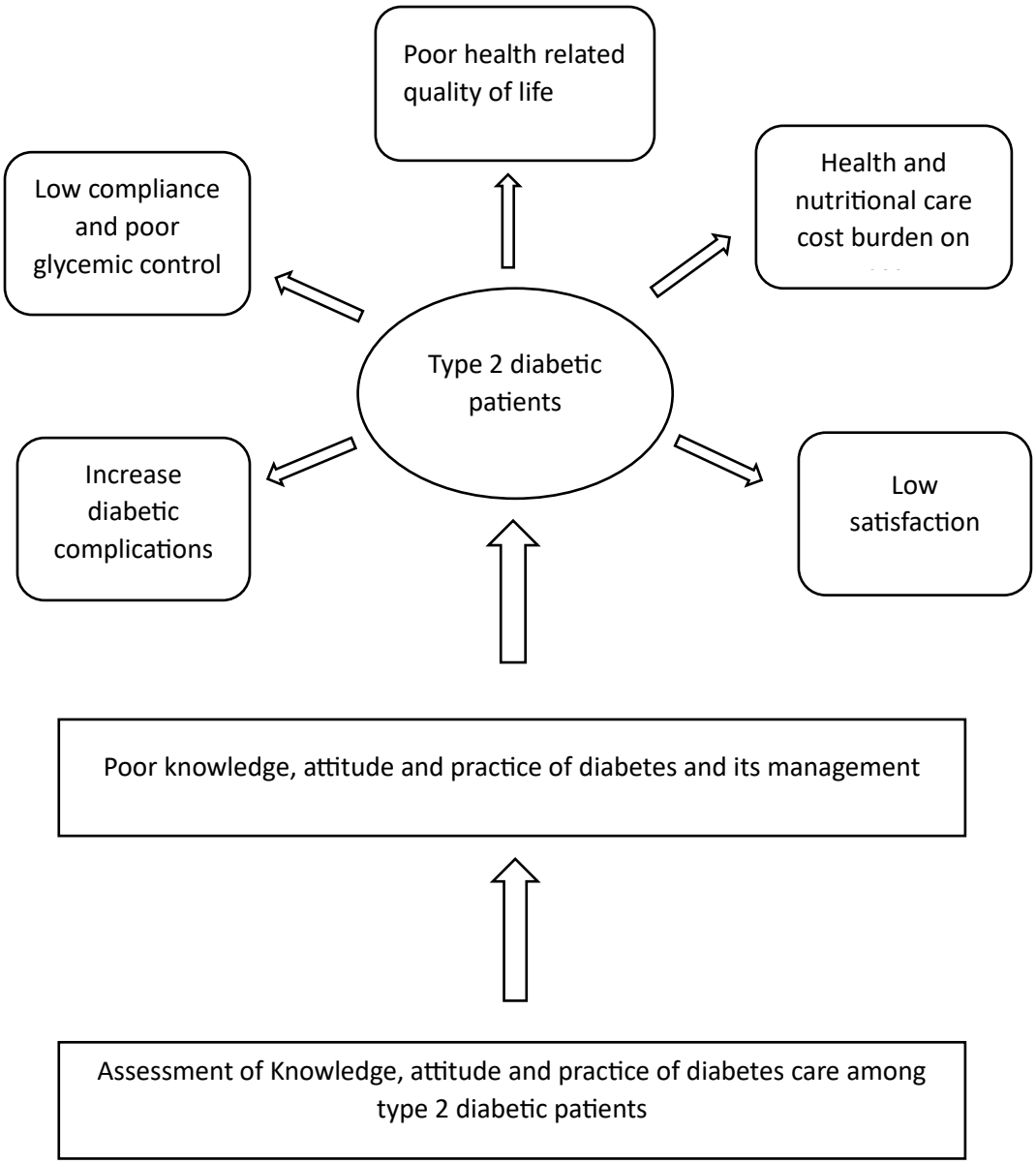

Figure 3.1 Conceptual Framework of the study

Source: (Sapkota, 2018)

Part IV

Result and Discussion

The cross-sectional study design was used to find out the level of Knowledge, attitude and practice regarding diabetes among Type-2 diabetic patients. This study was conducted in Barahakshetra Nagar Hospital with sample size 150. This study was also carried out to find the association between KAP score with socio-demographic clinical variables of diabetic patients.

4.1 Socio-demographic characteristics of the study population

4.1.1 Age distribution of the study population

Out of total sample150 patients were enrolled in the study from the age group 26-78 years, 6 (4%) respondents were in the age group of ≤35 years, 28 (18.7%) respondents were of age group 36-45 years, 46 (30.7%) respondents were of age group 46-55 years, 44 (29.3%) respondents were of age group 56-65 years and 26 (17.3%) were in the age group 65 above years. The participants mean age ± std. deviation was found to be 53.97 ± 10.514. The mean age of the participants which is near to the result by (Waris *et al.*, 2021) as the mean age of the participants was 53.14 ± 11.62 years. The study done by Baral *et al.* (2022) reported that the participants within in the age group of 45-64 years were the highest age group of T2DM prevalence in Nepal.

Table 4.1 Distribution of age

Age Category	Frequency	Percent
≤35	6	4.0j
36-45	28	18.7
46-55	46	30.7
56-65	44	29.3
>65	26	17.3
Total	150	100

4.1.2 Distribution of study population by gender

Figure 4.1 shows that majority of the participants 78 (52%) were female and 72 (48%) were male participants. It revealed that most of the female were affected by diabetes in the study area.

This may be due to higher visceral fats in female than male and men tend to be more physically active (Mekonnen *et al.*, 2020) and most of the women being housewife and having sedentary lifestyles which leads to overweight and diabetes. This finding is consistent with the study conducted in Urban area of south India (56.85%) (Hawal *et al.*, 2013) and Malaysia has shown that majority of the participants were female i.e. 52.60% (Abbasi *et al.*, 2018). Whereas, another study done by Upadhyay *et al.* (2008) and Abdelaziz *et al.* (2017) found that gender wise distribution of the study participants revealed most of the affected individuals as male .

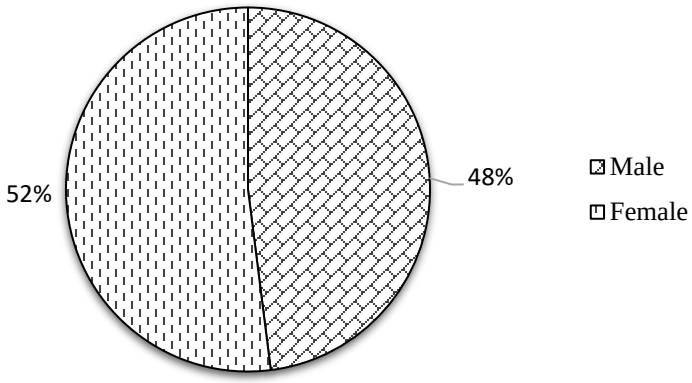

Fig 4.1 Gender distribution of participants

4.1.3 Distribution of population by ethnicity

This study shows that out of 150 T2DM, 58 (38.7%) were Janajati. 55 (36.7) were Brahmin/chhetri, 25 (16.7%) were Madhesi and remaining 12(8%) were Dalit.

Table 4.2 Distribution of ethnicity

Variables	Frequency	Percent
Ethnic group		
Brahmin/chhetri	55	36.7
Janjati	58	38.7
Madhesi	25	16.7
Dalit	12	8.0
Total	150	100

4.1.4 Distribution of study population by religion

Majority of the type 2 diabetic patients were belonged to Hindu religion 116 (77.3%) as followed by Kirat 19 (12.7%). Buddhist were 10 (6.7%) and rests were of other religion.

Table 4.3 Distribution of religion

Variables	Frequency	Percent
Religion		
Hindu	116	77.3
Buddhist	10	6.7
Kirat	19	12.7
Others	5	3.3
Total	150	100

4.1.5 Marital status of the study population

From the study it was found that the majority of the patients were married 135 (90%), 11 (7.3%) were widowed, 2 (1.3%) were single and rest 2 (1.3%) patients were divorced.

Table 4.4 Distribution of marital status

Marital status	Frequency	Percent
Single	2	1.3
Married	135	90
Divorced/separated	2	1.3
Widowed	11	7.3
Total	150	100

4.1.6 Educational status of the study population

Education status of the study participants varied from illiterate to higher education. Figure 4.2 shows that 34% respondents were illiterate, 27.3% respondents had done primary level, 29.3% respondents had done secondary level, 6% had done intermediate and 3.3% patients had done

their university degree. The study done in Nepal has shown that 32.8% were illiterate which was similar with these finding of this study (Baral *et al.*, 2022).

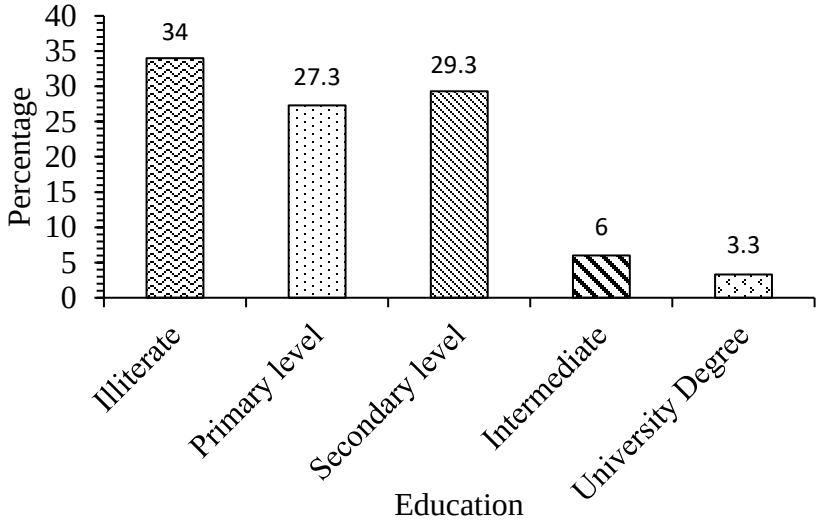

Fig 4.2 Distribution of educational status

4.1.7 Occupation status of the study population

The study revealed that, most of them were housewife (40%) and 20% were involved in agriculture. People engaged in business and service were 11.3% and 14%. 5.3% were retired from service. Remaining 9.3% patients were involved in other profession such as foreign employment, student, unemployment, etc.

Table 4.5 Distribution of occupation

Occupation	Frequency	Percent
Business	17	11.3
Service	21	14.0
Housewife	60	40.0
Agriculture	30	20.0
Retired	8	5.3
Other	14	9.3
Total	150	100

4.1.8 Distribution of study population by monthly income

The study revealed 53 (35.3%) patients had more than 31,000 monthly income of family members. 30 (20%) patients had ≤10,000 monthly income of family, 39 (26%) had 11,000-20,000 monthly income of family and 28 (18.7%) patients had 21,000-30,000 monthly income of family.

Table 4.6 Distribution of monthly family income

Monthly income	Frequency	Percent
≤10,000	30	20
11,000-20,000	39	26
21,000-30,000	28	18.7
>31,000	53	35.3
Total	150	100

4.1.9 Distribution of the study population by duration of diabetes

Among the study participants, 71 patients (47.3%) had a history of diabetes of less than 5 years duration. Of the remaining patients, 41 (27.3%) had a history ranging from 5-10 years and 38 (25.3%) patients had more than 10 years duration of DM.

Table 4.7 Distribution by duration of diabetes

Duration of diabetes	Frequency	Percent
<5years	71	47.3
5-10years	38	27.3
>10years	41	25.3
Total	150	100

4.1.10 Family history of diabetes of the study population

The study revealed that 42% of diabetic patients had a family history of diabetes, while 58% did not have any familial connection to the condition.

Table 4.8 Distribution of family history of diabetes

Family history of diabetes	Frequency	Percent
Yes	63	42
No	87	58
Total	150	100

4.1.11 Co-morbidities of the study population

The study showed that 45.3% of patients had co-morbidities with HTN, thyroid, dyslipidemia, CKD, heart diseases, etc. while 54.7% of patients had no any co-morbidities present.

Table 4.9 Distribution of Co-morbidities.

Co-morbidities	Frequency	Percent
Yes	68	45.3
No	82	54.7
Total	150	100

4.1.12 BMI of the study population

Figure 4.4 shows, majority of the patients were obese i.e. 45.3% followed by overweight 28% and 25.3% had normal BMI. The remaining 1.3% of patients had lower BMI than normal.

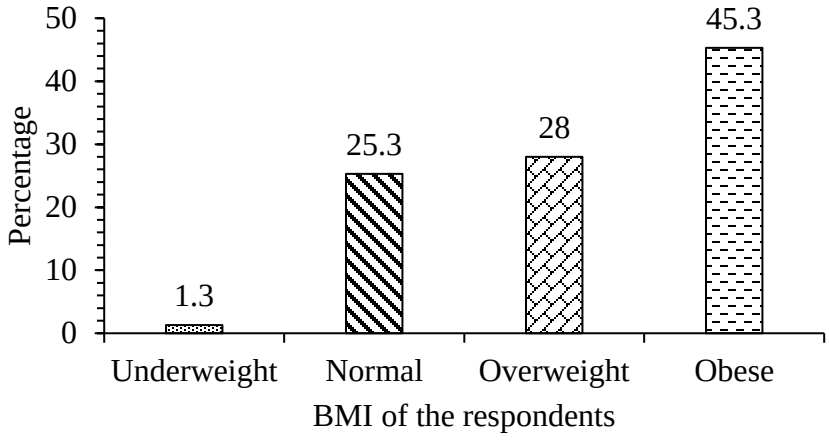

Figure 4.3 BMI distribution of participants

4.1.13 Distribution of study population by fasting blood glucose levels

Out of 150 participants of the study over the half 97(64.7%) of the patients had fasting blood sugar level under control while remaining 53(35.3%) had high fasting blood sugar level. This shows that 35.3% of the diabetic patients are either not following a controlled diet or they do not have good attitude and practices in their lifestyle regarding diabetes.

Table 4.10 Distribution by fasting blood glucose levels

FBGL of respondents	Frequency	Percent
<126	97	64.7
≥126	53	35.3
Total	150	100

4.2 Behavioral characteristics of the patients

Information like the behavioral factors of T2DM patients was collected. Questions about behavioral factors like smoking habits and alcohol consumption were asked to the patients.

4.2.1 Alcohol consumption and smoking habits

The study done in Nepal reported that 16% were current smokers and around 13% consumed harmful amount of alcohol by type 2 diabetic patients (Gyawali *et al.*, 2018). The finding of our study showed that 24(17%) patients of the study were currently alcohol consumed and 15(10%) respondents had smoking habits.

Table 4.11 Distribution of the participants by behavioral characteristics

Variables	Frequency	Percent
Alcohol consumption		
Yes	26	17.3
No	124	82.7
Smoking habit		
Yes	15	10.0
No	135	90.0

4.2.2 Association between Alcohol and smoking habits with FBGL

The table 4.12 shows that alcohol consumption was not found statistically significant with fasting blood glucose levels. However, the study done by Koppes *et al.* (2005) suggest an ~30% reduced risk of T2DM in moderate alcohol consumers whereas no risk reduction observed in consumers ≥48g/day. Additionally, smoking habits was found significant relationship with fasting blood glucose levels (p=0.035). Many studies shows that smoking habit is a risk factor for T2DM. The result of our study indicated that smoking can statistically impact the fasting blood glucose levels and smoker patients had significantly higher fasting blood glucose levels than compared to those who were non-smoker and this indicates a potential risk factor for elevated blood glucose levels in smokers. This finding was supported by the other previous studies was done by Ridwanto *et al.* (2020) among T2DM, reported smoking habits is statistically associated with higher fasting blood glucose levels.

Table 4.12 Association of alcohol consumption and smoking habits with FBGL

	Fasting blood glucose level			
Variables	**<126**	**≥126**	**Chi-square test**	**P-value**
Alcohol			1.612	0.204
Yes	14	12		
No	83	41		
Smoking habits			**4.438**	**0.035***
Yes	6	9		
No	91	44		

*Statistically significant: p-value <0.05

4.3 Knowledge, Attitude and Practice of type 2 diabetic patients

The knowledge, attitude and practice scores of diabetic patients were determined individually.

4.3.1 Knowledge related scores of respondents

Knowledge regarding questionnaires were asked to type 2 diabetic patients. Their responses were then analyzed, focusing on their answers to questions concerning knowledge of the condition.

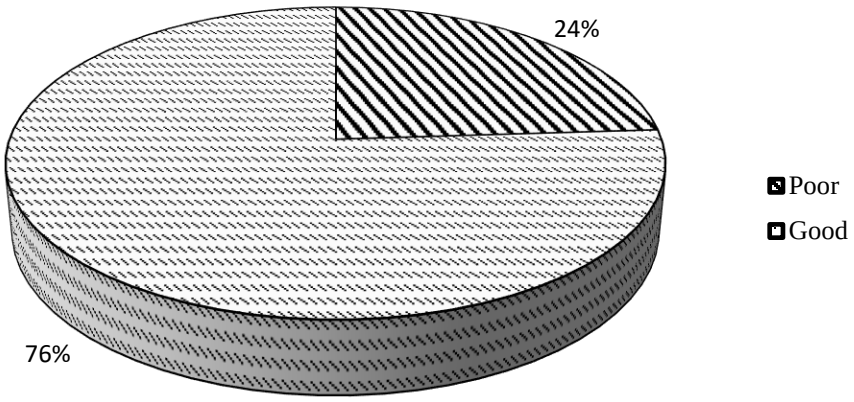

Fig 4.4 Knowledge related score of the patients

Figure 4.4 shows that out of 150 participants in the study, 76% (114) participants had good knowledge whereas 24% (36) participants had poor knowledge on diabetes related questions. Knowledge mean ± SD score was 9.06 ± 2.737.

This study showed that majority of the participants had good knowledge of consequences of diabetes if not treated, lifestyle modification and healthy diet and disease management. One of the cross- sectional study done in Al-Zahraa Teaching Hospital by Taher *et al.* (2022) reported 78.91% had good knowledge about diabetes. Similarly, good knowledge regarding diabetes have been reported in several other studies conducted in Nepal and other countries.(Gupta *et al.*, 2015; Nepal *et al.*, 2017; Asmelash *et al.*, 2019; Khan *et al.*, 2019). However, other several studies have been reported poor knowledge related to diabetes among T2DM (Upadhyay *et al.*, 2008; Okonta *et al.*, 2014; Mohammadi *et al.*, 2015).

Table 4.13 Response to Knowledge questions

Questions	Number of patients answering correctly	Percent
Diabetes is a condition in which body contains	82	54.7
The major cause of diabetes is	21	14
The symptom(s) of diabetes is/are	102	68
The most accurate method of monitoring diabetes is	135	90
Diabetes, if not treated	128	85.3
In a diabetic patient, high blood pressure can increase/worsen	129	86
A diabetic patient should measure his/her blood pressure	77	51.3
The lifestyle modification(s) required for diabetic patients is/are	131	87.3
A diabetic patient should have his/her eyes checked	62	41.3
Regular urine test will help in knowing	41	27.3
The important factors that help in controlling blood sugar are	140	93.3
The well-balanced diet includes	141	94
For proper foot care, a diabetic patient	60	40
What should be done in case of Hypoglycemic symptoms	110	73.3

4.3.2 Attitude related scores of respondents

The attitude of the patients was assessed based on the answer given to the questions related to regular exercise, importance of controlled and planned diet, regular intake of medication and check-ups.

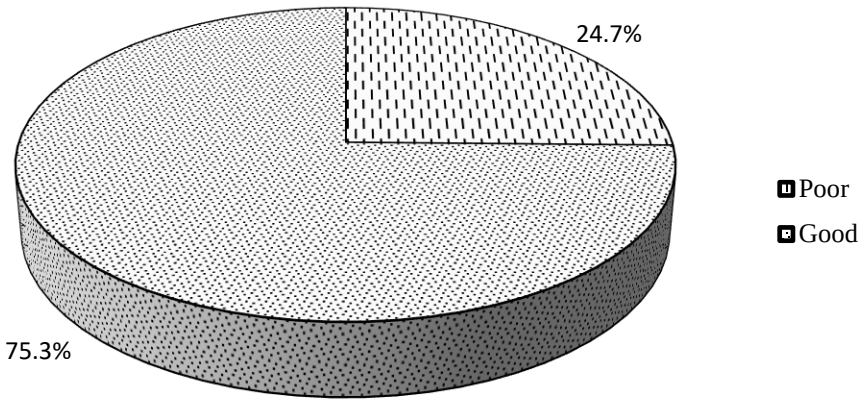

Fig 4.5 Attitude related scores of the patients

The study showed that 75.3% (113) participants had positive attitude whereas 24.7% (37) participants had poor attitude which showed that three-fourth diabetic patients were conscious about the importance of diabetic diet, regular exercise, regular check-ups with doctor for proper management of normal blood glucose levels. The mean ± SD of attitude score was 3.29±1.020.

This study finding showed that three-fourth study participants had positive attitude towards the importance of controlled and planned diet, regular exercise, medication and regular check-ups. The others hospital-based studies which reported that higher positive attitude than this study, 81.89% and 84.3% respondents had a positive attitude towards healthy lifestyle modifications (Adem *et al.*, 2014; Okonta *et al.*, 2014). The similar KAP study was conducted in Nepal among type 2 diabetic patients have been reported that poor attitude regarding diabetes among type 2 diabetic patients (Upadhyay *et al.*, 2008; Nepal *et al.*, 2017). Other studies conducted in Malaysia (62.69%), Southern Benin (52%), Ethiopia (59.6%) and Palestine (58.7%) reported lower attitude than this study (Abbasi *et al.*, 2018; Alaofè *et al.*, 2021; Mekonnen and Hussien, 2021; Shawahna *et al.*, 2021)

Table 4.14 Response to attitude questions

Questions	Numbers of patients providing positive responses	Percent
Do you exercise regularly?	74	49.3
Do you think that following a controlled (low sugar) and planned diet will help to improve diabetes?	130	86.7
Do you miss taking the doses of your diabetic medication?	109	72.7
Are you aware of blood sugar levels falling below normal when you taking drugs?	36	24
Do you think you should keep in touch with your physician?	145	96.7

4.3.3 Practice related scores of respondents

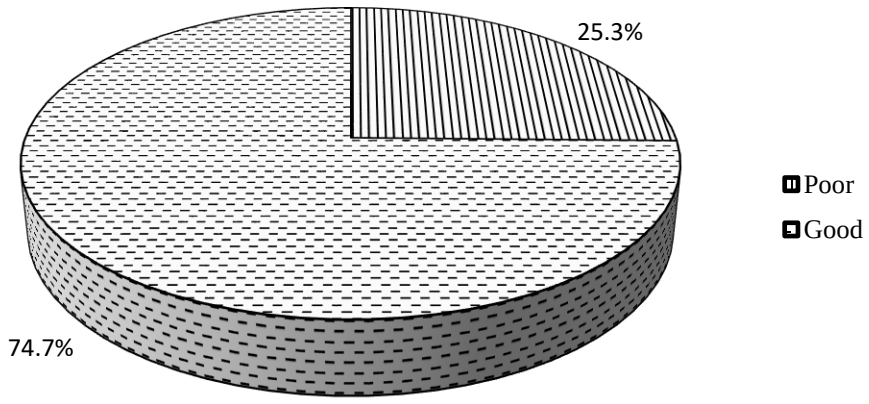

Fig 4.6 Practice related scores of the patients

Figure 4.6 shows that out of 150 participants in the study, 74.7% (112) participants had good practice score for the proper management of DM whereas one-fourth 38 (25.3%) participants had poor practice score. The mean ± SD of practice score was 4.25±1.70. This practice scores

indicates that most patients are aware of their disease condition and its management. This finding was found to be consistent with the KAP studies done by Asmelash *et al.* (2019) among diabetes patients (74.4%) towards glycemic control. .

The finding result was comparatively higher level of practice among diabetes as compared to other studies done in rural Northern India (47.82%), Iran (52.23%), Ethiopia (54.2%), Malaysia (58.03%), Cotonou, Southern Benin (47%) (Gupta *et al.*, 2015; Niroomand *et al.*, 2016; Abbasi *et al.*, 2018; Alaofè *et al.*, 2021; Mekonnen and Hussien, 2021). Despite different studies used different instruments and/or were carried out among different ethnic or age groups, this study findings are still significant. This study confirms that good knowledge leads to positive attitude and good practice. This study revealed that almost same score of good and poor knowledge, attitude and practice. Among the total study participants in the study, 114 (76%) patients were getting blood pressure checked regularly. This study shows that 61.3% patients did not have periodic eye examination due to lack of awareness. However, the hospital-based cross-sectional study was done by Srinivasan *et al.* (2017) reported that 61.1% of patients did not have periodic eye examination.

Table 4.15 Response to practice related questions

Questions	**Number of patients answering correctly**	**Percent**
When was your blood pressure last checked	114	76
When was your last eye examination?	58	38.7
When was your blood sugar last checked	111	74
When was your last urine examination	119	79.3
When was your last lipids checked?	122	81.3
Last visit to your physician?	113	75.3

4.4 Correlations between knowledge, attitude and practice

When knowledge and attitude score were compared the results revealed knowledge had a very significant positive Pearson correlation with attitude (r=+0.313; P=<0.001). This means that the better respondents were knowledgeable, better the patients had positive attitude towards DM. Therefore, it can be concluded that knowledge can influence attitude towards DM. These finding are in agreement with Fatema *et al.* (2017) who reported that there was a very significant positive correlation between level of knowledge and attitude (r=0.038; P=<0.001) and the study conduct in rural Northen India revealed that there was a significant positive correlation between knowledge and attitude regarding diabetes. In contrast, a study conduct in Kelantan, Malaysia showed that there was no significant Pearson correlation (r=-0.107; P=0.383) between knowledge and attitude levels towards DM (Remali *et al.*, 2019).

This study shows that there was also significant positive Pearson correlation (r=+0.171; P=0.036) between Knowledge and practice, this means that better respondents were knowledgeable, the better they were practices healthy lifestyle. This finding is aligned to previous study which have suggested that there is a positive correlation between knowledge and practice scores (Al-Maskari *et al.*, 2013; Adem *et al.*, 2014; Gupta *et al.*, 2015; Fatema *et al.*, 2017). This finding are not in agreement with Remali *et al.* (2019) who revealed that there was weak insignificant Pearson correlation between knowledge and practice score.

This study also revealed that a significant positive Pearson correlation (r=+0.198; P=0.015) between attitude and practice scores. This means the better patients had positive attitude towards DM, the better they were practices healthy lifestyle modification. Al-Maskari *et al.* (2013) also reported a weak but statistically significant correlation between attitude and practice. A study in Bangladesh also showed as a significant positive correlation between attitude and practice (Fatema *et al.*, 2017). The result found in this study were opposite to the study conducted in Bachok District, Kelantan which reported weak positive non-significant correlation between attitude and practice (Remali *et al.*, 2019).

Table 4.16 Correlation between knowledge attitude and practice scores

Variables	Pearson correlation	P-value	Interpretation
Knowledge and attitude	+0.313	**<0.001****	Positive correlation
Knowledge and practice	+0.171	**0.036****	positive correlation
Attitude and practice	+0.198	**0.015****	Positive correlation

****Correlation is significant at the 0.05 level(2-tailed)

4.5 Association between level of knowledge and Sociodemographic characteristics

In the study total knowledge score of the study participants is categorized into poor or good. The chi-square test showed that age (p=<0.001), gender (p=0.005), ethnicity (p=0.001), education level (p=<0.001), occupation (p=0.012) and family history of diabetes (p=0.047) were significantly associated with the knowledge level regarding diabetes among type 2 diabetic patients in Barahakshetra Municipality as shown in the table 4.16.

The study revealed that participants who were less than 55years old had more good knowledge related to healthy lifestyle modification, complications of diabetes, care of diabetes, healthy diet compared to those who were ≥55 years. The study result was aligned to other studies conducted among T2DM in Palestine by. Shawahna *et al.* (2021), reported that knowledge score was significantly higher for patients who were younger than 55 years old.

Our study finding suggests there was association between level of knowledge and gender of the patients (p=0.005). The result revealed that male respondents had a more knowledge regarding diabetes than females. The possible explanation might be males had more information than females through being an outsiders and having more contact with the social environment. A similar study was done by Fatema *et al.* (2017) in Bangladesh, reported that male patients with T2DM had significantly higher knowledge of their disease compared to female patients.

The ethnic groups significantly influence the knowledge and attitude regarding diabetes among type 2 diabetic patients. This indicates that participants from different ethnic groups tends to have significantly different knowledge concerning diabetes. Brahmin/chhetri and Janjati groups showed higher knowledge compared to others. In study others ethnic groups

included Madhesi and Dalit. This finding is contrary to the previous study was done by Gautam *et al.* (2015) in Nepal and suggested that ethnicity can not impact the knowledge of patients.

Similarly, our finding revealed that educational status of the participants those who were illiterate were less knowledgeable compared with educated participants. This indicates that a highly educated person has high knowledge score about diabetes. A better educated person may be more inquisitive while being counseled or educated on diabetes. In addition, it is possible that educated person could gather more information through different means of communication. i.e. radio, television, articles, magazine, etc. This finding were consistent with the other previous studies were done in Nepal and Cotonou, Southern Benin (Gautam *et al.*, 2015; Alaofè *et al.*, 2021), suggested that educated persons had more good knowledge related to diabetes as compared to those who are illiterate.

Likewise, our study finding also revealed that participants from business and government or private service had more knowledgeable regarding diabetes compared to those with housewife and others. Likewise, another study was conducted in Central Nepal, reported that business person as well as government or private employees had greater score than others (Shrestha *et al.*, 2015). The plausible justification is that business person as well as government or private employees are better educated and have greater contact with education materials. This represents that knowledge is affected by professions of the patients where they are engaged for years.

Our finding suggests association between family history of DM and level of knowledge. The result revealed that patients with family history of DM had more good knowledge as compared to those no family history of DM. It suggests that individuals with a family history diabetes tend to be more aware and informed about the disease. This finding was in agreement with the previous study results was done by Al-Maskari *et al.* (2013), reported that having a family member with diabetes was associated with having good knowledge of diabetes.

No significant association was found between level of knowledge and religion, marital status, monthly income, duration of diabetes and co-morbidities in the study.

Table 4.17 Association between level of knowledge and sociodemographic characteristics

Variables	Poor knowledge	Good knowledge	Chi-square test	P-value
Age			**14.620**	**<0.001*$_a$**
<55	8(10.7%)	67(89.3%)		
≥55	28(37.3%)	47(62.7%)		
Gender			**7.761**	**0.005*$_a$**
Male	10(13.9%)	62(86.1%)		
Female	26(33.3%)	52(66.7%)		
Ethnic group			**13.207**	**0.001*$_b$**
Brahmin/chhetri	7(12.7%)	48(87.3%)		
Janjati	12(20.7%)	46(79.3%)		
Others	17(45.9%)	20(54.1%)		
Religion			1.682	0.195$_a$
Hindu	25(21.5%)	91(78.4%)		
Non-Hindu	11(32.4%)	23(67.6%)		
Education			**26.519**	**<0.001*$_a$**
Illiterate	25(49.0%)	26(51.0%)		
Literate	11(11.1%)	88(88.9%)		
Marital status			0.065	0.757$_a$
Single/Divorced	4(26.7%)	11(73.3%)		
Married	32(23.7%)	103(76.3%)		
Occupation			**12.777**	**0.012*$_b$**
Business	2(11.8%)	15(88.2%)		
Service	2(9.5%)	19(90.5%)		
Housewife	23(38.3%)	37(61.7%)		
Agriculture	4(13.3%)	26(86.7%)		
Others	5(22.7%)	17(77.3%)		

Monthly income			2.214	0.137_a
≤31,000	27(27.8%)	70(72.2%)		
>31,000	9(17.0%)	44(83.0%)		
Duration of DM			3.807	0.149_b
<5years	22(31.0%)	49(69.0%)		
5-10yeras	8(19.5%)	33(80.5%)		
>10years	6(15.0%)	32(84.2%)		
Family history of DM			**3.933**	**$0.047*_a$**
Yes	10(15.9%)	53(84.1%)		
No	26(29.9%)	61(70.1%)		
Co-morbidities				
Yes	14(20.6%)	54(79.4%)	0.794	0.373_a
No	22(26.8%)	60(73.2%)		

* Statistically significant: p-value < 0.05
[a] Tested by Chi-square Test; [b] Tested by Goodness of Fit Test

4.6 Association of level of knowledge and BMI and FBGL

The study showed there was no significant association between knowledge level and BMI. This suggests that knowledge related to diabetes does not significantly influence their BMI.

The study was found no significant association between Fating blood glucose level and knowledge which may be due to lack of proper utilization of their knowledge in their day-to-day life. In this study only 49.3% exercise regularly, 86.7% know about importance of controlled and planned diet and 72.7% miss taking the doses of diabetic medication This represents that only having good knowledge about care of diabetes through exercise, medication and importance of controlled diet and planned diet is not enough to keep the blood glucose level in normal unless it is brought into the regular practice with positive attitude towards it. Similarly, this finding was in aligned to another study conducted in Nepal which revealed that there was no significant association between knowledge and fasting blood glucose levels (Nepal *et al.*, 2017). However, another similar study conducted in Palestine among T2DM was done by

Shawahna *et al.* (2021) revealed that having usual fasting blood glucose level <140mg/dL tended to score more than 50% in the knowledge item.

Table 4.18 Association between level of knowledge and BMI and FBGL

Variables	Poor knowledge	Good knowledge	Chi-square test	P-value
BMI			1.077	0.299
<23	12(30.0%)	28(70.0%)		
≥23	24(21.8%)	86(78.2%)		
FBGL			0.262	0.609
<126	22(22.7%)	75(77.3%)		
≥126	14(26.4%)	39(73.6%)		

*Statistically significant:p-value<0.05

4.7 Association between level of attitude and Sociodemographic characteristics

The study revealed that monthly income was significantly associated with attitude level of diabetic patients (p=0.044) and no significant association were found between attitude level and studied sociodemographic variables such as age, gender, ethnicity, religion, education level, marital status, occupation, duration of diabetes, history of diabetes and co-morbidities.

The study finding showed that participants with an income above 31,000 had more positive attitude as compared to those with an income ≤31,000. This finding was consistent with the previous study conducted in JMC, Ethiopia which reported that significant association was found between attitude and monthly income. This might be because of having a higher monthly income will help to access and afford necessary information related to diabetes that resulted in behavioral change among patients (Mekonnen and Hussien, 2021). Likewise, another similar study was done by Shawahna *et al.* (2021), also reported that patients who had higher income tended to have higher positive attitude towards their DM. This information can help in tailoring educational and support programs to improve attitude towards diabetes management. specially focusing on group that show poorer attitude.

Table 4.19 Association between level of attitude and sociodemographic characteristics

Variables	Poor attitude	Good attitude	Chi-square test	P-value
Age group			0.897	0.344_a
<55	21(28.0%)	54(72.0%)		
≥55	16(21.3%)	59(78.7%)		
Gender			2.032	0.154_a
Male	14(19.4%)	58(80.6%)		
Female	23(29.5%)	55(70.5%)		
Ethnic group			4.039	0.133_b
Brahmin/chhetri	14(25.5%)	41(74.5%)		
Janjati	18(31.0%)	40(69.0%)		
Others	5(13.5%)	32(86.5%)		
Religion			1.398	0.237_a
Hindu	26(22.4%)	90(77.6%)		
Non-Hindu	11(32.4%)	23(67.6%)		
Education			3.123	0.077_a
Illiterate	17(33.3%)	34(66.7%)		
Literate	20(20.2%)	79(79.8%)		
Marital status			0.195	1.000_a
Single/Divorced	3(20.0%)	12(80.0%)		
Married	34(25.2%)	101(74.8%)		
Occupation			6.636	0.156_b
Business	2(11.8%)	15(88.2%)		
Service	5(23.8%)	16(76.2%)		
Housewife	21(35.0%)	39(65.0%)		
Agriculture	5(16.7%)	25(83.3%)		
Others	4(18.2%)	18(81.8%)		

Monthly income			**4.041**	**0.044*$_a$**
≤31,000	29(29.9%)	68(70.1%)		
>31,000	8(15.1%)	45(84.9%)		
Duration of DM			3.393	0.183*$_b$
<5years	22(31%)	49(69.0%)		
5-10yeras	9(22.0%)	32(78.0%)		
>10years	6(15.8%)	32(84.2%)		
Family history of DM			3.036	0.081$_a$
Yes	11(17.5%)	52(82.5%)		
No	26(29.9%)	61(70.1%)		
Co-morbidities			0.087	0.769$_a$
Yes	16(23.5%)	52(76.5%)		
No	21(25.6%)	61(74.4%)		

*Statistically significant: p-value <0.05
$_a$ Tested by Chi-square Test; $_b$ Tested by Goodness of Fit Test

4.8 Association between level of attitude and BMI and FBGL

No significant association between attitude and BMI but such association between attitude and FBGL was found. This suggests that patient's attitude related to diabetes does not significantly influence his/her BMI and patients with lower FBGL (<126) are more likely to have good attitude compared to those with FBGL (≥126). This finding was not aligned to previous study that reported FBGL was not associated with attitude of the patients (Shawahna *et al.*, 2021).

Table 4.20 Association between level of attitude and BMI and FBGL

Variables	Poor attitude	Good attitude	Chi-square test	P-value
BMI			0.835	0.361
<23	12(30%)	28(70.0%)		
≥23	25(22.7%)	85(77.3%)		
FBGL			**9.866**	**0.002***
<126	16(16.5%)	81(83.5%)		
≥126	21(39.6%)	32(60.4%)		

*Statistically significant: p-value <0.05

4.9 Association between level of practice and Sociodemographic characteristics

No significant association were found between practice level and any of the studied sociodemographic factors such as age, gender, ethnicity, religion, education, marital status, occupation, monthly income, family history of diabetes, duration of diabetes and co-morbidities. This finding was supported by the studies was done by Al-Maskari *et al.* (2013), reported that age, sex, family history of diabetes, monthly income or occupation were not significantly associated with practice of the participants.

Table 4.21 Association between level of practice and Sociodemographic characteristics

Variables	Poor practice	Good practice	Chi- square test	P-value
Age group			0.564	0.453[a]
<55	21(28.0%)	54(72.0%)		
≥55	17(22.7%)	58(77.3%)		
Gender			1.076	0.300[a]
Male	21(29.2%)	51(70.8%)		
Female	17(21.8%)	61(78.2%)		
Ethnic group			0.258	0.879[b]
Brahmin/chhetri	13(23.6%)	42(76.4%)		
Janjati	16(27.6%)	42(72.4%)		
Others	9(24.3%)	28(75.7%)		
Religion			0.387	0.534[a]
Hindu	28(24.1%)	88(75.9%)		
Non-Hindu	10(29.4%)	24(70.6%)		
Education			0.183	0.669[a]
Illiterate	14(27.5%)	37(72.5%)		
Literate	24(24.2%)	75(75.8%)		
Marital status			1.269	0.357[a]
Single/Divorced	2(13.3%)	13(86.7%)		
Married	36(26.7%)	99(73.3%)		

Occupation			5.161	0.271[b]
Business	6(35.3%)	11(64.7%)		
Service	8(38.1%)	13(61.9%)		
Housewife	10(16.7%)	50(83.3%)		
Agriculture	8(26.7%)	22(73.3%)		
Others	6(27.3%)	16(72.7%)		
Monthly income			1.021	0.312[a]
≤31,000	22(22.7%)	75(77.3%)		
>31,000	16(30.2%)	37(69.8%)		
Duration of DM			0.708	0.702[b]
<5years	18(25.4%)	53(74.6%)		
5-10yeras	12(38.7%)	29(93.5%)		
>10years	8(21.1%)	30(78.9%)		
Family history of DM			<0.001	0.988[a]
Yes	16(25.4%)	47(74.6%)		
No	22(25.3%)	65(74.7%)		
Co-morbidities			0.794	0.373[a]
Yes	14(20.6%)	54(79.4%)		
No	22(26.8%)	60(73.2%)		

*Statistically significant: p-value <0.05

[a] Tested by Chi-square Test; [b] Tested by Goodness of Fit Test

4.10 Association between level of practice and BMI and FBGL

The study was found that there was no statistically significant association between level of practice and BMI. This indicates that participants across different BMI categories did not show significant differences in their diabetes care practices if they had similar exposure to disease related information. Practice related to management of blood sugar level might be influenced more by general health awareness and education rather than BMI. Similarly, the association between fasting blood glucose level and practice was found statistically significant (p=<0.001). The study revealed that patients with lower fasting blood glucose level (<126) had more good

practice compared to those with higher fasting blood glucose level (≥126). This represents that better controlled-blood sugar levels are strongly associated with more effective diabetes care practices. This finding was consistent to other KAP study among T2DM was done by Shawahna *et al.* (2021), reported that fasting blood glucose levels was associated with practice of patients towards diabetes management and reported that patients with higher fasting blood glucose levels had less practice score.

Table 4.22 Association between level of practice and BMI and FBGL

Variables	Poor practice	Good practice	Chi-square test	P-value
BMI			0.820	0.365
<23	8(20.0%)	32(80%)		
≥23	30(27.3%)	80(72.7%)		
FBGL			**14.137**	**<0.001***
<126	15(15.5%)	82(84.5%)		
≥126	23(43.4%)	30(56.6%)		

*Statistically significant: p-value <0.05

Education regarding diabetes is very important to improve lifestyle of the patients which would be helpful in maintain blood glucose levels (Adem *et al.*, 2014). Diabetic patients develop complications due to lack of mindfulness of the disease and insufficient glycemic control. Hence, patients counselling of diabetics on improving their KAP will have impact on their disease management. The American Diabetes Association has advised that education on self-management is essential to provide diabetic patients with the knowledge and ability that is needed to perform self-care, manage crises and make lifestyle changes (Reddy *et al.*, 2023).

Control of obesity is important for better glycemic control and prevention of diabetes complications (Fatema *et al.,* 2017), but it is evident from the present study that DM do not attain this ideal goal as 73.3% patients were overweight and obese. Knowledge of the patients regarding the importance of self-monitoring of blood glucose and regular blood pressure (BP). In this study half of the patients (51.3%) were aware of the importance of regular checking BP.

Only 49.3% participants exercise regularly. Smoker patients had higher FBGL. Throughout the knowledge assessment we recognized that most of the patients didn't know about the causes of diabetes. smoker patients had higher FBG than compared to those who were non-smokers.

It is important for patients with T2DM to modify their lifestyle, and enhance their knowledge regarding diabetes. However, these changes alone may not lead to significant improvements. Attitude, as a psychological variable, plays a crucial role in bridging the gap between knowledge, practice, thus facilitating lifestyle changes. The key components of lifestyle management include Diabetes-self management education and support, medical nutrition therapy, physical exercise, smoking cessation counselling and physiological care (ADA, 2017). Additionally, regular monitoring of blood sugar levels and blood pressure and maintaining a healthy weight are crucial. Medication should be taken regularly; however, in this study one-fourth of the participants were miss taking the doses of diabetic medication. Regular intake of diabetic medications is important for patients that helps them to prevent complications due to DM. Increased the level of appropriate knowledge, good attitude and appropriate practices among diabetes help to improve the life of the patients through prevention of development of related complications which usually tend to affect the quality of life of the diabetics (Joho *et al.*, 2023).

The finding of this study reaffirms the gaps in knowledge, attitude and practice regarding diabetes. Understanding the study finding results associations helps in designing effective interventions for diabetes management. This study also revealed that patients had uncontrolled glucose levels because of poor attitude or practice which may due to lack of proper utilization of knowledge in their day-to-day life. Possible factors contributing to this poor self-management, lack of motivation, insufficient resources needed for sustained lifestyle modification or behavior change. Collaborative efforts between patients, health care professions along with social support are essential for patients empowerment. This collaboration enhances patients understanding and self-management for their illness effectively. Additionally, ensuring access to resources and fostering a positive attitude towards lifestyle changes are essential for better diabetes management.

Part IV

Conclusion and Recommendation

5.1 Conclusion:

The study assessed the knowledge, attitude and practice of type 2 diabetic patients regarding diabetes. Following are the conclusions drawn from this study:

I. The study revealed that 76% of the participants had good level of knowledge, 75.3% had good attitude and 74.7% had a good practice regarding diabetes and remaining others 26%, 24.7% and 25.3% had poor knowledge, poor attitude and poor practice.

II. Majority of the respondents were obese and overweight (73.3%).

III. 17.3% respondents were currently consumed alcohol and 10% had smoking habits.

IV. Smoking habits was found to be statistically significant with FBGL.

V. The study shows that significant positive correlation between knowledge, attitude and practice. Knowledge enhances the attitude and practice and positive attitude improves health practices for management of blood sugar levels.

VI. Age, gender, ethnicity, education, occupation and history of diabetes were found to be significantly associated with knowledge of type 2 diabetic patients.

VII. Monthly income and FBGL were found to be significantly associated with attitude of type 2 diabetic patients.

VIII. FBGL was found to be significantly associated with practice of type 2 diabetic patients.

5.2 Recommendation:

I. Hospital and community-based health education on self-management and lifestyle intervention programs should be implemented in order to improve KAP of patients regarding glycemic control.

II. Implement educational programs focused on lifestyle changes and raising awareness about diabetes and its risks factors within the general society to effectively prevent onset of diabetes.

Part VI

Summary

Poor dietary habits and sedentary lifestyles are the major factors driving the rapid increase in diabetes incidence in developing countries. Self-management of patients with T2DM largely depends on KAP of such people regarding diabetes. This cross-sectional study was carried out to assess KAP regarding diabetes among type 2 diabetic patients visiting the selected OPD of Barahakshetra Nagar hospital and association it with sociodemographic factors. A total of 150 type 2 diabetic patients, face-to-face interview was done and validated knowledge, attitude and practice (KAP) questionnaire were used to determine knowledge, attitude and practice of diabetic patients and anthropometric measurements were taken. Collected data were analyzed using IBM SPSS version 25. Correlation test was used to assessed the association between KAP scores. Chi-square test was used to analyzed the association of KAP with sociodemographic factors.

Out of 150 T2DM, KAP scores of the patients were assessed as 76%, 75.3%, 74.7% had good knowledge, positive attitude and good practice respectively. Half of the patients 49.3% had no regular exercise and majority were overweight and obesity 110 (73.3%). 64.7% respondents had normal FBGL. 17.3% had drink alcohol and 10% had smoking habits. Study reported 78 (52%) were females and 72 (48%) were males. Majority were housewife 60 (40.0%). Additionally, the study revealed that positive correlation between KAP regarding diabetes. Majority of T2DM patients had good knowledge, positive attitude and good practice regarding diabetes. Knowledge level, regarding diabetes was associated with age, gender, ethnicity, education, occupation and family history of diabetes; Attitude was associated with monthly income and FBGL. Similarly, only FBGL was significantly associated with practice.

In conclusion, study finding underscores the need for targeted educational interventions to improve diabetes-related knowledge, attitude and practices across different demographic groups for better health outcome. Public health promotion activities aimed at preventing diabetes should be tailored to enhance knowledge about diabetes prevention and also create lifestyle intervention program to improve knowledge, attitude and practice.

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Appendices

Appendix A: Informed consent

Namaste!

I am Asmita Tamang, undergraduate student in Department of Nutrition and Dietetics conducting a dissertation work for award of bachelor's degree in Nutrition and Dietetics.

The topic for the study is **"Knowledge, attitude and practice regarding diabetes among type 2 diabetic patients In Barahakshetra Municipality, Sunsari"**.

I have been told in a language that I understand about the study. I have been told that this is for a dissertation procedure; me and my participations is voluntary and I reserve the full right to withdraw from the study at my own initiative at any time without having to give reason. Confidentiality will be maintained and only shared for academic purpose.

I hereby give consent to participate in the above study. I am also aware that I can withdraw this consent at any later date, if I wish to. This consent form being signed voluntarily indicates participate in the study until I decide otherwise. I understand that I will receive a signed and dated copy for this form. I have signed this consent forms before my participation in the study.

Signature of participants:_____ Sign of witness:_____

Date: Date:

Place: Place:

I hereby state the study procedure were explained in the detail and all questions were fully and clearly answered to the above mentioned participant/his/her relative.

Investigator's sign:_____

Date:

Contact address:

Appendix B: Questionnaire

Part 1: Demographic, socioeconomic, clinical and behavioral variables of the participants

1. Name of the patient:_____
2. Age:_____
3. Gender:

   Male ( ) Female ( ) others ( )
4. Address:_____
5. Ethnic Group:_____
6. Religion:

   a) Hindu b) Buddhist c) Kirat d) Others
7. Education

   a) Illiterate b) Primary level c) Secondary level

   d) Intermediate e) University Degree
8. Marital Status

   a) Single c) Divorced/separated

   b) Married d) Widowed
9. What is your Occupation:

   a) Business c) Agriculture e) Retired

   b) Service d) Housewife f) Other
10. Total annual income of the family:

    a) ≤10,000 c) 21,000-30,000

    b) 11,000-21,000 d) More than 31,000
11. Does anybody in your family have diabetes?

    a) Yes b) No
12. Anthropometric measurements:

    Height: cm; Weight: Kg; BMI:

    a) Underweight c) Overweight

    b) Normal d) Obese

13. How long have you been suffering from diabetes?
    a) Less than 5 years
    b) 5-10 years
    c) More than 10 years
14. Does anybody in your family have diabetes?
    a) Yes
    b) No
15. Co-morbidities:
    a) Present
    b) Absent
16. Current fasting blood glucose levels (obtained from patients record)

    FBG: _____ mg/dL
17. Do you drink alcohol?
    a) Yes
    b) No
18. Smoking Habits
    a) Yes
    b) No

Part 2: Knowledge related questions

1. Diabetes is a condition in which body contains
    a) A higher level of sugar in the blood than normal
    b) A lower level of sugar in the blood than normal
    c) Either higher or lower level of sugar in the blood
    d) I don't know
2. The major cause of diabetes is:
    a) an increased the availability of insulin in the body
    b) a decreased the availability of insulin in the body
    c) I don't know
3. The symptom(s) of diabetes is/are:
    a) Increased frequency of urination
    b) Increased thrust and hunger
    c) Slow healing of wounds
    d) Weight loss
    e) All of the above
    f) I don't know
4. The most accurate method of monitoring diabetes is:
    a) Checking blood glucose level
    b) Checking urine sugar
    c) I don't know

5. Diabetes, if not treated:
    a) Can lead to eye problems
    b) Can lead to heart problems
    c) Can lead to kidney problems
    d) Can lead to foot ulcers
    e) All of above
    f) I don't know
6. In a diabetic patient, high blood pressure can increase or worsen:
    a) The risk of heart attack
    b) The risk of stroke
    c) The risk of eye problems
    d) The risks of kidney problems
    e) All of above
    f) I don't know
7. A diabetic patient should measure his/her blood pressure:
    a) Once a year
    b) Once every six months
    c) Once every two months
    d) Once every month
    e) Need not to check at all
    f) I don't know
8. The lifestyle modification(s) required for diabetic patients is/are:
    a) Weight reduction
    b) Stopping smoking
    c) Stopping alcohol intake
    d) Regular exercise
    e) All of above
    f) I don't know
9. A diabetic patient should have his/her eyes checked:
    a) Once a year
    b) Every six months
    c) Need not to check at all
    d) I don't know
10. The regular urine test will help in knowing:
    a) The status of liver function
    b) The status of kidney function
    c) The control of diabetes
    d) I don't know
11. The important factor that help in controlling sugar is/are:
    a) A controlled and planned diet
    b) Regular exercise
    c) Medication
    d) All of above
    e) None
12. A well-balanced diet include:
    a) Green-leafy vegetables
    b) Fiber-rich foods
    c) Low sugar, Oil and fat
    d) All of above
    e) I don't know

13. For a proper foot care, a diabetic patient:
    a) Should inspect and wash the feet daily
    b) Should select the best possible footwear
    c) Should walk barefoot inside and outside the house
    d) Should not walk barefoot inside and outside the house
    e) I don't know
14. What should be done in case of hypoglycemic symptoms:
    a) Eat sugar/glucose/any sweet
    b) Take medication
    c) Take insulin
    d) I don't know

Part 3: Attitude related questions

1. Do you exercise regularly?

a) Yes
b) No

if yes, how often?

a) Everyday
b) 2-3 times in a week
c) Once week
d) Once month

2. Do you think that following a controlled (low sugar) and planned diet will help to improve diabetes?
    a) Yes
    b) No
3. Do you miss taking the doses of your diabetic medication?
    a) Yes
    b) No

    If yes, how often?

    a) Occasionally
    b) Once a week
    c) Once a month
4. Are you aware of your blood sugar levels fall below normal (hypoglycemia) when you are taking drugs?
    a) Yes
    b) No

    If yes, did you at any time experience any of the following symptoms?

    a) Weakness
    b) Confusion

c) Visual disturbances
d) I don't know

5. Do you think you should keep in touch with your physician?
   a) Yes
   b) No

Part 4: Practice related questions

1. When was your blood pressure checked last?
   a) One week ago
   b) Two months ago
   c) Six months ago
   d) One year ago
   e) Not done at all
2. When was your last eye examination?
   a) One month ago
   b) Six months ago
   c) One year ago
   d) Two years ago
   e) Not done at all
3. When was your blood sugars last checked?
   a) One month ago
   b) Six months ago
   c) One year ago
   d) Two years ago
   e) Not done at all
4. When was your last urine examination?
   a) One month ago
   b) Six months ago
   c) One year ago
   d) Two years ago
   e) Not done at all
5. When was your lipids last checked?
   a) One month ago
   b) Six months ago
   c) One year ago
   d) Two years ago
   e) Not done at all
6. Last visit to your physician.
   a) One month ago
   b) Six months ago
   c) One year ago
   d) Not met at all

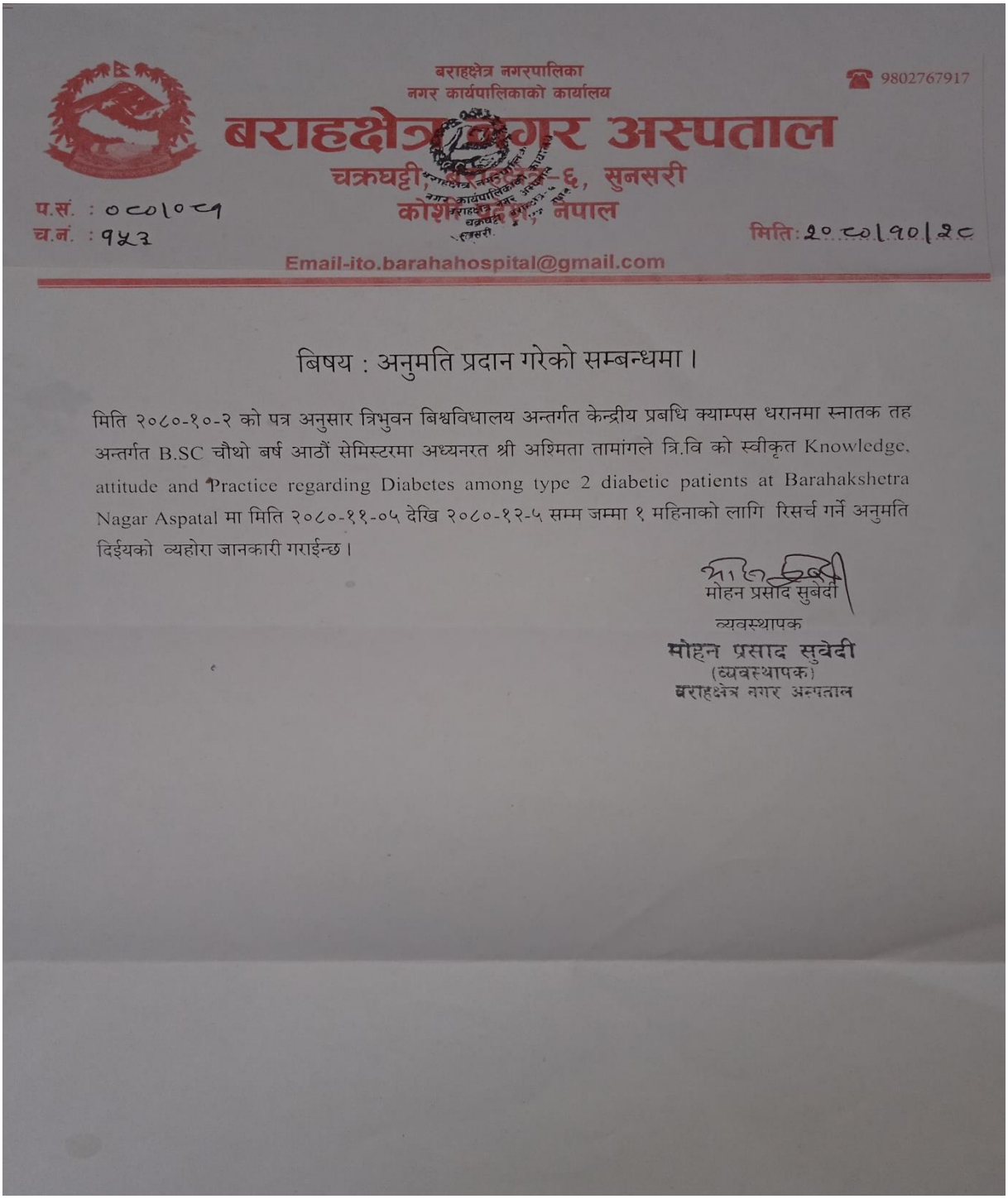
Appendix C: Photo gallery

Picture 1: Asking survey questionnaire

Picture 2: Measurement of weight

Picture 3: Measurement of height

Appendix D: Permission letter



बराहक्षेत्र नगरपालिका
नगर कार्यपालिकाको कार्यालय

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मिति: २०८०।१०।२८

बिषय : अनुमति प्रदान गरेको सम्बन्धमा ।

मिति २०८०-१०-२ को पत्र अनुसार त्रिभुवन बिश्वविधालय अन्तर्गत केन्द्रीय प्रबधि क्याम्पस धरानमा स्नातक तह अन्तर्गत B.SC चौथो बर्ष आठौं सेमिस्टरमा अध्यनरत श्री अश्मिता तामांगले त्रि.वि को स्वीकृत Knowledge, attitude and Practice regarding Diabetes among type 2 diabetic patients at Barahakshetra Nagar Aspatal मा मिति २०८०-११-०५ देखि २०८०-१२-५ सम्म जम्मा १ महिनाको लागि रिसर्च गर्ने अनुमति दिईयको व्यहोरा जानकारी गराईन्छ ।

मोहन प्रसाद सुबेदी
व्यवस्थापक

मोहन प्रसाद सुबेदी
(व्यवस्थापक)
बराहक्षेत्र नगर अस्पताल

Appendix E: Map of the study area