KNOWLEDGE, ATTITUDE AND PRACTICE OF TYPE 2 DIABETIC PATIENTS VISITING SELECTED OUTREACH CLINICS OF DHARAN

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Knowledge, Attitude and Practice of Type 2 Diabetic patients visiting selected outreach clinics of Dharan

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Approval Letter

This ***dissertation*** entitled ***"Knowledge, Attitude and Practice of Type 2 Diabetic Patients Visiting Selected Outreach Clinics of Dharan"*** presented by **Susmita Basnet** has been accepted as the partial fulfillment of the requirement for the **B.Sc. degree in Nutrition and Dietetics.**

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Susmita Basnet

Abstract

This cross sectional descriptive study was carried out with the objective to assess the knowledge, attitude and practice of type 2 diabetic patients visiting the selected outreach clinics of Dharan. A total of 90 respondents were selected by using convenience sampling method. A face-to-face interview using a structured questionnaire was carried out for data collection which incorporated info on socio-demographic characteristics. Anthropometric measurements were taken to obtain the body mass index and obesity status among the participants. The participants of the study were from the age group 27-89 years. Among 90 participants, 66.7% had been suffering from diabetes for more than 3 years with 32.2% having genetic history. The percentage of overweight and obese people was 73.3% and only 50% had blood glucose level under control.

60% of the respondents had good knowledge whereas 75.6% had positive attitude and good practices. Among socio-demographic variables, religion and education level were found to be significantly correlated with knowledge, attitude and practice score. Non-hindu patients were 3.7 times more likely to have good score as compared to Hindu while literate were 4.7 times more likely to have good knowledge, attitude and practice than illiterate. In overall, this study revealed good knowledge, positive attitude and good practice among patients but can't be said to the satisfactory level. Well-designed educational programs and health interventions needs to be planned and implemented targeting diabetics to increase the awareness and to bring positive attitude along with behavior change.

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Abbreviations	Full form
AOR	Adjusted odds ratio
BMI	Body mass index
CAD	Coronary artery disease
CI	Confidence interval
COR	Crude odds ratio
CVD	Cardiovascular disease
DCCT	Diabetes control and complications trial
DCM	Diabetic cardiomyopathy
DKA	Diabetic ketoacidosis
DM	Diabetes mellitus
DN	Diabetic nephropathy
DR	Diabetic retinopathy
ESRD	End-stage renal disease
FBG	Fasting blood glucose
FFA	Free fatty acid
FPG	Fasting plasma glucose
FY	Fiscal year
GFR	Glomerular filtration rate
GL	Glycemic load
HDL	High-density lipoprotein
HHS	Hyperosmolar hyperglycemic state
HTN	Hypertension
IDDM	Insulin dependent diabetes mellitus
IRC	Institutional review committee
KAP	Knowledge, attitude and practice
LADA	Latent auto immune diabetes of adults
LDL	Low-density lipoprotein
LMIC	Low and middle income country
NCD	Non-communicable disease
NDCP	National diabetic control program

NGSP	National glycohemoglobin standardization program
NHS	Nurses health study
NIDDM	Non-insulin dependent diabetes mellitus
OGTT	Oral glucose tolerance test
PN	Polyneuropathy
Ref.	Reference
SPSS	Statistical packages for the social sciences
T2DM	Type 2 diabetes mellitus
TV	Television
UK	United kingdom
VLDL	Very-low-density lipoprotein
WHO	World health organization
2-h PG	2 hour plasma glucose

Part I

Introduction

1.1 General introduction

Diabetes mellitus is a metabolic disorder of multiple etiological factors characterized by chronic hyperglycemia with disturbance of carbohydrate metabolism which resulted from either insufficient insulin secretion, resistance to the action of insulin or both (Alberti *et al.*, 2005). It is a medical problem that can affect individual's health through involvement of several body systems. With its inevitable complications, a diabetic patient may end up crippled in a way or another, for instance: losing sight, having leg amputation, hooked up on hemodialysis machine, or suffering from congestive cardiac failure due to coronary artery disease (CAD) (Al-Nozha *et al.*, 2004).

Diabetes mellitus may be categorized into several types but the two major types are type 1/IDDM (Insulin Dependent Diabetes Mellitus) and type 2/NIDDM (Non-Insulin Dependent Diabetes Mellitus) (Lindblad *et al.*, 2011). Type 1 diabetes is characterized by deficient insulin production and requires daily administration of insulin. Neither the cause of Type 1 diabetes nor the means to prevent it are known (WHO, 2021b).Type 2 diabetes mellitus (T2DM) is one of the most common non-communicable diseases in the world and its prevalence is continuously increasing among developing countries (Cho *et al.*, 2018). Type 2 Diabetes makes up about 90% of the diabetes cases. Some data indicate rates are roughly equal in women and men, but male excess in diabetes has been found in many populations with higher type 2 incidence (Paudel, 2017).

Knowledge, attitude and practice regarding diabetes vary greatly depending on socioeconomic conditions, cultural beliefs, education level, religion, personal habits, and from one country to another. Understanding these variables is important in designing prevention and management strategies for diabetes (Satia-Abouta, 2003). In the last decade, there has been an extraordinary increase in the prevalence of T2DM, mostly among young people (Haddad and Haddad, 2018). Sound knowledge, the right attitude and correct practices are the backbone of self-control in T2DM patient. A significant knowledge practice gap needs attention (Alsunni *et al.*, 2020). A patient's self-empowerment approach to

diabetes care may enhance the efficiency of DM prevention and control programs in countries experiencing DM as a major public health problem (Ng *et al.*, 2012).

Appropriate educational program can have effect on the attitude of the people about diabetes (Badruddin *et al.*, 2002). Diabetes knowledge is vital in developing diabetes related healthful attitudes which enhance the self-care skills of patients (Kambar and Jali, 2007). Diabetes education can improve glycemic control and quality of life of diabetic patients (Maina *et al.*, 2010). Knowledge acquired through culturally oriented diabetes education programs can create awareness and understanding of the disease among patients. This awareness and understanding can strengthen motivation and self-care, improve the clinical outcomes, and reduce the cost of treatment of diabetes by preventing complications. It has been recognized that health promotion, based on common knowledge and perceptions regarding chronic diseases such as diabetes, is an essential component of any strategy aimed at disease control and prevention (Saleh *et al.*, 2016).

1.2 Statement of the problem and justification

Diabetes mellitus is becoming more prevalent in developing countries as a result of high-energy diets and sedentary lifestyles. The problem is further expanded due to ignorance and lack of knowledge. There was poor knowledge, attitude and practice about the diabetes (Kant *et al*., 2015). Improved knowledge can bring positive changes in the attitudes and practices thus leading to better management of the disease and better health outcomes (Malekzadeh *et al.*, 2016). Also, participation of patients is very crucial in the management of diabetes mellitus as medications alone aren't enough to manage the disease (Siminerio *et al.*, 2011). The objective of the study is to find out the knowledge, attitude and practice profile of the patients suffering from diabetes visiting the clinics in Dharan.

Diabetes cases have been rapidly registered in hospitals of Nepal, with 1,99,113 cases as of FY 2017/18 (MOHP, 2017/18). Lack of knowledge of diabetes care among patients can have adverse effects on their capabilities to control diabetes. Awareness of measures to identify primary complications of diabetes, such as blood pressure monitoring, periodic eye examination were poor, which reveals the need for some aspects to be focused in diabetes education programs (Mohammadi *et al.*, 2015). However, very few studies have focused on this area and there is a scarcity of data on diabetic patients' knowledge, attitudes, and practice (KAP).

Diabetes is causing high wastage of life and resources (Zaki and Albarraq, 2014). The lack of knowledge about diabetes is deteriorating clinical outcomes and increasing complications in diabetic patients (Rayappa *et al.*, 1999). The patient with Type 2 diabetes mellitus should undergo behavioral modification to develop positive attitude and healthy lifestyle (Shrestha *et al*., 2019). However, patients' lack of knowledge about diabetes care limits patients' ability to improve diabetes control through self-management (Gautam *et al.*, 2015). Diabetic patients develop complications due to poor awareness regarding the disease and inadequate glycemic control (Malathy *et al.*, 2011). Deficiency in knowledge of diabetes patients may be one of the obstacles to developing an active and dependable role in their self-management of the disease (Saleh *et al.*, 2016).

There is lack of public awareness regarding DM in Nepal where, medical services are also poor (Mangi et al., 2018). Diabetic patients visit the clinic for blood glucose measurement whenever they feel it is needed. This attitude and practice of people hampers their overall health and increases the complications. These observations raised the concern about the knowledge, attitude and practice of diabetic patients, which this study seeks to explore and document. Since there was no similar study in the area, this information gap could be answered by this study.

1.3 Objectives of the study

1.3.1 General objective

This cross-sectional study aims to assess the knowledge, attitude and practice of Type 2 diabetic patients with regard to their disease in selected outreach clinics of Dharan.

1.3.2 Specific objectives

a) To assess the knowledge, attitudes and practices of Type 2 diabetic patients visiting selected outreach clinics of Dharan.
b) To co-relate knowledge, attitude and practice with socio-demographic characteristics of the patients.
c) To assess the relation between knowledge, attitude and practice and fasting blood glucose level.
d) To assess the relation between knowledge, attitude and practice and body mass index (BMI).

1.4 Research Questions

a) How is the knowledge of Type 2 diabetic patients regarding Diabetes?
b) What is the attitude and practice status of diabetic patients about the care of type-2 diabetes?

1.5 Significance

a) The results from this study can serve as helpful guide to government and voluntary institution like NGOs and INGOs to plan suitable nutritional and health programs for the diabetic patients of this community based on the facts and figures discovered from this study.
b) It can contribute as reference in the future for evaluating quality of type 2diabetic care for community people and provide insight related to type 2 diabetic patients health action at local and district level.

1.6 Limitations

a) As this is a cross sectional study, KAP might be greatly influenced by socio-demographic factors of the population.

Part II

Literature Review

2.1 Background

While communicable diseases remain an important public health issue in low- and middle-income countries (LMICs), the rising burden of non-communicable diseases (NCDs) and their risk factors poses a double burden on health systems (Boutayeb, 2006). Diabetes is increasingly becoming a significant public health problem worldwide. In 2019, the global prevalence of diabetes was projected at 9.3 percent (463 million people), increasing to 10.2 percent (578 million) by 2030 and 10.9 percent (700 million) by 2045 (Federation, 2019). Furthermore, LMICs not only have higher predicted increases in prevalence rates, but people diagnosed with diabetes living in LMICs also have worse blood glucose control compared to those living in high-income countries (Whiting *et al.*, 2011).

In south-east Asia, an estimated 88 million people were affected by DM. This number is expected to rise to 115 million by 2035 and 153 million by 2045 (Federation, 2019). The prevalence of T2DM and pre-diabetes in Nepal was estimated to be 10% and 19.4% respectively (Shrestha *et al*., 2021) . Very little is known about the burden of diabetes and pre-diabetes, treatment and control across provinces of Nepal. There was a wide variation in diabetes prevalence across the provinces in Nepal, the lowest 2% in Province 6 to the highest 10% in Province 3 and Province 4 (Shrestha *et al*., 2020). Overall 5.8% of adults had raised blood sugar based on the criteria of fasting blood glucose ≥ 126 mg/dl (Dhimal M *et al.*, 2020). The Nepalese health system is struggling to deliver comprehensive, quality treatment and services for diabetes at all levels of health care. Several challenges in diabetes management were identified, including high cost of treatment, limited health care facilities, and lack of disease awareness among patients. No specific guideline was identified for the prevention and treatment of diabetes in Nepal (Gyawali *et al.*, 2016).

Problems associated with DM can be minimized by early diagnosis and proper management. The primary aim of management of DM is to delay the macro and microvascular complications by achieving optimal glycemic control (Nathan *et al.*, 2009). This involves lifestyle modification, including regular exercise, healthy diet and weight loss, and drug therapy. Therefore, health literacy is an integral part of the diabetes management.

Patients with good knowledge on diabetes and its complications seek proper treatment and care, and take charge of their health (Shrivastava *et al.*, 2013). There is strong evidence that individuals who are educated and diligent with their diabetes self-care achieve better and durable diabetic control (Powers *et al.*, 2017). Furthermore, previous studies on knowledge, attitude and practice (KAP) on diabetes have supported the needs of greater awareness of prevention, diagnosis, and risk factor control in diabetes (Upadhyay *et al.*, 2012).

2.2 Diabetes mellitus

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood sugar. Hyperglycemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels (WHO, 2021a).

The medical term 'Diabetes Mellitus' is derived from the Greek words 'syphon' and 'sugar', describing symptoms of uncontrolled diabetes, passing huge amounts of urine containing sugar-glucose. Diabetes is a condition characterized by high blood sugar (glucose) levels due to a lack or insufficient production of a hormone called insulin in the body. Insulin is responsible for decreasing the blood sugar levels and aids in producing energy for the cells. Without enough insulin, glucose obtained from the food builds up in the blood stream leading to a hike in blood sugar levels above than the normal limits. This causes many health complications (Nagarathna *et al.*, 2015).

Although diabetes is a common disease, its pathogenesis remains unclear, probably due to a host of reasons. Perhaps the most important is the heterogeneity of type 2 diabetes because of an interplay between a variety of genetic and environmental factors. Although the diagnosis rests on documentation of hyperglycemia, it is important to appreciate that other metabolic abnormalities, such as disorders of lipid metabolism, are also present and may even precede the emergence of hyperglycemia (Fonseca and John-Kalarickal, 2010).

2.3 Diagnostic criteria for diabetes

Diabetes may be diagnosed based on A1C criteria or plasma glucose criteria, either the fasting plasma glucose (FPG) or the 2-h plasma glucose (2-h PG) value after a 75-g oral glucose tolerance test (OGTT). The same tests are used to both screen for and diagnose

diabetes. Diabetes may be identified anywhere along the spectrum of clinical scenarios: in seemingly low-risk individuals who happen to have glucose testing, in symptomatic patients, and in higher-risk individuals whom the provider tests because of a suspicion of diabetes. The same tests will also detect individuals with pre-diabetes (ADA, 2014).

i. A1C $\geq$ 6.5%: The test should be performed in a laboratory 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 $\geq$ 126 mg/dL (7.0 mmol/L): Fasting is defined as no caloric intake for at least 8 hour.*
iii. 2-hour PG $\geq$ 200 mg/dL (11.1 mmol/L) during an 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 $\geq$ 200 mg/dL (11.1 mmol/L).

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

2.4 Symptoms of diabetes mellitus

Disturbed metabolism of carbohydrates, protein and fat brings about many symptoms. Polyuria or frequent and large outflow of urine occurs because of the large amount of glucose content in the kidneys. Polydipsia or excessive thirst is another cause because of great loss of body fluids in the urine. Dehydration may occur if fluid is not taken in polyphagia or increased appetite results from the inefficiency of the body to utilize carbohydrate foods. General weakness and loss of body weight takes place because of the depletion of body fat to energy purposes. Decreased resistance to infection especially staphylococcal infection, and tuberculosis, occur in poorly regulated cases of diabetes. Delayed wound healing occurs because of high blood sugar and oedema. Degenerative changes like peripheral neuritis, retinisis, diseases of coronary arteries and atherosclerosis are symptoms of advanced cases or poorly adjusted diabetes. Ketosis or acidosis is another symptom because of high depletion of fat from the body. Urine changes show certain biochemical indices. Glycosuria and ketonuria are common (Begum, 2008).

2.5 Types of diabetes mellitus

Diabetes mellitus can be categorized into several types but there are two major types: Type 1/IDDM (Insulin Dependent Diabetes Mellitus) and type 2/NIDDM (Non-Insulin Dependent Diabetes Mellitus) (Massoud and Massoud, 2012).

2.5.1 Type I diabetes mellitus

In type 1 DM, also known as juvenile onset diabetes, patients depend on insulin. There is usually sudden onset and occurs in the younger age group and there is an inability of pancreas to produce adequate amount of insulin. This may be caused by virus or due to autoimmunity. The child is usually underweight. Acidosis is fairly common. In older groups there is slower onset of the disease which is referred as latent auto immune diabetes of adults-LADA (Srilakshmi, 2014).

2.5.2 Type II diabetes mellitus

Type 2 diabetes mellitus (adult onset diabetes), is not insulin dependent form, and develops slowly and usually milder and more stable. Insulin may be produced by pancreas but action is impaired. This form occurs mainly in adults and the person is usually overweight. Acidosis is infrequent. The majority of patients improve with weight loss and are maintained on diet therapy. Women who have had large babies or large families are prone to develop this type of diabetes later in life.

By far the majority of people worldwide have type 2 diabetes mellitus. This is characterized by insulin resistance with insulin deficiency (Srilakshmi, 2014).

2.6 Risk factors for Type 2 diabetes mellitus

Although the impact of diabetes is largely a function of both social determinants of health and genetic predisposition, there are various factors that are responsible for the cause of diabetes (Dowell *et al.*, 2018).

2.6.1 Irreversible risk factors

The following section deals with important risk factors for the development of type 2 diabetes, which are based on inherent genetic or developmental factors, which are not modifiable by dietary and/or other lifestyle changes:

Age

There is a clear association between increasing age and higher diabetes prevalence, from 9.0% aged 45 to 54 to 23.8% aged 75 years and over (Axford et al., 2015). However, the incidence of DM is starting to rise at a younger age. Compared with Western populations, Asians develop diabetes at younger ages (Chan *et al.,* 2009). Most people with diabetes in developed countries are above the age of retirement, and hence there is less impact on their productivity (Boutayeb *et al.*, 2012).

Gender

The prevalence and incidence of type 2 diabetes vary to some extent between the sexes from one population to another (Steyn *et al.*, 2004). Some data indicate rates are roughly equal in women and men, but male excess in diabetes has been found in many populations with higher type 2 incidence, possibly due to sex-related differences in insulin sensitivity, consequences of obesity and regional body fat deposition, and other contributing factors such as high blood pressure, tobacco smoking, and alcohol intake (Paudel, 2017). Asian women are also at greater risk of gestational diabetes, thereby putting their children at risk for type 2 diabetes later in life (Hu, 2011).

Race

The prevalence of type 2 diabetes mellitus varies considerably among populations of different ethnic origins living in apparently similar environments (Steyn *et al.*, 2004). In Singapore, the frequency of diabetes in 1992 was 8.5–7.7% in Chinese men and women aged 18–69, compared with Asian Indians and Malays whose frequency of diabetes was 13.3 and 12.3%, respectively (Hong *et al.*, 2004). 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 (Gujral et al., 2013).

In the UK, where the majority of research on ethnicity-based risk for diabetes originates, people of South Asian descent (Indian, Pakistani and Bangladeshi) have prevalence rates of diabetes that are 3-6 times that of the white, British population (Creatore, 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 Polynesian origin, have higher prevalence than other ethnic groups While environmental factors undoubtedly account for some of these differences, they are likely also to reflect inherent ethnic in susceptibility to the diseases (George *et al.,* 2014).

Heredity

Genetics play a strong role in the chances of developing both type- Ⅰ and type- Ⅱ diabetes (Scott *et al.*, 2014). The risk of developing diabetes is affected by whether parents or siblings have diabetes. For Type 2 diabetes, if either mother or father has diabetes, it increases risk of diabetes by 15%; if both mother and father have diabetes, it increases risk by 75%. If non-identical twin has diabetes, this increases risk by 10% and if identical twin has diabetes, it increases risk by 90% (Nagarathna *et al.*, 2015). The greatest risk of type 2 diabetes was observed in those with a bi-parental history of type 2 diabetes and those whose parents had been diagnosed with diabetes at a younger age (UK, 2013). The study done in tertiary care teaching hospital in India showed 30% had a family history of diabetes (George *et al*., 2017).

2.6.2 Reversible risk factors

While some things that contribute to the development of diabetes are beyond a person's control, there are also a number of modifiable risk factors. By making healthy changes in these areas, people can reduce their risks or delay the development of diabetes and improve their overall quality of life.

Overweight/Obesity

The WHO defined obesity and overweight as abnormal or excessive fat accumulation that may impair health (WHO, 2021c).

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

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

Source: (WHO, 2000)

The increase in the prevalence of type 2 diabetes is closely linked to the upsurge in obesity. It is estimated that about 90% of T2DM is attributable to excess weight (Hossain *et al.*, 2007). There are 2.19 times higher odds of having T2DM if the body mass index is ≥ 24.9 kg/m^2 (Shrestha *et al.*, 2021). The pathophysiology connecting obesity and diabetes is chiefly attributed to two factors: insulin resistance and insulin deficiency (Hossain *et al.*, 2007). Overweight and obesity lead to insulin resistance by at least four mechanisms, namely: inflammation in adipose tissue, resulting in cytokine production; oxidative stress; lipotoxicity; and altered microbiome in the gut (Bellamkonda, 2019).

Both insulin resistance and insulin deficiency may present genetic implications in the development of the diabetes of the obese (Gerich, 1998). Compared with Western populations, Asians develop diabetes at lower degrees of obesity, and at much higher rates given the same amount of weight gain (Chan *et al.*, 2009). By 2025, there are reports that obesity, which is related to diabetes, would rise to an alarming number of 300 million (Leitner *et al.*, 2017).

Diet

Excessive caloric intake is a major driving force behind escalating obesity and type 2 diabetes epidemics worldwide, but diet quality also has independent effects (Hu, 2011). In the Nurses' Health Study (NHS), it was 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 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 (Ristic-Medic *et al.*, 2017). 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). Similarly, higher meal frequency without excessive carb intake is valuable lifestyle habits for people with diabetes (Elsamma, 2021).

Physical activity

Physical activity is recognized to produce multiple general and diabetes-specific health benefits (Hayes et al., 2008). Numerous epidemiologic studies show that increased physical activity reduces risk of diabetes, whereas sedentary behaviors increase risk (Hu, 2011). In the Nurses' Health Study (NHS), each 2-h/day increment of time spent watching television (TV) was associated with a 14% increase in diabetes risk. Each 2-h/day increment of standing or walking around at home was associated with a 12% reduction in risk. Each 1-h/day increment of brisk walking was associated with a 34% reduction in risk (Hu *et al.*, 2003).

Smoking

Cigarette smoking is an independent risk factor for type 2 diabetes. Although smoking is known to decrease body weight, it is associated with central obesity (Canoy *et al.*, 2005). Smoking also increases inflammation and oxidative stress (Morrow *et al.*, 1995), to directly damage β-cell function and to impair endothelial function (Noma *et al.*, 2005). Smoking increases the risk of developing diabetes, and aggravates the micro and macro-vascular complications of diabetes mellitus (Chang, 2012). A meta-analysis found that current smokers had a 45% increased risk of developing diabetes compared with non-smokers (Willi *et al.*, 2007). Moreover, there was a dose-response relationship between the number of cigarettes smoked and diabetes risk (Hu, 2011). In the guidelines from the Korean Diabetes Association, smoking cessation is recommended as one of the most important steps in preventing the cardiovascular complications of diabetes (Ko *et al.*, 2011).

Alcohol use

Light-to-moderate alcohol consumption is associated with reduced risk of diabetes (Hu, 2011). A meta-analysis of 3,70,000 individuals with 12 years of follow-up showed a U-shaped relationship, with a 30–40% reduced risk of the disease among those consuming 1–2 drinks/day compared with heavy drinkers or abstainers. The risk of diabetes among those who consumed three or more drinks/day was similar to that of abstainers (Koppes *et al.*, 2005). 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 caloric intake and obesity, increased triglyceride levels, pancreatitis, disturbance of carbohydrate and glucose metabolism, and impairment of liver function (Koppes *et al.*, 2005).

Hypertension

Hypertension (HTN) is another risk factor associated with type 2 DM. Its prevalence in diabetic patients is almost double as compared to non-diabetics (Mogre *et al.*, 2014). Insulin resistance in the type II diabetic individual may play a role in the pathogenesis of hypertension (Epstein *et al.*, 1992). The presence of HTN expedites the development of complications in a diabetic patient like stroke, myocardial infarction, retinopathy, neuropathy, and nephropathy. The concomitant presence of HTN increases the mortality and morbidity in a diabetic patient (Epstein *et al*., 1992). More than 65% of deaths in patients with diabetes are from CVD (Eguchi, 2015).

Stress

Stress is a potential contributor to chronic hyperglycemia in diabetes. Stress has long been shown to have major effects on metabolic activity. Stress stimulates the release of various hormones, which can result in elevated blood glucose levels. Although this is of adaptive importance in a healthy organism, in diabetes, as a result of the relative or absolute lack of insulin, stress-induced increase in glucose cannot be metabolized properly (Surwit *et al.*, 1992). In a large population-based cross-sectional study of glucose intolerance, Mooy et al. demonstrated an association between stressful experiences and the diagnosis of type 2 diabetes, also taking other factors into account, such as alcohol consumption, physical activity level, and education (Mooy *et al.*, 2000). Bjorntop has attempted to explain the

physiological links between stressful experiences and the onset of diabetes. He argues that the psychological reaction to stressors of defeatism or helplessness leads to various endocrine abnormalities that antagonize the actions of insulin (Björntorp, 1997). At the same time, an increase in visceral adiposity (increased girth) is seen, which plays an important role in diabetes by contributing to insulin resistance (Björntorp, 1991).

2.7 Metabolic Disturbances in Type 2 diabetes

Hyperglycemia is often accompanied by increased levels of the gluconeogenic precursors, lactate, alanine, pyruvate, and glycerol. Lipolysis is often increased, particularly in obese patients and those with poor insulin secretion resulting in elevated fasting and postprandial plasma free fatty acid (FFA) levels and increased hepatic VLDL production. Under normal circumstances enough insulin is present to prevent unrestrained lipolysis and the development of ketoacidosis, but ketoacidosis may develop during intercurrent illness (trauma, severe infection, myocardial infarction) because of increased counter-regulatory hormone levels. Dyslipidemia in type 2 diabetes, like the abnormalities of glucose metabolism, may be related to a combination of insulin resistance and inadequate insulin secretion (Fonseca *et al.*, 2010).

2.8 Complications of diabetes mellitus

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 complications (Diabetes UK, 2021).

2.8.1 Acute complications

Acute complications of Type I or Type II Diabetes Mellitus (DM) can arise over hours to days in individuals and result from absolute or relative insufficiency of insulin. Acute complications are highly serious and in the absence of treatment can rapidly result in death (Murphy, 1998). In patients with type 2 diabetes, either extremely high or extremely low blood glucose can cause an acute diabetic emergency (Long, 2021).

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

a) Hyperglycemic crises

Uncontrolled hyperglycemia can lead to a physiologic crisis of dehydration, electrolyte imbalance, and confusion or coma. Hyperglycemic crises are typically triggered by physical stress, such as an illness, injury, stroke, or myocardial infarction, which causes a sudden persistent hyperglycemia. Without the help of a 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 crisis depends on whether there is any circulating insulin at all. When there is a total lack of insulin, a hyperglycemic crisis will take the form of diabetic ketoacidosis (DKA). DKA is characterized by hyperglycemia, metabolic acidosis, ketonemia, dehydration, and loss of electrolytes. When there is a relative lack of insulin, 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, hypotension, mental confusion, and possibly coma (Long, 2021).

b) Hypoglycemic crises

Hypoglycemia occurs when a person's blood glucose is too low, usually below 70 mg/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 hypoglycemic if:

- Too much insulin or secretagogue 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 g of oral glucose. After blood sugar returns to normal, regular meal with protein can be eaten within the next hour (Long, 2021).

2.8.2 Long term complications

Chronic Complications of Diabetes Mellitus refer to the clinic-pathological consequences that develop over years in individuals with Type I and Type II Diabetes Mellitus (Haas, 1993). The chronic complications of Type II diabetes mellitus are:

2.8.2.1 Micro-vascular complications of diabetes

a) Diabetic retinopathy

A microvascular 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 diabetics. Vitreous hemorrhage or retinal objectivity may cause a total or partial loss of vision (Abdulwahab, 2020). The severity of DR ranges from non-proliferative and pre-proliferative to more severely proliferative DR, in which the abnormal growth of new vessels occurs (Harding *et al.,* 2003). Total or partial vision loss can occur through a vitreous hemorrhage or retinal detachment, and central vision loss can occur through retinal vessel leakage and subsequent macular edema (Sheetz and King, 2002). The prevalence of DR increases with prolonged duration of diabetes (Orchard *et al.*, 1990).

b) Diabetic neuropathy

Diabetic neuropathy is one of the macro-vascular complications in Type 2 DM patients; this can occur due to uncontrolled blood sugar in diabetic patients, the more uncontrolled, the faster the neuropathy complaints. People with diabetes have 11 times riskier of developing neuropathy compared to those without diabetes (Amelia *et al.*, 2019). In more than 15 percent of chronic diabetics, diabetic neuropathy tends to be the biggest and least known complication (Herat *et al.*, 2018).

Distal symmetric polyneuropathy is the most common form of diabetic neuropathy. Depending on the classification of sensory fibers involved, symptoms differ. Small fiber intervention is the most frequent early symptom that involves pain (e.g. acute, shooting) that synesthesia (e.g. burning). In the case of a regular clinical examination and regular nerve

conduction experiments, which are a measure of broad fiber efficiency, discomfort can be present (Thrainsdottir *et al.*, 2003). Big fiber involvement can result in numbness, tingling and loss of protective sensation. Unlike DR, both vascular and non-vascular metabolism appear to be related to PN pathogenesis, but this theory is uncertain (Cameron *et al.*, 2001).

c) 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 diabetic mellitus, T1DM and T2DM (Alicic *et al.*, 2017). Proteinuria was seen in about 40% of type 2 diabetes patients. It's also the major source of end-stage renal disease (ESRD) development in the world (Ritz *et al.*, 2011). This includes the creation of basement membrane thickening and the growth of microaneurysms (ADA, 1998). Recently, more and more evidence indicates that inflammation is involved in the development of DN (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).

2.8.2.2 Macro-vascular complications

Diabetic mellitus is a 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 infarction is 2.13 times greater in males and 2.95 times higher in females than in non-diabetic groups (Salman *et al.*, 2019; Vergès, 2015). The primary contributing factor in the occurrence of diabetic vascular complications has been identified as chronic hyperglycemia (Zelniker *et al.*, 2019). The cause of endothelial dysfunction is hyperglycemia, which is the main activating factor in diabetic vascular pathogenesis (Shi et al., 2017).

The central pathological mechanism in macro vascular disease is the process of atherosclerosis, which leads to narrowing of arterial walls throughout the body. Atherosclerosis is thought to result from chronic inflammation and injury to the arterial wall in the peripheral or coronary vascular system. In response to endothelial injury and inflammation, oxidized lipids from LDL particles accumulate in the endothelial wall of arteries (Fowler, 2011). Diabetes increases the risk that an individual will develop

cardiovascular disease (CVD) .CVD is the primary cause of death in people with either type 1 or type 2 diabetes (Laing *et al.*, 2003; Paterson *et al.*, 2007). In fact, CVD accounts for the greatest component of health care expenditures in people with diabetes (Dall *et al.*, 2003; Paterson *et al.*, 2007).

2.8.2.3 Diabetic foot

Diabetic foot, often due to a combination of sensory neuropathy (numbness or insensitivity) and vascular damage, increases rates of skin ulcers (diabetic foot ulcers) and infection and, in serious cases, necrosis and gangrene. It is why diabetics are prone to leg and foot infections and why it takes longer for them to heal from leg and foot wounds. It is the most common cause of non-traumatic adult amputation, usually of toes and or feet, in the developed world (Scott, 2013).

Foot Care Education

The best way to protect your feet is by controlling your blood sugar levels every day. This will help keep nerve and blood vessel damage from getting worse. The next step is to keep the skin of your feet healthy (Medline Plus, 2021).

Good foot care for people with diabetes includes (Medline Plus, 2021):

i. Check feet every day, including the bottoms of feet. Look for cuts, redness, and other changes in the skin and toenails.
ii. Washing feet every day.
iii. Trim toenails straight across with a clipper.
iv. Always wear well-fitting shoes and socks or slippers to protect your feet when walking. Don't walk barefoot, even indoors.
v. Protect feet from heat and cold. Use sunscreen on exposed skin and don't walk barefoot at the beach.
vi. Ask doctor how to remove corns and calluses safely. Also, get the feet checked at health care visits.

2.8.2.4 Diabetic cardiomyopathy

Diabetic cardiomyopathy is referred to as a pathological heart type and presentation in the absence of other cardiac risk factors, such as coronary artery disease, hypertension and

severe valve dysfunction (Jia *et al.*, 2018). Clinical trials show the commonness of cardiac insufficiency in diabetic patients ranging from 19 to 26 %. The Framingham Heart Study showed that the risk of heart failure was elevated relative to age ranges of both male and female diabetes patients, and this association was liberated of obesity (Lee and Kim, 2017). DCM's pathophysiologic processes have still not been fully elucidated. The incidence of DCM is multifactorial and numerous causes are indicated, including insulin resistance, microvascular failure, subcellular component defects, metabolic disorders, autonomic cardiac dysfunction, renin-angiotensin system changes, and maladaptive immune response (Alavi *et al.*, 2014).

2.8.2.5 Infection

Patients with poorly controlled diabetes mellitus are prone to bacterial and fungal infections because of adverse effects of hyperglycemia on granulocyte and T-cell function. In addition to an overall increase in risk for infectious diseases, individuals with diabetes have an increased susceptibility to mucocutaneous fungal infections (eg, oral and vaginal candidiasis) and bacterial foot infections (including osteomyelitis), which are typically exacerbated by lower extremity vascular insufficiency and diabetic neuropathy. Hyperglycemia is a well-established risk factor for surgical site infections (Brutsaert, 2021).

2.9 Literature reviews on knowledge, attitude and practices among type 2 diabetes mellitus patients

The similar studies to this one were already done in the past that aimed at evaluating the knowledge, attitudes and practices about type 2 diabetes mellitus patients. A cross-sectional study was conducted in primary healthcare facilities frequently visited by patients with T2DM across the West Bank of Palestine in the period of October 2018 to January 2019. Out of 300 patients invited, 220 (73.3%) patients responded. In this study, the median age was 57.0 years, the median time elapsed since diagnosis with T2DM was 7.0 years, the median fasting blood glucose was 150.0 mg/dL, and the median BMI was 28.8 kg/m^2. More than half (52.2%) had good knowledge, 58.7% has positive attitude and only 36.4% had good practice. Findings of this study highlighted gaps in knowledge, attitude, and practice with regard to T2DM among patients (Shawahna *et al.*, 2021).

A cross-sectional survey design was used to assess KAP of both 90 diabetic and 90 non-diabetic population and associated factors via interview administered questionnaire. Among

diabetic population, it was found that, the mean ± SD Knowledge, Attitude and Practice score was 12.97 ± 5.682, 3.28 ± 1.805 and 11.87 ± 4.604 respectively. 60%, 70% and 47.8% of diabetic participants had good knowledge, attitude and practice scores respectively. A significant association was found between KAP score and education level of the patient and with physical activity level of the patient. No significant association was found between KAP score and age group and with genetic history of the patient (Sapkota, 2018).

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).

Likewise, this cross-sectional study was conducted on 238 diabetic patients attending the Jabber Abulizz Hospital, Khar-toum State, Sudan between August and September 2015 using a structured questionnaire through face-to-face interview. Majority of the patients demonstrated good knowledge (54.6%), positive attitude (79%); and good practice (58%). There was evidence of an association between following the recommended diet and good knowledge and a positive attitude towards the recommended diet, after controlling the socio-demographic variables. Individuals with good dietary knowledge are 4.7 times more likely to follow the recommended diet compared to those with poor knowledge. In addition, individuals with positive attitudes towards the recommended diet are 3.2 times more likely to follow the diet recommended by the hospitals compared to those with negative attitudes. Hence, the study findings highlight the need for improved health education and counselling pertaining to the appropriate diets for T2DM patients in hospitals (Adam *et al.*, 2021).

Similarly, this study assessed the level of diabetes KAP among type 2 diabetes patients through a self-administered questionnaire-based study on a convenience sample of 386 type

2 diabetes mellitus patients in Kuala Muda District, Kedah, Malaysia. Majority of the respondents possessed levels above the cut-off points for poor levels in knowledge (63.21%), attitude (62.69%), and practices (58.03%). Age, academic qualification, occupation, monthly income were associated with KAP whereas the associations of disease duration, the best source of information about diabetes, and health status satisfaction were witnessed for attitude and practice. Academic qualification had strongest correlation for knowledge, attitude, and practice. Knowledge level was significantly correlated with attitude level, practice level, income, occupation, age. Attitude level had significant correlations with practice level, income, occupation, age, and gender. Practice level correlated significantly with income, occupation, age. All associations and correlations were significant at $p < 0.005$. Although overall having good levels of diabetes KAP, educational interventions are required to further improve diabetes KAP (Abbasi *et al.*, 2018).

In this multicenter analytical cross-sectional study, a simple random sampling method was used to select 200 type-2 diabetic patients who were admitted to 4 government hospitals of Tehran, the capital of Iran from February to September 2014. The mean diabetes duration was 13.06 years. The levels of patients' good knowledge, attitude, and practice were 61.41%, 50.44% and 52.23%, respectively. Age, treatment methods, DM duration, and existence of diabetic retinopathy had significant correlations with KAP level. The results of this study showed that recent educational programs in Iran improved KAP level. Patients' KAP increases as their condition worsens (Niroomand *et al.*, 2016). Similar KAP study attending the out-patient Diabetes Clinic at Golestan Hospital, Ahvaz, Iran showed that KAP score for the majority of the patients was on medium level (Mohammadi *et al.*, 2015).

Part III

Materials and Methods

3.1 Research design

A cross-sectional descriptive study was conducted among the type 2 diabetic patients attending the selected outreach clinics of Dharan to assess the information on knowledge, attitude and practices on Type 2 Diabetes Mellitus. Each participant was interviewed face-to-face using a structured questionnaire and anthropometric measurements were also taken.

3.2 Study area

The study was conducted in Dharan Diagnostic Centre and Manjushree Polyclinic and Diagnostic Centre, Dharan. The location was chosen due to the researcher's convenience and feasibility, as well as the fact that these two centres are located in the centre of Dharan and there is good flow of diabetics in them.

3.3 Target population

The study population were Type 2 Diabetic patients who visited the selected outreach clinics of Dharan.

Inclusion criteria:

a) Patients of both genders who were above 22 years and diagnosed with T2DM at least 6 months ago.

Exclusion criteria:

a) Participants who did not consent to participate in the study.

3.4 Study variables

The different variables of the study are listed below:

1) Dependent variable: Knowledge, attitude and practice of diabetic patients.
2) Independent variables**:**
    a) Socio-economic and demographic variables: Religion, ethnicity, income, occupation
    b) Individual/sample characteristics: Age, sex, marital status, education level

c) Genetic history of diabetic patient
d) BMI
e) Fasting blood glucose

3.5 Sampling technique

The samples of respondents were selected by convenience sampling method. All diabetic patients visiting the Dharan Diagnostic Centre and Manjushree Polyclinic and Diagnostic Centre during the period of two months from February 13 to April 13, 2021 were recruited in the study.

3.6 Sample size

The required sample size was determined by using a single population proportion formula assuming the prevalence rate of type 2 diabetes to be 10% (Shrestha *et al*.,2021), 95% confidence interval (CI) and 7% margin of error (d).

Calculation of sample size for infinite population:
Sample size (n) = $Z^2 \times p (1 - p) / d^2$
Where,
Z = 1.96 (confidence interval at 95%)
P (Estimated prevalence) = 10%
d (margin of error) = 7%
Now,
$n = (1.96)^2 \times 0.1 (1 - 0.1) / (0.07)^2$
$= 70.6$

The sample size was calculated to be $70.6 \approx 71$.

Thus calculated sample size was adjusted for non-response. Considering non-response rate as 15%, the adjusted sample size was calculated to be 82. However, 90 samples were taken in the study.

3.7 Research instruments

The materials used for data collection were:

a) Questionnaire: A well designed and pretested set of questionnaire developed by Subish et al. with slight modification was adapted (Palaian *et al.*, 2006). The self-administered questionnaire had a total of 27 questions (knowledge - 12, attitude - 6, and practice - 9) and 14 questions related to socio demographic information The questionnaire had four sections:

    Part 1: Demographic factors

    Part 2: Questions related to knowledge

    Part 3: Questions related to attitude of patients towards diabetic care

    Part 4: Questions related to practices of patients towards diabetic care

    The questionnaire was prepared in English and later translated to Nepali language. Pretesting was done to ensure that the questionnaire was accurate and clear. To assess the questionnaire's suitability and clarity, a brief pilot test was conducted with a sample group of 5 individuals.

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

c) Weighing balance: A digital weighing balance manufactured by Microlife, USA to measure the weight with minimum and maximum measuring capacity of 0.1 kg and 150 kg respectively was used.

3.8 Validity and reliability

To ascertain the degree to which the data collection instruments will measure what they purpose to measure, the instruments were validated by comparing with standard known weights (for weighing balance). Reliability of the instruments (stadiometer and weighing balance) was tested by the test retest method. Two consecutive measurements were made at a short time difference by the same observer and were compared. Instruments was set at zero before taking measurements with standardized reference. Questionnaire was validated by reviewing different literatures and was checked daily for completeness, consistency and clarity. The questionnaire was made simple and clear as possible. Validity and reliability of the study was ensured by pretesting of the questionnaire, using standardized instruments.

3.9 Data collection techniques

3.9.1 Questionnaire

Data was collected using a structured questionnaire (Appendix B) based on the objectives of the study. A face to face interview was conducted with the Type 2 Diabetic patients of selected outreach clinics of Dharan to fill the questionnaire. The information on demographic, socio-economic aspects and knowledge, attitude practice and fasting blood glucose level of type 2 diabetic patients was collected. Patient's fasting blood glucose was also obtained from the same clinic where data was collected.

3.9.2 Height

Following steps were carried out for measurement of height:

a) Stadiometer was placed on a smooth surface.
b) Participants were asked to stand straight on the base bare foot ensuring that the back of the head, shoulder, hips and legs touch the wall of stadiometer.
c) It was made sure that the head was held erect with their arms hanging loosely at their sides.
d) Head of the participant was positioned so that the line of sight is perpendicular to the horizontal surface.
e) The index was brought up to the head of the participant and height was then noted to the nearest 0.1mm.

3.9.3 Weight

Following steps were carried out for the measurement of weight:

a) Weighing balance was placed on a smooth surface and activated.
b) Participant was asked to step on the scale without their slipper and light clothes.
c) The measurement was noted.

3.10 Data analysis

The data obtained in this study was checked for completeness and consistency. It was then coded and entered into IBM SPSS version 20 for statistical analysis. Descriptive analysis was done in the form of frequencies, percentages, mean, median and standard deviation. For

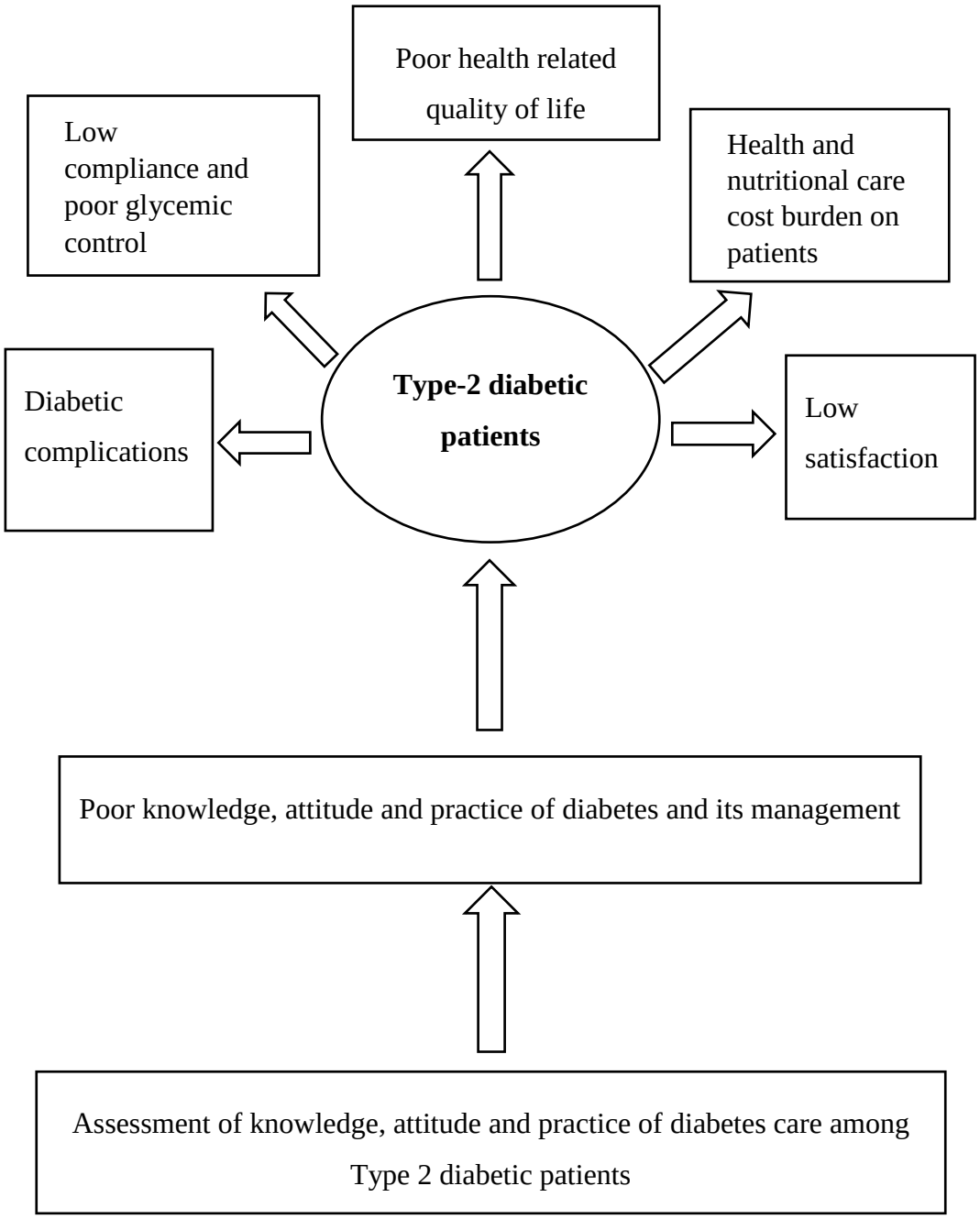
inferential statistics, chi-square test was applied to test the association between KAP and socio-demographic variables at 95% CI and level of significance as p = 0.05. Variables were subjected to multivariate analysis (Binary Logistic Regression with category). Adjusted odds ratio (AOR) with 95% confidence interval (CI) and the p-value < 0.05 were considered to declare significantly associated factors.

For knowledge, attitude, and practice items, the patients were given 1 point for each correct/positive answer and 0 for each incorrect/negative answer. Knowledge scores could range from 0 to 12, attitude scores could range from 0 to 6, and practice scores could range from 0 to 9. Based on the score obtained by each participant, two categories were defined: poor (≤ 50% of the total score) and good (> 50% of total score).

3.11 Logistical and ethical considerations

Permission to conduct survey in clinics of Dharan was obtained from Central Campus of Technology, Dharan and respective clinics. Informed written and verbal consent was obtained from all the respondents after a full explanation of the nature, purpose, and procedures used for the study. Participants were informed about their rights to withdraw from the study at any stage of their participation. Respondents were assured that the data collected will be for the purpose of the study and will be treated with the uttermost confidentiality.

3.12 Conceptual framework of the study



Source: Sapkota (2018)

Fig 3.1 Conceptual framework

Part IV

Results and Discussion

The cross-sectional descriptive study with sample size of 90 was conducted in selected outreach clinics of Dharan in order to determine the knowledge, attitude and practice of type-2 diabetic patients. This study was also carried out to find the association of the knowledge, attitude and practice score with socio-demographic variables of diabetic patients.

4.1 Socio-demographic characteristics of the study population

4.1.1 Classification of age of patients

Table 4.1 Distribution by age

Age	Frequency	Percent
≤ 35 years	5	5.6
36-45 years	11	12.2
46-55 years	26	28.8
56-65 years	23	25.6
66-75 years	17	18.9
≥76 years	8	8.9
Total	90	100

Table 4.1 depicts the age wise distribution of patients. The patients who were enrolled in the study were from the age group 27-89 years. Of all participants, 28.8% were of age group 46-55 years, followed by 25.6% in age group 56-65 years. The mean ± std. deviation age of the patients was found to be 57.11 ± 13.39.

4.1.2 Gender classification

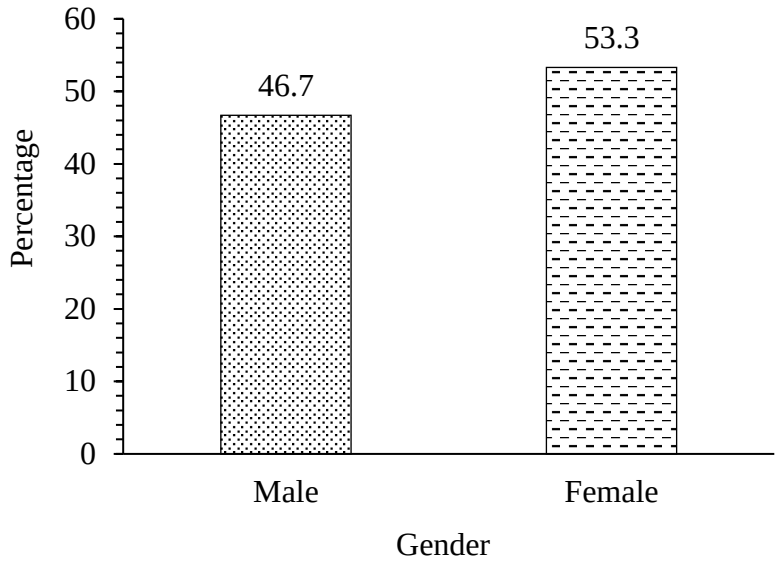


Fig 4.1 Distribution by gender

Fig 4.1 shows that 48 (53.3%) were female participants and 42 (46.7%) were male participants. It reveals that more females were affected by diabetes in the study area.

4.1.3 Classification of ethnic group

Table 4.2 Distribution by ethnic group

Ethnic Group	Frequency	Percent
Brahmin	10	11.1
Chhetri	22	24.4
Dalit	5	5.6
Janajati	46	51.1
Madhesi	7	7.8
Total	90	100.0

Table 4.2 shows that, out of all participants, 51.1% (46) were Janajati. Nearly one-fourth (24.4%) were Chhetri, 11.1% were Brahmin, 5.6% were Dalits and remaining (7.8%) were Madhesi.

4.1.4 Classification of religion of patients

Table 4.3 Distribution by religion

Religion	Frequency	Percent
Hindu	76	84.4
Christian	2	2.3
Kirant	5	5.6
Buddhist	3	3.3
Others	4	4.4
Total	90	100.0

As seen in table 4.3, out of total subjects, maximum number of respondents were hindu (84.4%) followed by kirant (5.6%). Christian were 2.3% whereas Buddhist were 3.3% and rests were of other religion.

4.1.5 Classification of education level

Table 4.4 Distribution by education

Education	Frequency	Percent
Illiterate	30	33.3
Primary Level	21	23.3
Secondary Level	16	17.8
Intermediate	15	16.7
University Degree	8	8.9
Total	90	100.0

Education status of patients varied from illiterate to university degree. Table 4.4 shows that one third (33.3%) of the participants were illiterate and least (8.9%) were the participants that had completed university degree. 23.3% (21) had completed primary level, 17.8% (16) had completed secondary level and 16.7% (15) had completed their intermediate level.

4.1.6 Classification of marital status

Table 4.5 Distribution by marital status

Marital Status	Frequency	Percent
Single	2	2.2
Married	81	90.0
Divorced	2	2.2
Widowed	5	5.6
Total	90	100.0

The majority 90.0% (81) of the respondents were married, 5.6% (5) were widowed, 2.2% (2) were divorced and rest 2 respondent i.e., 2.2% were unmarried as shown in table 4.5.

4.1.7 Classification of occupation

Table 4.6 Distribution by occupation

Occupation	Frequency	Percent
Business	15	16.7
Service	14	15.6
Agriculture	15	16.7
Housewife	37	41.0
Other	9	10.0
Total	90	100.0

Table 4.6 depicts the distribution of participants by occupation in which majority (41%) of them were housewife. People involved in business, agriculture and service were nearly equal i.e. 16.7%, 16.7% and 15.6% respectively. Remaining (10.0%) were involved in other profession such as foreign employment, student, unemployed etc.

4.1.8 Classification based on annual income

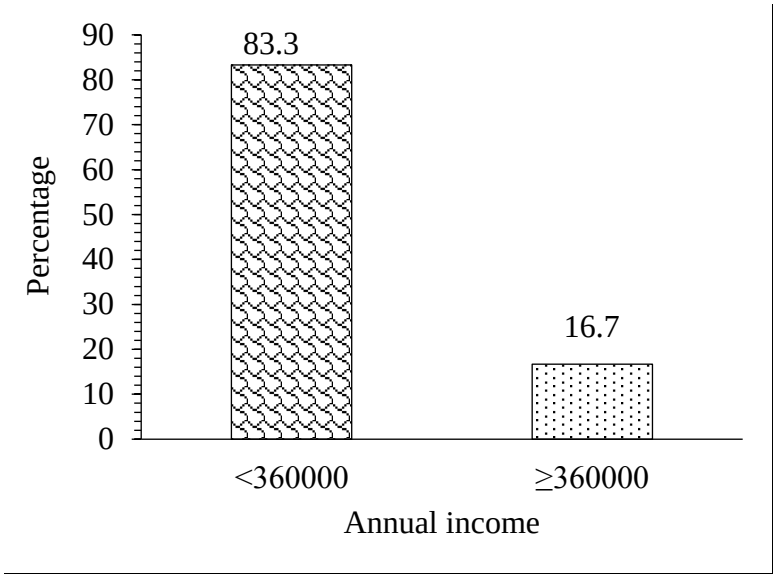


Fig 4.2 Distribution based on annual income

In the survey population, maximum number of households i.e. 83.3% (75) were found to be having annual income less than 3,60,000 whereas 16.7% (15) of households were found to have annual income equal to or greater than 3,60,000. Average income categorization was done based on the survey report of Nepal Rastra Bank, where the average monthly income of Nepalese household was found to be Rs.30,121 (Nepal Rastra Bank, 2016)**.**

4.1.9 Classification based on duration of diabetes

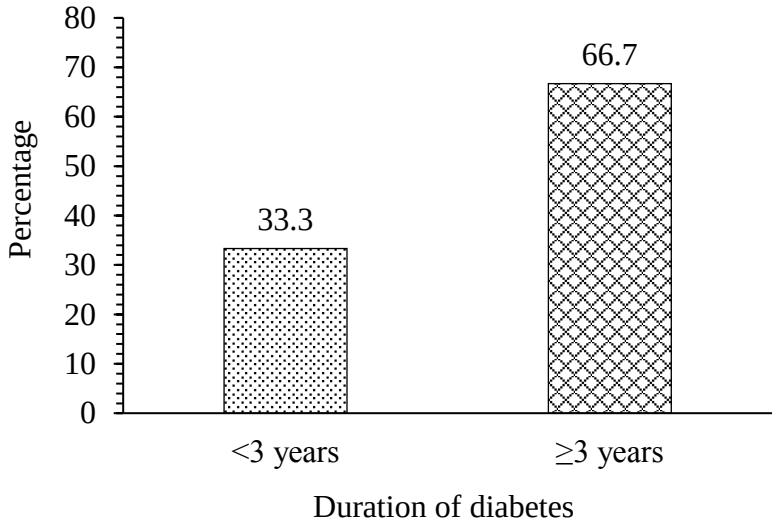


Fig 4.3 Distribution based on duration of diabetes

Fig 4.3 depicts the distribution of study participants based on duration of diabetes where one third 30 (33.3%) of the participants were found to be suffering from diabetes for less than 3 years and remaining 60 (66.7%) were suffering for more than or equal to 3 years.

4.1.10 Classification of genetic history

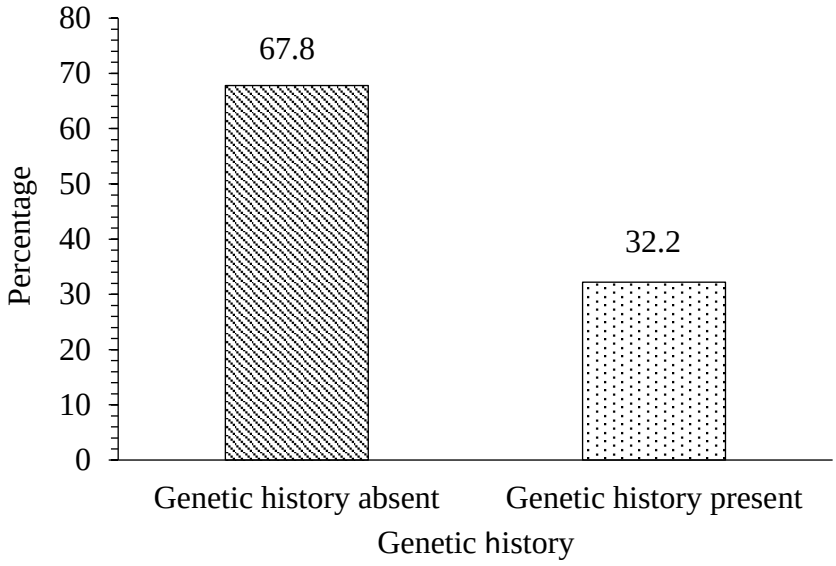


Fig 4.4 Distribution by genetic history

Genetic history is an important non-modifiable risk factor for diabetes. Fig 4.4 demonstrates that majority of participants 61 (67.8%) belong to family with no genetic history while only about one third 29 (32.2%) of them were from the family with genetic history.

4.1.11 Classification based on BMI

Table 4.7 Distribution based on BMI

BMI	Frequency	Percent
<18.5	1	1.1
18.5-22.9	23	25.6
23-24.9	18	20.0
≥25	48	53.3
Total	90	100

Table 4.7 shows the distribution of participants based on body mass index. Only one fourth (23) of the study participants had normal BMI. 1.1% (1) were underweight whereas 20.0%

(18) were overweight and majority (53.3%) of them were obese. BMI was categorized based on the recommendation for Asia-Pacific region by WHO (WHO, 2000). There are 2.19 times higher odds of having T2DM if the body mass index is ≥ 24.9 kg/m^2 (Shrestha *et al*., 2021). Similar study done in Bangladesh showed that 5% were underweight, 39% were normal, 36% were overweight and 20% were obese (Fatema *et al.*, 2017).

4.1.12 Classification based on fasting blood glucose

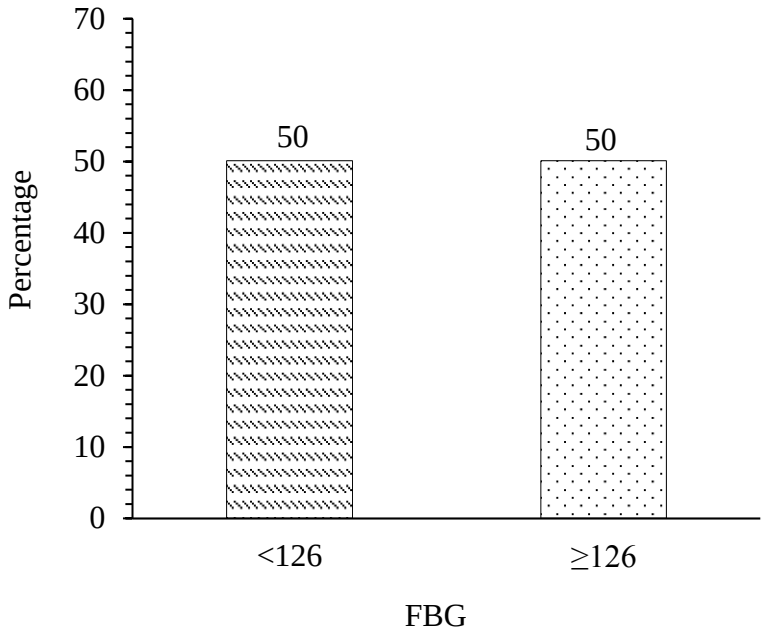


Fig 4.5 Distribution based on fasting blood glucose

Fig 4.5 illustrates that among 90 participants of the study, exactly half (45) had fasting blood glucose level under control while remaining half had high fasting blood glucose level. This shows that half of the diabetic patients are either not following controlled and planned diet or they do not have good attitudes and behavior in their lifestyle regarding disease or both. Similar study done in Palestine showed that 66 (30.0%) had fasting blood glucose under 140 mg/dL whereas 154 (70.0%) had fasting blood glucose equals to or greater than 140 mg/dL (Shawahna *et al.*, 2021).

4.2 Knowledge, Attitude and Practice of diabetic patients

The knowledge, attitude and practice related scores of diabetic patients were determined individually and based on them, overall KAP score was determined.

4.2.1 Knowledge related score of the patients

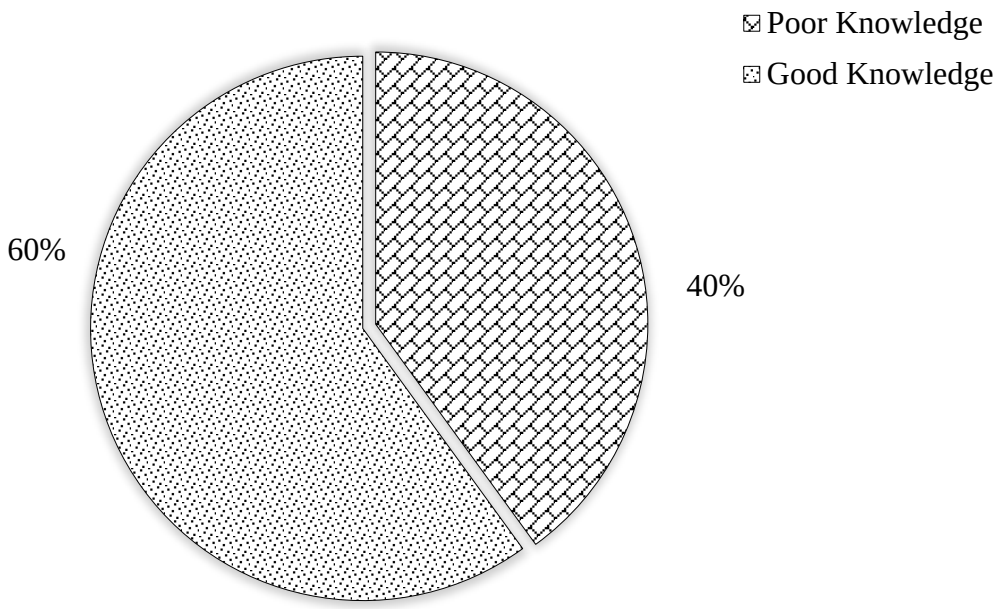


Fig 4.6 Knowledge related score of the patients

Figure 4.6 shows that out of 90 diabetic patients in the study, 60% (54) patients had good knowledge on diabetes related questions whereas 40% (36) patients had poor knowledge.

This study showed that over half of the participating patients had good knowledge; hence were aware of the disease and its management. Even though we didn't assess how individuals acquired the knowledge on diabetes, it is possible that higher literacy rate as well as well-developed social and media networks may have positive effect on their knowledge towards diabetes. A hospital-based cross-sectional study among diabetic and non-diabetic patients in Kathmandu coincided with our study in which 60% of the diabetic participants had good knowledge and 40% had poor knowledge (Sapkota, 2018). However, poor knowledge regarding diabetes have been reported in several other studies (Mohammadi *et al.*, 2015; Upadhyay *et al.*, 2008).

Table 4.8 summarizes the responses of type-2 diabetic patients to knowledge.

Table 4.8 Response to knowledge questions

Questions	No. of patients answering correctly	Percent
Diabetes is a condition in which the body contains	53	58.9
The major cause of diabetes is	13	14.4
The symptoms of diabetes is	81	90
Diabetes, if not treated	77	85.6
The most accurate method of monitoring diabetes is	80	88.9
A diabetic patient should measure his or her blood pressure	57	63.3
A diabetic should have his or her eyes checked	23	25.6
Regular urine test will help in knowing	32	35.6
The important factor that help in controlling blood sugar are	82	91.1
For proper foot care, a diabetic patient	16	17.8
The symptom of hypoglycemia is	46	51.1
What should be done in case of hypoglycemic symptoms	45	50

4.2.2 Attitude related score of the patients

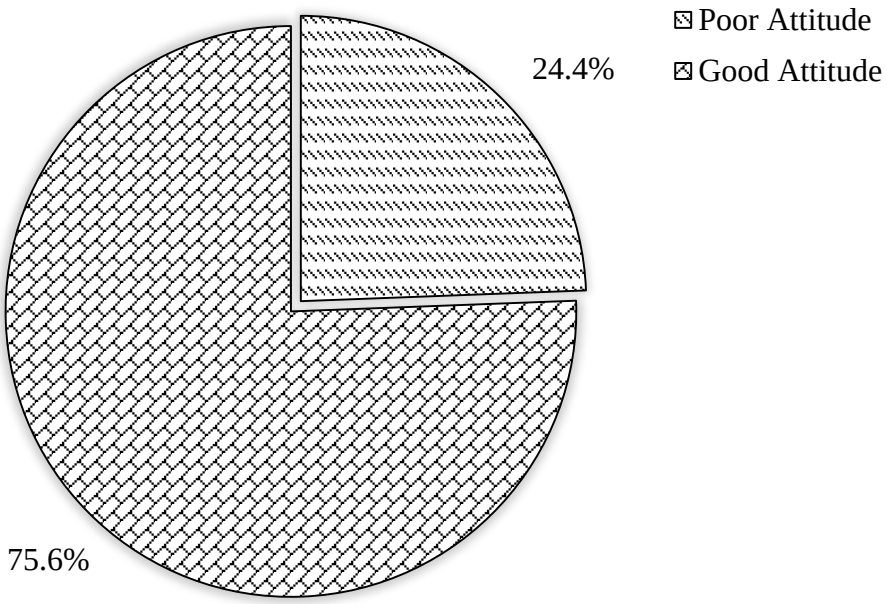


Fig 4.7 Attitude related score of the patients

The patients attitude was assessed based on the answer given to the questions related to regular exercise, importance of balanced diet, regular intake of medication in which 75.6% (68) of patients have good attitude where as 24.4% (22) of patients have poor attitude which shows that around three fourth of the patients were conscious about the importance of regular exercise, balanced diabetic diet, follow up with doctor for proper management of normal blood glucose level.

This finding showed that the majority of the study participants reported positive attitude towards the recommended diet, exercise, medication and check-ups. This findings is consistent with that of another hospital-based survey in Sudan which reported that 79% have positive attitude towards the recommended diet (Adam *et al.,* 2021). Other studies conducted in Malaysia (62.69%), Iran (50.44%) and Palestine (58.7%) reported lower positive attitude than this study (Abbasi *et al.,* 2018; Niroomand *et al.,* 2016; Shawahna *et al.,* 2021).

The response of the patients regarding the attitude related questions are listed in Table 4.9.

Table 4.9 Response to attitude questions

Questions	No. of patients answering correctly	Percent
Do you think diabetes is a big deal	66	73.3
Do you think regular exercise helps in controlling diabetes	76	84.4
Are you following a controlled and planned diabetic diet	49	54.4
Do you miss taking the doses of diabetic medication	61	67.8
Are you aware of your blood sugar levels fall below normal when you are taking drugs	35	38.9
Do you think you should keep in touch with your physician	89	98.9

4.2.3 Practice related score of the patients

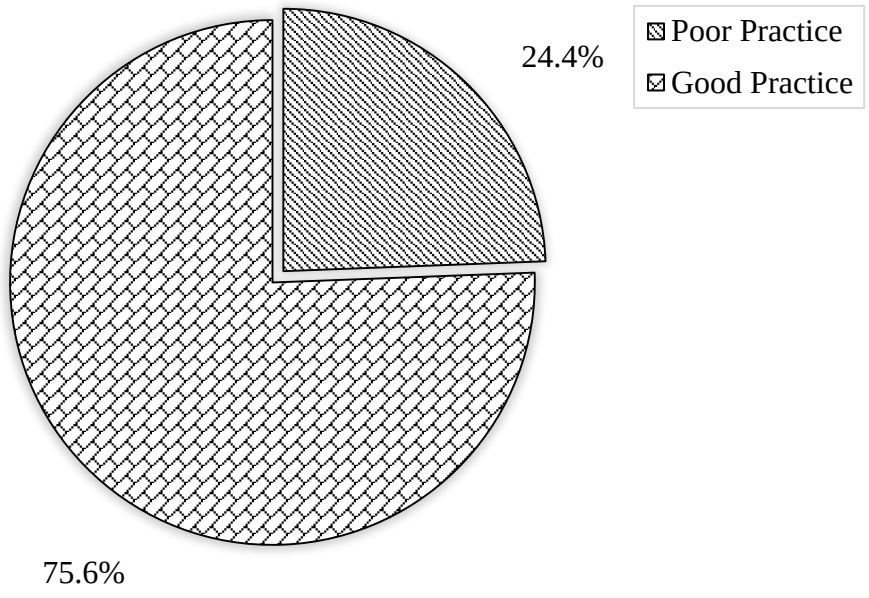


Fig 4.8 Practice related score of the patients

Around three fourth 68 (75.6%) study participants have the good practice score for the proper management of diabetes mellitus whereas one fourth 22 (24.4%) have the poor practice score. This score represents that majority of patients are conscious about their disease condition and management.

Unlike most studies from Nepal and other countries which reported poor practice among diabetics, this study showed that the practice score is comparatively better, with the majority (> 75%) having good practice (Gautam *et al.*, 2015; Shawahna *et al.*, 2021). Even though, the different studies used different instruments and/or were carried out among different ethnic or age groups, it is still a notable finding in this study. Positive attitudes lead to good practice which is also supported by this study findings. This study revealed exactly same score of good and poor attitude and practice.

The response of the patients regarding the practice related questions are listed in Table 4.10.

Table 4.10 Response to practice questions

Questions	No. of patients answering correctly	Percent
Do you exercise	40	44.4
How many times do you take food per day	6	6.7
Do you smoke	82	91.1
When was your blood pressure last checked	65	72.2
When was your last eye examination	59	65.6
When was your last visit to physician	57	63.3
When was your blood sugar last checked	69	76.7
When was your last urine examination	61	67.8
When was your lipid profile last checked	53	58.9

4.2.4 KAP score of the patients

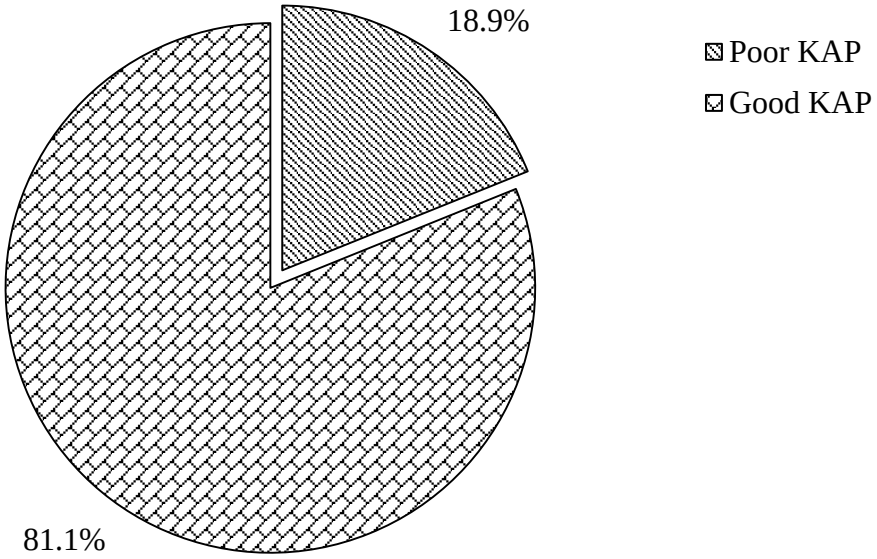


Fig 4.9 KAP score of the patients

In this study, the total KAP score of diabetic patients was categorized into low or high KAP. Figure 4.9 indicates that 81.1% (73) of participants had good KAP score while 18.9% (17) had poor KAP score. This study showed good KAP scores among diabetic patients which is consistent with the similar studies done in Malaysia and Sudan (Abbasi *et al.*, 2018; Adam *et al.*, 2021). However, similar studies done in India and Kenya showed poor knowledge, attitude and practice towards diabetes (Kant and Thapliyal, 2015; Maina *et al.*, 2010). Similarly, a cross-sectional study done in Iran showed that KAP score for the majority of the patients was on medium level (Mohammadi *et al.*, 2015). The differences in the results of studies may be due to the differences in educational level of the diabetic patients and accessibility of information and diabetes education.

4.3 Factors associated with Knowledge, Attitude and Practice (KAP) score of patients

Table 4.11 Association between KAP and socio-demographic variables

Variables		Poor KAP (%)	Good KAP (%)	χ^2	P-value
Age	< 57	6 (13.6)	38(86.4)	1.55	0.213
	≥ 57	11 (23.9)	35 (76.1)		
Gender	Male	7 (16.7)	35 (83.3)	0.254	0.614
	Female	10 (20.8)	38 (79.2)		
Ethnicity	Brahmin/ Chhetri	6 (18.8)	26 (81.2)	0.001	0.98
	Others	11 (19)	38 (79.2)		
Religion	Hindu	11 (14.5)	65(85.5)	6.216	0.013*
	Non-hindu	6 (42.9)	8 (57.1)		
Education	Illiterate	11 (36.7)	19 (63.3)	9.283	0.002*
	Literate	6 (10.0)	54 (90.0)		
Marital Status	Single/ Divorced	2 (22.2)	7 (77.8)	0.073	0.788
	Married	15 (18.5)	66 (81.5)		
Occupation	Service	1 (7.1)	13 (92.9)	3.206	0.361
	Agriculture	4 (26.7)	11 (73.3)		
	Housewife	9 (24.3)	28 (75.7)		
	Others	3 (12.5)	21 (87.5)		
Annual income	< 3,60,000	15 (20.0)	60 (80.0)	0.363	0.547
	≥ 3,60,000	2 (13.3)	13 (86.7)		
Duration of diabetes	< 3 years	7 (23.3)	23 (76.7)	0.58	0.446
	≥ 3 years	10 (16.7)	50 (83.3)		
Family history	Absent	14 (23.0)	47 (77.0)	2.039	0.153
	Present	3 (10.3)	26 (89.7)		

*Statistically significant: p - value < 0.05

4.3.1 Association between KAP and age of patient

Age categorization was done based on the mean age of the patients. Association between KAP and age group of patients was not found statistically significant (p = 0.213). This represents that age does not depend upon having good knowledge about care of diabetes, nutritional management and exercises to keep the blood sugar level in normal and to bring-in to the regular practice with positive attitude towards it. If a person himself is conscious about the disease and condition, s/he can control diabetes irrespective of their age.

4.3.2 Association between KAP and gender

Association between KAP and gender of patients was not found statistically significant (p = 0.614). This represents that gender of the participants does not affect level of knowledge, attitude or practice. A person's own behavior and practice determines his/her contribution in control of blood sugar irrespective of gender.

4.3.3 Association between KAP and ethnicity

Table 4.11 demonstrates that there is no any significant association between knowledge, attitude and practice score of patients with ethnicity. A person's ethnic background does not define his/her knowledge towards diabetes, neither his attitude towards contributing factors of diabetes nor his actions responsible for glycemic control.

4.3.4 Association between KAP and religion

Association between KAP and religion was found to be statistically significant (p = 0.013). This represents that religion which people follow as a part of their lifestyle, affects cultural beliefs, values, attitude and practices which in turn affects the diabetes related knowledge, attitude and practice. Also, religious beliefs can affect how diabetic patients **c**ope with the stress of diabetes, with positive attitudes resulting in good lifestyle habits that result in greater success with glycemic control for the diabetic patients.

4.3.5 Association between KAP and education level

Association between KAP and education level was found to be statistically significant (p = 0.002); this indicates significant relationship. This represents that a highly educated person has high level of KAP scores about diabetes. A better educated person may be more inquisitive while being counseled or educated on diabetes. In addition, it is possible that

educated patients could gather more information through different means of communication, i.e. radio, television, manual, magazine, etc.

4.3.6 Association between KAP and marital status

As depicted in table 4.11, there was no significant association of KAP with marital status. This tells us that marital status has no any relation with the patient's level of knowledge, attitude or practice. It can be said that marriage is not a vital factor for change in knowledge, behavior or practice of people related to diabetes.

4.3.7 Association between KAP and occupation

Association between KAP and occupation of patients was not found statistically significant ($p = 0.361$). This represents that knowledge, attitude and practice is not affected by the profession of participants. They could have high or low knowledge, good or poor practice and positive or negative attitude, irrespective of their profession where they were engaged for years.

4.3.8 Association between KAP and annual income

There was no any significant association between the KAP and annual income of the study participants. This shows that a person's income has nothing to do with his/her knowledge. Even the attitude towards diabetes and their practice in daily life is not hampered by the income level. Low income people could have good practice and high income people could have poor practice due to their busy working schedule or sedentary lifestyle.

4.3.9 Association between KAP and duration of diabetes

Association between KAP and duration of diabetes was not found statistically significant ($p = 0.446$, $p > 0.05$). This represents that although patient had been suffering from diabetes since long, there is still no improvement in diabetes related knowledge, attitude or practice. Stress, sedentary lifestyle, work environment and work schedule doesn't let people to have good and healthy behaviour or practices.

4.3.10 Association between KAP and family history

Association between KAP and family history was not found statistically significant (p = 0.153). This represents that if a person has diabetes in his family history, it doesn't mean that he is conscious about the diseases in terms of knowledge, attitude and practice.

4.3.11 Association of KAP with BMI and FBG

Table 4.12 Association of KAP with BMI and FBG

	Variables	Poor KAP(%)	Good KAP(%)	χ^2	P-value
BMI	< 23	5 (20.8)	19 (79.2)	0.081	0.776
	≥ 23	12 (18.2)	54 (81.8)		
FBG	< 126	11 (24.4)	34 (75.6)	1.813	0.178
	≥ 126	6 (13.3)	39 (86.7)		

The KAP scores were satisfactory among participants although BMI was far from the satisfactory range. Table 4.12 demonstrates that there is no significant association between KAP and BMI of study participants. This represents that if a person has high level of knowledge, attitude and practice score about diabetes, there is still possibility that they will be overweight or obese. 18.9% have poor KAP score and there are many aspects like regular exercise, controlled diet and no. of meals in which respondents have shown poor attitude and practice.

There was no significant association between the knowledge, attitude and practice (KAP) score of the patients with fasting blood glucose level (p = 0.178), which may due to the lack of proper utilization of their knowledge in their day to day life. In this study, though 91.1% have knowledge of factors that help in controlling blood sugar, only 54.4% are following a controlled and planned diet, only 44.4% exercise regularly and 67.8% miss taking the doses of diabetic medication. This represents that only having good knowledge about care of diabetes through medication, nutritional management and exercise is not enough to keep the blood sugar level in normal unless it is brought into the regular practice with positive attitude towards it.

4.4 Logistic Regression

Table 4.13 Factors associated with KAP

Variables	COR(95% CI)	P-value	AOR(95% CI)	P-value
Religion				
Hindu	Ref.		Ref.	
Non-hindu	0.226 (0.066-0.777)	0.018	3.766 (1.009-14.059)	0.049
Education				
Illiterate	Ref.		Ref.	
Literate	5.211 (1.694-16.029)	0.004	4.732 (1.492-15.009)	0.008

The binary logistic regression showed that non-hindu patients were 3.766 (95% CI: 1.00-14.05) times more likely to have good KAP as compared to hindu patients while literate were 4.73 (95% CI: 1.49-15.00) times more likely to have good KAP than illiterate. The Hosmer and Lemeshow Test indicated a good fit (p = 0.610) since the significant value is greater than 0.05. This finding is similar with the study done in a diabetes clinic of Southwest Iran where patients who had passed primary level of education or didn't have any formal education were 0.23 and 2.6 times respectively more likely to report a low score of diabetes knowledge compared to those who passed secondary level of education (Mohammadi *et al.*, 2015).

More than half (57.8%) of the people living with diabetes are aged under 60 years and are at the peak of their productive years (40 years of age). Thus, diabetes becomes a real burden that results in productivity loss. In contrast, most people with diabetes in developed countries are above the age of retirement, and hence there is less impact on their productivity (Boutayeb *et al.*, 2012). Since, diabetes can be managed well with adequate patient involvement, improving their KAP should be prioritized (Upadhyay *et al.*, 2008).

This study explored the relation between KAP score and fasting blood glucose level as per the report of study participants and compared it with actual glycemic control of the diabetics. There was no association between fasting blood glucose and KAP score which is supported by the result shown by similar KAP study done in Malaysia (Ng *et al.*, 2012). Similarly, there was no any significant correlation between KAP and BMI. Only education level and religion had significant correlation with the KAP score of diabetics.

The findings of the present study reassert the gaps in knowledge, attitude and practice regarding DM. Control of obesity is important for better glycemic control and prevention of complications, but it is evident from the present study that DM subjects do not attain this ideal goal as more than half of them are overweight and obese. Only less than half (44.4%) exercise regularly. Given the importance of physical activity to diabetes management, the low physical activity in this and similar studies should raise concerns among clinicians and it is necessary that all patients should be encouraged to increase their physical activity.

Regarding self-care practices, it should be a matter of concern that only 54.4% follow controlled and planned diabetic diet and only 6.7% consume 4-5 meals per day. The Nepalese food culture consisting of carbohydrate rich meals, limited food options and typical food preparation poses a barrier to dietary management of T2DM (Sapkota *et al*., 2017). Dietary advice should be imparted by a trained health professional whenever possible and customized to the patient profile (Shrestha *et al*., 2019). The management of Diabetes Mellitus not only requires the prescription of appropriate nutritional and pharmacological regimen by the physician but also intensive education and counseling of the patient (Nuttall, 1993).

Knowledge of the patients regarding the importance of self-monitoring of blood glucose and regular blood pressure (BP) check-up is essential. This study participants seemed to underestimate the importance of checking their blood sugar regularly though 98.9% of the diabetics regarded regular physician visits are important in the management of DM. Only 63.3% of the patients were aware of the importance of regular checking of BP. Serious diabetes education can improve glycemic control and quality of life of diabetic patients (Maina *et al.*, 2010).

In this study, predictors of higher knowledge, positive attitude, and good practice were identified which showed that being literate was strongly associated with having higher level of knowledge, positive attitude and good practice. It has been argued that educated patients are more likely to be interested in learning about their disease compared to uneducated patients who might be less interested in learning about their diseases and bring changes in their behavior accordingly. Additionally, being non-hindu is moderately associated with having higher KAP scores which can be because of the differences in cultural beliefs, attitudes and practices.

Although this study showed good level of KAP score, 18.9% showed poor level of knowledge, attitude and practice which is an important finding of this study. Improved knowledge can bring positive changes in the attitudes and practices thus leading to better management of the disease and better health outcomes (Malekzadeh *et al.*, 2016). Lifestyle management is a fundamental aspect of care for T2DM. Diabetes self-management education and support (DSMES), medical nutrition therapy (MNT), physical activity, smoking cessation counseling, and psychosocial care are important components of lifestyle management. Similarly, medication should be taken regularly although 67.8% participants miss taking the doses of diabetic medication in this study.

Sound knowledge, the right attitude and correct practices are the backbone of self-control in T2DM patient. A significant knowledge practice gap needs attention (Alsunni *et al.*, 2020). Health education messages provided to the patients by the health care providers perhaps play an important role in developing positive attitudes towards the recommended diets irrespective of their socio-demographic background. Previous studies have supported the needs of greater awareness of prevention, diagnosis, and risk factor control in diabetes (Upadhyay *et al.*, 2012).

The diagnosis of T2DM is a stressful life event and education on stress management forms an important aspect of the holistic management strategy. The patient with T2DM should undergo behavioral modification to develop positive attitude and healthy lifestyle. Specific guidance should be provided for developing coping skills, fostering family support and inculcation of healthy workplace environment (Shrestha *et al.*, 2019)

Part V

Conclusion and Recommendations

5.1 Conclusions

This study assessed the knowledge, attitude and practice of type 2 diabetic patients visiting selected outreach clinics of Dharan. The followings are the conclusions drawn from this study:

i. The study revealed a high level of knowledge 60%, attitude 75.6% and practice 75.6% in diabetic patients of Dharan.
ii. Religion and education level were found to be significantly associated with knowledge, attitude and practice of type 2 diabetic patients.
iii. There was no significant association between knowledge, attitude and practice and body mass index and knowledge, attitude and practice and fasting blood glucose.

5.2 Recommendations

The following measures are recommended to address the knowledge, attitude and practice deficits uncovered in this study:

1) Studies with wider scope and much large sample size is recommended to confirm findings and explore relevant features.
2) New policies should be established with a focus on increasing community awareness of diabetes and preventive measures in Nepal.

Part VI

Summary

Diabetes mellitus is becoming more prevalent in developing countries as a result of high-energy diets and sedentary lifestyles. The problem is further expanded due to ignorance and lack of knowledge. A cross-sectional descriptive study was conducted among the type 2 diabetic patients attending the selected outreach clinics of Dharan to assess the information on knowledge, attitude and practices on Type 2 Diabetes Mellitus. Each participant was interviewed face-to-face using a structured questionnaire. The study included 90 diabetic patients selected by convenience sampling method. Socio-demographic characteristics of the participants were determined. The knowledge, attitude and practice of participants were assessed. Data collected from the survey was analyzed using IBM SPSS version 20. Chi-square test and binary logistic regression were used to analyze the factors associated with KAP.

Out of 90 participants, 60% (54), 75.6% (68) and 75.6% (68) of the patients had good knowledge, positive attitudes and good practice scores respectively. A significant relationship existed between total KAP score and education level and religion of the patient. No significant relationship was found between total KAP score and other socio-demographic variables such as age, sex, ethnicity etc. Also, there was no significant association between the KAP score of the patients and fasting blood glucose level and with BMI. Non-hindu patients were 3.7 times more likely to have good KAP as compared to hindu patients while literate were 4.7 times more likely to have good KAP than illiterate. Despite positive attitude and good practices, knowledge of the participants was quite low. An integrated diabetes awareness program should be launched in both community and national level for improving knowledge of the patients. Knowledge incorporated change in attitude and behavior would bring a lot better results. Patients and healthcare professional should work together on optimizing lifestyle for enhancing diabetes care. Dietary advice should be imparted by a trained health professional whenever possible and customized to the patient profile.

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Appendices

Appendix A: Informed consent

Namaste!

I am Susmita Basnet, graduate 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 of Type 2 diabetic patients visiting selected outreach clinics of Dharan"**.

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 participation 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 be shared for academic purposes.

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 of this form.

I have signed this consent forms before my participation in the study.

Signature of patients: _____ Sign of witness: _____

Date: Date:

Place: Place:

I hereby state the study procedures 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:

Appendix B: Questionnaire

Part 1: Demographic, sociological and economic information

1. Name: _____
2. Age: _____
3. Gender: M ( ) F( ) Others ( )
4. Address: _____
5. Ethnic Group: _____
6. Religion:
   a) Hindu b) Buddhist c) Kirant d) Christian e) Others
7. Education:
   a) Illiterate b) Primary level c) Secondary level
   d) Intermediate e) University Degree
8. Marital Status:
   a) Single b) Married c) Divorced d) Widowed
9. What is your occupation?
   a) Business b) Service c) Agriculture d) Housewife e) Other
   If service, when were you found diabetic?
   a) Before retirement
   b) After retirement
10. Total annual income of the family:
    a) Below 1,20,000 b) 1,20,000 - 2,40,000
    c) 2,40,000 -3,60,000 d) 3,60,000 and above
11. How long have you been suffering from diabetes?
    a) Less than 3 years b) More than 3 years
12. Does anybody in your family have diabetes?
    a) Father b) Mother c) Grandfather d) Grandmother e) None
13. Height: _____cm Weight: _____
    BMI: _____
    Underweight ( ) Normal ( ) Overweight ( ) Obese ( )
14. Current fasting blood glucose levels? (Obtained from patients records)

    FBG: _____ mg/dl

Part 2: Knowledge related questions

1. Diabetes is a condition in which the body contains:
   a. Blood sugar higher than normal
   b. Blood sugar lower than normal
   c. Either higher or lower level of sugar in the blood than normal
   d. I don't know
2. The major cause of diabetes is:
   a. An increased availability of insulin in the body
   b. A decreased availability of insulin in the body
   c. I don’t know
3. The symptoms of diabetes is/are:
   a. Increased frequency of urination
   b. Increased thirst and hunger
   c. Increased tiredness
   d. Slow healing of wounds
   e. Weight loss
   f. All of above
   g. I don’t know
4. Diabetes, if not treated:
   a. Can lead to eye problems
   b. Can lead to kidney problems
   c. Can lead to foot ulcers
   d. Can lead to heart problems
   e. All of above
   f. I don’t know
5. The most accurate method of monitoring diabetes is:
   a. Checking blood glucose level
   b. Checking urine sugar
   c. I don’t know
6. A diabetic patient should measure his or her blood pressure:
   a. Once every month
   b. Once every two months
   c. Once every six months
   d. Once a year
   e. Need not check at all
   f. I don’t know
7. A diabetic patient should have his or her eyes checked:
   a. Once every six months
   b. Once a year
   c. Need not check at all

8. 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
9. The important factor that help in controlling blood sugar are:
   a. A controlled and planned diet
   b. Regular exercise
   c. Medication
   d. All the above
   e. None
10. For 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.
11. The symptom of hypoglycemia is/are:
   a. Sweating
   b. Dizziness
   c. Hunger
   d. Nausea
   e. All of the above
   f. I don't know
12. 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 think diabetes is a big deal?
   a. Yes b. No c. Don't know
2. Do you think regular exercise helps in controlling diabetes?
   a. Yes b. No c. Don’t know
3. Are you following a controlled and planned diabetic diet?
   a. Yes b. No

   If yes, how often?

   a. Always b. Sometimes c. Rarely

4. 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
5. 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 c. Visual disturbances
   b. Confusion d. I don't know
6. Do you think you should keep in touch with your physician?
   a. Yes b. No

Part 4: Practice related questions

1. Do you exercise?
   a. Yes b. No
   If yes, how often?
   a. Every day c. Twice a week or more
   b. Once weekly d. Irregularly
2. How many times do you take food per day?
   a. _____ main meals
   b. _____ in-between meals
3. Do you smoke?
   a. Yes b. No
4. When was your blood pressure last checked?
   a. One week ago d. Six month ago
   b. One month ago e. Not done at all
   c. Two months ago
5. When was your last eye examination?
   a. One month ago d. Two years ago
   b. Six months ago e. Not done at all
   c. One year ago

6. When was your last visit to your physician?
   a. One month ago
   b. Six month ago
   c. One year ago
   d. Two years ago
   e. Not at all

7. 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

8. 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

9. When was your lipid profile last checked?
   a. One month ago
   b. Six months ago
   c. One year ago
   d. Two years ago
   e. Not done at all

Appendix C: Photo gallery

P1: Asking survey questionnaire

P2: Measurement of weight

P3: Measurement of height

Appendix D: Map of the study area