DIABETES KNOWLEDGE, RISK PERCEPTION, AND DIABETES RISK ASSESSMENT IN TEACHING STAFF OF THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

June, 2021

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Nutrition and Dietetics

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for the Degree of Masters of Science
Family and Community Sciences
Foods and Nutrition (Dietetics)

By

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June, 2021

CERTIFICATE

This is to certify that the research work present in this thesis has been carried out independently by Ms. Sanchita Khanna under the guidance of Dr. Shonima Venugopal in pursuit of the Degree of Masters of Science (Family and Community Sciences) with majors in Foods and Nutrition (Dietetics) and this is her original work.

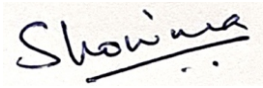

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

BMI-Body Mass Index

CARRS-Centre for Cardio-Metabolic Risk Reduction South East Asia

CVD- Cardiovascular disease

CRP- C - Reactive Protein

DALYs- Disability Adjusted Life Years

FTO-Fat Mass and Obesity Associated Gene

EAR-Estimated Energy Requirements

ESRD-End stage renal disease

RDA- Recommended Dietary Allowances

EAR – Estimated Average Requirement

GAD 65-Glutamic Acid Decarboxylase 65

HbA1C-Glycated Hemoglobulin

HDL -High-Density Lipoprotein

HLA – Human Leucocyte Antigen

IA 2 – Islet Antigen -2

IA- 2 β- Islet Antigen – 2 Beta

ICMR- Indian Council of Medical Research

IDF-International Diabetes Federation

IFG-Impaired Fasting Glucose

IGT- Impaired Glucose Tolerance

INF α-Tumour Necrosis Factor Alpha

IR – Insulin Resistance

KAP-Knowledge attitude and practices

NCDs- Non-Communicable Disease

NEFA- Non-Esterified Fatty Acids

NF- kB- Nuclear Factor Kappa Light Chain Enhancer of Activated B cells

NFHS- National Family Health Survey

PCR – Polymerase Chain Reaction

PR- Perceived Risk

RFLP-Restriction Fragment Length Polymorphism

T1DM- Type 1 Diabetes Mellitus

T2DM-Type 2 Diabetes Mellitus

TCF 7 L 2 – Transcription Factor 7 Like 2

Type 2 DM- Type 2 Diabetes Mellitus

WC- Waist Circumference

WHO-World Health Organization

WHR-Waist Hip Ratio

WSR- Waist Stature Ratio

ZnT8- Zinc Transporter 8

ABSTRACT

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Diabetes is a metabolic disorder with an alteration in the metabolism of the macronutrients such as carbohydrates, proteins, and fats. Epidemiologic studies have also proposed that without any effective intervention to control this chronic disease, number of diabetics will continue to upsurge both in developing and developed nations The coexistence of diabetes and cardiovascular ailments lead to a high mortality rate and among such patients, the risk of neurological disorders such as stroke and other cardiovascular morbidities were also found to be on the higher side. Furthermore, a high mortality rate due to diabetes leads to the loss of 12-14 productive lifestyle years.

Even though physical activity and healthy eating patterns are widely endorsed approaches to curb diabetes and avert its sequelae, the prevalence of diabetes continues to surge globally and in India.

The present study was planned to assess diabetes knowledge, diabetes risk perception, and diabetes risk assessment in the teaching staff of The Maharaja Sayajirao University of Baroda.

The results of the study revealed that the mean age of the subjects was 42.7 ± 11.5 years. Around 59% of the subjects were female and 41% of the subjects were male. Overall prevalence of overweight and obesity in subjects was 74%. A higher percentage of females (59%) were found to be obese in comparison to males (52%). Prevalence of overweight was higher in males (22%) in comparison to females (15.3%).

The medical conditions that were most prevalent among subjects were hypertension (18.9%) followed by diabetes (10.6%). Co-existence of diabetes and hypertension was reported in 5% of the subjects. Around 20.7% of the subjects were physically inactive and nearly 18.43% of the subjects were not

consuming fruits, vegetables, and berry in their everyday diet. Average fat (55.7 ± 25.3) and carbohydrate (210.6 ± 67.6) intake of the subjects was approximately twice the estimated average requirements. Diet was also deficient in micronutrient calcium.

Most of the subjects (99%) were aware of what diabetes is. But only 92% of subjects knew how diabetes is measured. Awareness regarding older age and hypertension being risk factors for diabetes was lacking in 64.6% and 72.4% of the subjects respectively. Around 56.5%,65.2%,69.6%,78.3,78.3%,95.7% of the subjects had knowledge of symptoms of diabetes such as fatigue, increased hunger, blurred vision, slow healing of wound, increased thirst, and frequent urination. Almost 93.5% of the subjects were aware of complications of diabetes, but awareness regarding specific complications of diabetes was lacking. Around 39.2%, 34.7%, 29%, 23.5% of subjects respectively were not aware that foot problems, heart disease, kidney disease, eye disease were complications linked with diabetes. Almost 58.3% of the subjects were unaware of the association between smoking and diabetes risk. Overall diabetes knowledge scores of females were higher than males ($p=0.0004$) and the diabetes knowledge scores of physically active individuals was more than physically inactive individuals ($p=0.02$). Knowledge score on diabetes varied with a family history of diabetes($p=0.0001$) and with BMI ($p=0.01$).

Roughly one-third (33.7%) of the female subjects were at high risk of diabetes and around 50% of the male subjects were in a slightly elevated diabetes risk category. The diabetes risk scores varied significantly with family history of diabetes (p-value=0.000),across the categories of BMI (p-value=0.000) and age group (p-value=0.04). A significant association was found between diabetes risk score with BMI and waist circumference at a p-value=0.01.

Only 7.8% of the subjects were very worried about developing type 2 diabetes in their lifetime. A statistically significant difference was not found in diabetes knowledge across the categories of the diabetes risk perception and only 15% of the subjects who were actually at a very high risk perceived themselves to be at high risk of developing diabetes. A meaningful difference in diabetes risk perception was observed with gender ($p=0.02$) and with a family history of diabetes ($p=0.0001$).

Thus, it can be concluded that there is a dire need to generate awareness about diabetes and its risk factors, symptoms, complications, and preventive factors in the general population as well as among diabetic subjects. Also, educating people about risk factors for diabetes may promote more accurate perception of diabetes risk. Awareness campaigns using appropriate IEC materials need to be conducted to sensitise the people about making healthy lifestyle choices which may aid in preventing the development of chronic conditions like diabetes.

INTRODUCTION

INTRODUCTION

NON-COMMUNICABLE DISEASE GLOBAL SCENARIO

Non-communicable disease (NCDs) is a term used to distinguish the group of diseases that are chronic such as diabetes, cardiovascular disease, respiratory disease, cancer. These diseases are caused due to the coexistence of environmental, genetic, behavioural, and physiological risk factors. Globally 41 million deaths occur due to NCDs every year. NCDs that cause most deaths are cardiovascular disease (17.9 million), cancer (9 million), respiratory disease (3.9 million), and diabetes (1.6 million). About 80% of all deaths attributed to these four NCDs occur prematurely and around 15% of NCDs-related deaths occur in the age group of 30 - 69 years. Metabolic risk factors such as raised blood pressure, overweight, obesity, hyperlipidaemia, hyperglycaemia, and modifiable behavioural risk factors such as tobacco consumption, excess intake of alcohol, physical inactivity, unhealthy eating pattern, upsurges the risk of non-communicable diseases (WHO, 2018).

NCDs: INDIAN SCENARIO

Non-communicable disease (NCDs) burden is rising enormously in India. Indians develop NCDs at a younger age (≥ 45 years of age) in comparison to individuals of many developed nations where the mean age for the development of NCDs is 55 years or above due to the presence of undiagnosed chronic disease conditions and lack of health care facilities. NCDs that were found to be most prevalent among Indians were diabetes, cardiovascular diseases (CVD), respiratory diseases. These three NCDs contribute to 4 million deaths annually in India. The majority of the NCDs-related deaths occur prematurely in the age group of (30-70) years (Arokiasamy, 2018).

DIABETES

Diabetes mellitus is a long-term illness with the existence of elevated blood glucose levels. The metabolism of fats and proteins is also altered in the presence of this condition. High blood glucose levels may occur due to the inability of the cells to metabolize it. It may occur due to insufficient secretion of insulin by the beta cells of the pancreas or inefficiency of the cells to utilize the produced insulin. Three major types of diabetes are type 1 diabetes, type 2 diabetes, and gestational diabetes (Roglic, 2016). Diabetes can be classified in to type 1 diabetes mellitus, type 2 diabetes mellitus, gestational diabetes mellitus as shown in Figure 1.1. Type 1 diabetes accounts for 5-10% of deaths in all diabetic cases. Type 2 diabetes accounts for 90-95% of all diabetic cases.

AETIO- PATHOLOGY OF DIABETES

Destruction of beta cells or insufficient secretion of insulin is commonly found in all types of diabetes. Many factors impact beta cell functioning such as insulin resistance, autoimmunity, epigenetic process, inflammation, and environmental factors (Classification of Diabetes Mellitus, 2019).

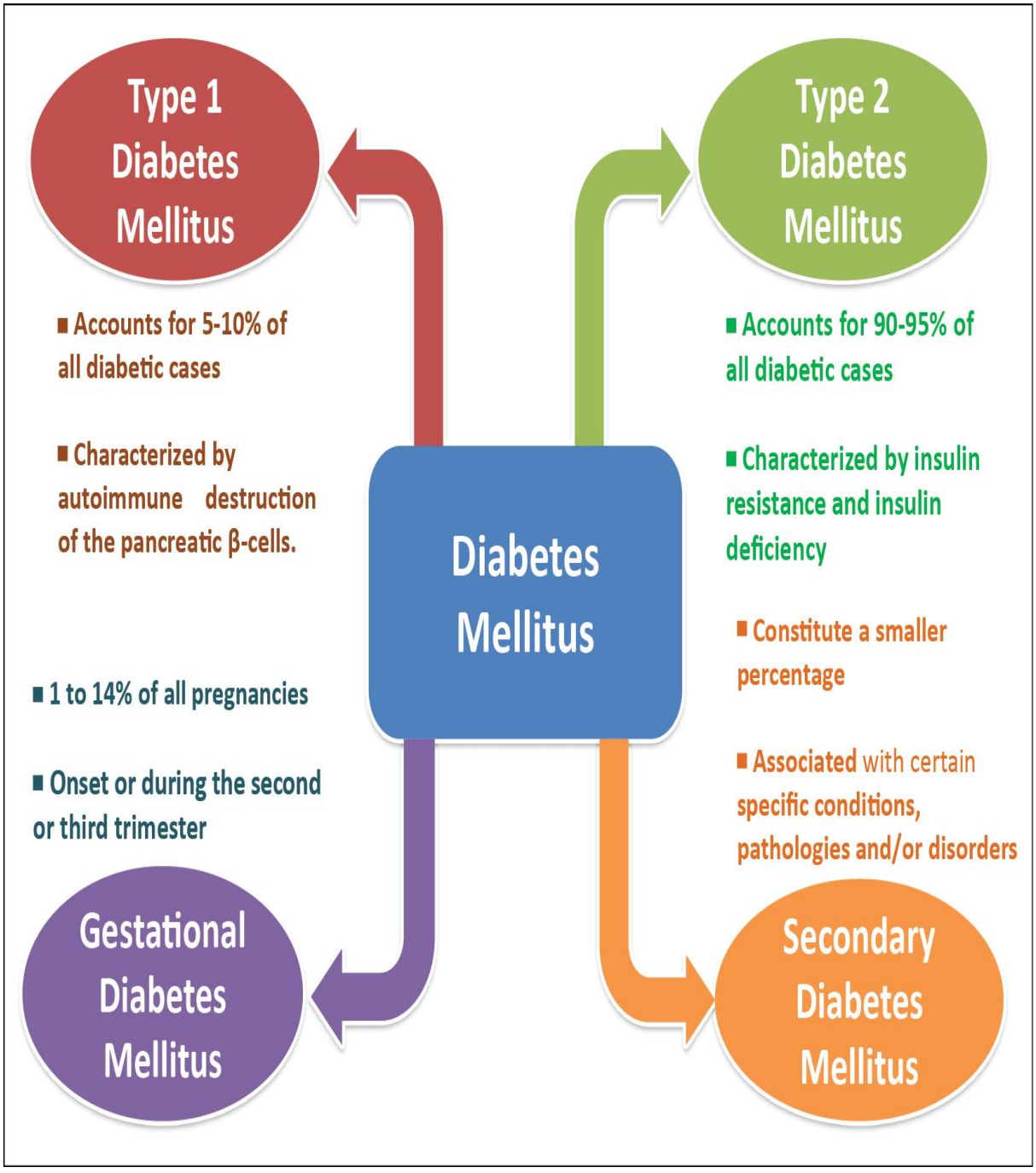
PREVALENCE OF DIABETES

Globally, the number of people having diabetes has increased four times in the last three decades. Diabetes was reported to be the 9th major cause of death globally. One in eleven people in the world were reported to have diabetes. Among them, 90% were reported to have type 2 diabetes. Most of type 2 diabetes cases can be prevented by adopting a healthy lifestyle (Zheng et al, 2018).

In the year 2019, about 463 million people were reported to have diabetes, and numbers are expected to rise to 578 million by 2030, and about 700 million by

FIGURE - 1.1

CLASSIFICATION OF DIABETES



Source- Banday et al, 2020

the year 2045. The prevalence of diabetes was reported to be higher in urban areas (10.8%) than in rural areas (7.2%). Countries with higher income reported having a high prevalence of diabetes in comparison to low-income countries (10.4% vs 4%) (Saeedi et al, 2019).

The prevalence of prediabetes is also rising at an alarming rate. In the year 2019 around 374 million people were expected to be prediabetic and the numbers are expected to rise to 454 million by 2030 and 548 million by 2045 (IDF, 2019).

The swift rise in the prevalence of diabetes has been observed in recent years in developing nations. However, variation in the prevalence rate was observed in the urban and rural areas. The prevalence of diabetes also varies among the different ethnic groups. South Asians, Africans develop diabetes a decade earlier at lower BMI levels in comparison to Caucasians. Among them, the majority have the presence of abdominal obesity. The presence of micro and macrovascular complications was also very high (Misra et al, 2019).

The Centre for Cardio-Metabolic Risk Reduction South East Asia (CARRS) study was conducted to evaluate the prevalence of diabetes and prediabetes and their association with risk factors in three large cities of South East Asia (Chennai, Delhi, and Karachi). The general prevalence of diabetes and prediabetes among the study participants was found to be (47.3-73.1 %), In Chennai, the prevalence of diabetes and prediabetes was 22.8% and 37.9% respectively. In Delhi, the prevalence of diabetes and prediabetes was 25.2% and 37.9%, and in Karachi 16.3% and 31% respectively. Association was also observed between family history, obesity, high cholesterol level, high triglyceride level, high waist-hip ratio, low HDL cholesterol, age, hypertension, as risk factors for diabetes (Deepa et al, 2015).

As per the global burden of disease study (1990 – 2016), an immense rise in the prevalence of diabetes was reported in India from 26 million in the 1990s to 65 million in 2016. In the 1990s around 5.5% of the adults aged 20 years and above were reported to have diabetes and in 2016 the prevalence rates increased to 7.7%. Age-standardized prevalence of diabetes and disability-adjusted lifestyle years (DALYs)were reported to increase to 39.6% in 2016. Around 36% of

DALYs in subjects with diabetes were reported to be related to overweight and obesity (Tandon et al, 2018).

In the year 2016, among every 100 overweight adults in India, around 38 were reported to have diabetes in comparison to the global average of 19 adults (Tandon et al, 2018).

Akhtar and Dhillon (2017) analysed the prevalence of diagnosed diabetes and its associated risk factors using clinical, biochemical, and anthropometric data from the District Level Household and Facility Survey (2012–2013) and Annual Health Survey (2014) in India. They observed that the overall prevalence of diabetes was around 7%. The prevalence in the urban areas was found to be higher than the rural areas (9.8% vs 5.7%) and its preponderance was found to be more in males in comparison to females (7.1% vs 6.8%).

The regional prevalence of diabetes in the urban Indian population varies from as low as around 5.4% in the Northern States to as high as 12.3 to 15.5 in Chennai, South India, and 12.3% to 16.8% in the Jaipur, Central India (Gupta et al, 2007).

As a part of a non-communicable disease risk factor surveillance survey, the prevalence of diabetes was studied across the different geographical locations of India from April 2003 to March 2005. The individuals in the age group of (15 – 64 years) were included as a part of the study. The prevalence of diabetes varies in urban, rural and slum areas around 7.3%, 3.2%, 3.1% respectively and among the self-reported diabetic individual's obesity and sedentary lifestyle was found to be a major risk factor associated with diabetes (Mohan et al, 2008).

The prevalence of diabetes varies across the states of India. As per the ICMR-INDIAB a population-based crossectional study, the prevalence of diabetes across the states was Andhra Pradesh (8.4%), Bihar (4.3%), Gujrat (7.7%), Punjab (10.0%), Arunachal Pradesh (5.1%), Assam (5.5%), Manipur (5.1%), Meghalaya (4.5%), Mizoram (5.8%), Tripura (9.4%) (Anjana eta al, 2017).

A crossectional study was conducted by Dasappa et al (2015) to study the overall prevalence of diabetes and prediabetes in the urban slum dwellers of

Bangalore. They observed that the overall prevalence of diabetes was 12.3% and prediabetes was 11.57%.

Statistically, a significant association was observed between risk factors such as female gender, physical inactivity, central obesity, and age greater than 45 years and above, and prevalence of diabetes at p-value (< 0.01). Madhu et al (2018) also reported the prevalence of diabetes to be around 18.3% and prediabetes about 21% in a study conducted among the residents of East Delhi.

DIABETES AND ITS RISK FACTORS

The risk of diabetes is determined by various factors such as ethnicity, genetics, family history of diabetes, older age, overweight and obesity, unhealthy eating pattern, physical inactivity, smoking, and stress, high blood pressure, history of gestational diabetes Figure 1.2 (Global Report on Diabetes, 2016).

Around 40% of the first-degree relatives of diabetic patients were at risk to develop diabetes in the near future but in the general population, the incidence rate of diabetes was found to be around 6% (Kobberling, 1982).

A study was conducted among the working women in Berhampur, Orissa to assess the risk factors for developing diabetes. It was observed that increasing age and the presence of obesity act as risk factors for the development of diabetes (Malini et al, 2009).

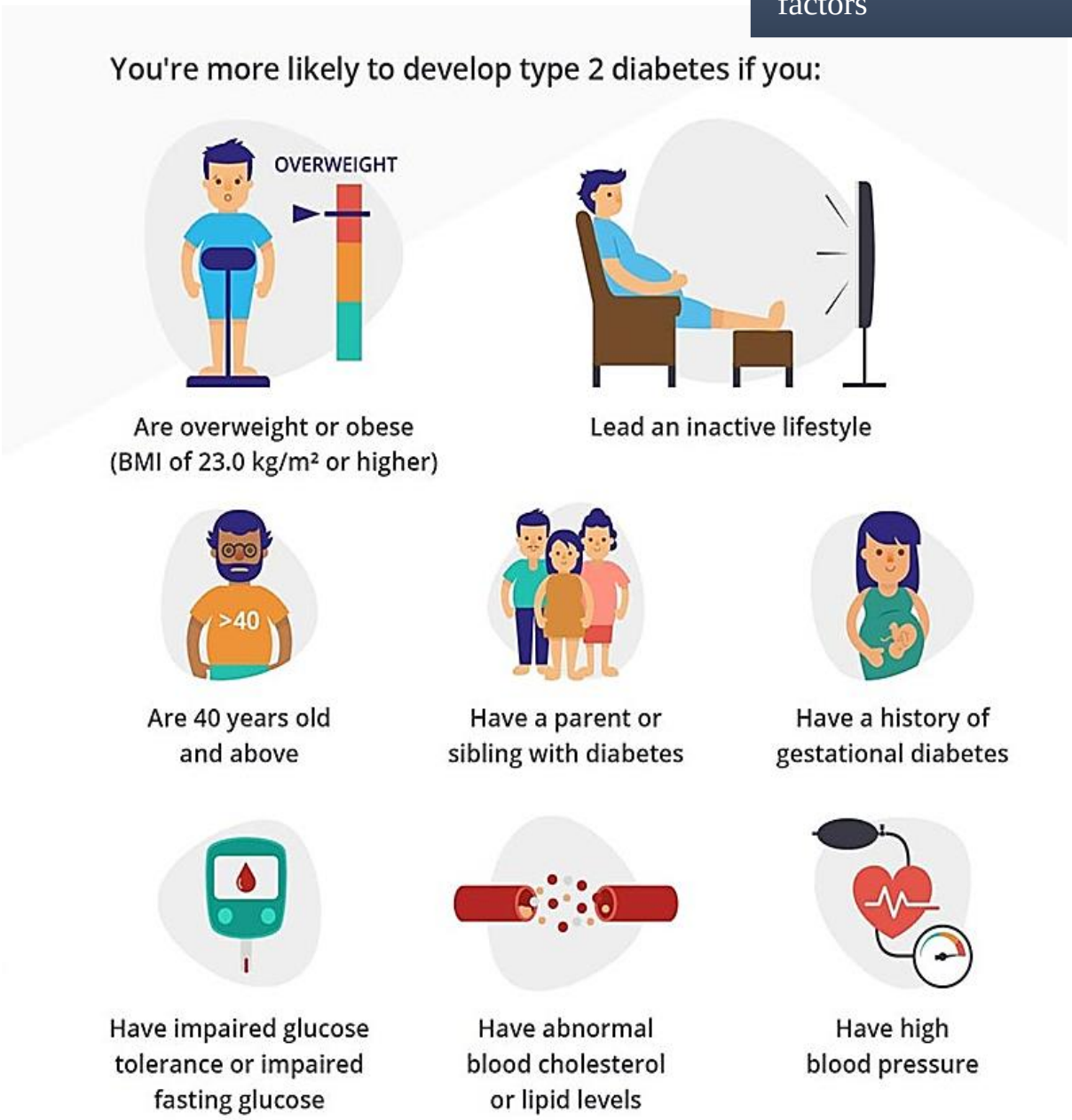
In a study by Oggioni et al (2014) it was reported that there is a correlation between physical inactivity, age, and prevalence of diabetes and westernized eating pattern also increases the prevalence of type 2 diabetes.

Ectopic fat obesity is also a risk factor for type 2 diabetes mellitus. It is a kind of obesity in which fat is stored as a triglyceride in the tissues other than adipose tissues which normally contain a small amount of fat such as skeletal muscle, pancreas, liver, and heart.

FIGURE - 1.2

DIABETES RISK FACTORS

Individual is likely to have increased diabetes risk with presence of these risk factors



(Diabetes Pocket Guide, 2020)

This type of obesity increases insulin resistance and enhances the risk of type 2 diabetes among individuals with ectopic fat obesity In a study by Okamura et al (2019) the hazard ratios (HR) for the incidence of diabetes among the only obese individuals were found to be around 1.85 in men and 1.79 in women. For visceral fat obesity hazard ratio for the incidence of diabetes in men was 3.41 and 2.30 for women. For ectopic fat obesity hazard ratio for the incidence of diabetes in men was 4.74 and for women was 13.99. The overall hazard ratios for incidence of diabetes in obese men and women were reported to be around 10.50, 30.0 respectively.

In this study, a significant association was observed between the incidence of diabetes and ectopic fat obesity at a p-value < 0.001. So, it can be concluded that ectopic obesity is a risk factor for diabetes.

Various longitudinal and crossectional studies reported that physical inactivity is an independent risk factor for diabetes in both men and women and the incidence of diabetes was found to be lower in physically active obese individuals (Alberti et al, 2007).

Depression may act as a risk factor for diabetes. Rotella & Edoardo (2013) conducted a study to explore is depression is linked with diabetes. In their study results, it was observed that a higher incidence of diabetes was found in the depressed individuals in comparison to non-depressed individuals at a p-value $< .001$.

A nationwide survey was conducted to assess the prevalence of the risk factor of diabetes and its association with diabetes in the Canadian population. In the study results, it was observed that increasing age and obesity increases the prevalence of diabetes whereas a negative association was observed between the energy expenditure and prevalence of diabetes. Smoking was also found to be associated with the prevalence of diabetes (Choi & Shi, 2001).

COMPLICATIONS OF DIABETES

Type 2 diabetes leads to acute and chronic complications if left untreated. The macrovascular diseases that are caused due to diabetes are hyperlipidaemia,

heart attack, coronary artery disease, peripheral vascular disease, and stroke. The microvascular diseases that are caused by diabetes are neuropathy, nephropathy, and retinopathy (Wu et al, 2014).

One of the key causes of morbidity and mortality in type 2 diabetes is heart disease and it was estimated that in diabetics cardiovascular disease accounts for 10% to 11% of vascular deaths (Barret et al, 2018).

Low Wang Cecilia et al (2016) in a clinical update on diabetes had also reported that cardiovascular disease is a key cause of demise and morbidity in type 2 DM patients and among the type2DM patients with undiagnosed cardiovascular morbidities even if they are taking any hypoglycaemic drugs the risk reduction for the cardiovascular ailment was not adequately altered. However, the subjects taking diabetes medication along with multifactorial risk reduction medication for cardiovascular diseases such as lipid-lowering agents, antihypertensive agents, hypoglycaemic agents among them, the risk of cardiovascular complication falls but yet remains higher than the patients without diabetes with the presence of the cardiovascular disease risk factors.

Kidney disease is found to be quite common in diabetics in a lifetime and also leads to serious complications if left untreated and also impacts the quality of life of the individual. Most commonly seen kidney diseases are diabetic nephropathy, ischemic nephropathy, hypertensive nephropathy that may lead to kidney failure if left untreated (McFarlane et al, 2018).

In the IDF Diabetes Atlas (2019) it was reported that 80% of the deaths due to end-stage renal disease (ESRD) are attributed to either diabetes or hypertension or the coexistence of both.

About 70% of the individuals with diabetes were affected by hypertension too. The prevalence of the coexistence of diabetes and hypertension varies across social, ethnic, and racial groups. Moreover, individuals with the coexistence of diabetes with hypertension are at risk of vascular diseases, and individuals with the coexistence of diabetes and hypertension are prone to kidney diseases too. Other comorbidities that result from the coexistence of diabetes and hypertension are ischemic cerebrovascular disease, retinopathy, and sexual dysfunction (Lago et al, 2007).

The study by Abraham et al (2015) was conducted in a tertiary care hospital in South India to study the prevalence of foot complications in diabetics. The foot complications observed among the participants were non-healing of the wounds and ulcers 41.51% followed by Charcot arthropathy 10.46%, gangrene 9.38%, cellulitis 7.94%, fungal infection 6.89%, callus 3.6%, osteomyelitis 3.9%, necrotizing fasciitis 2.52% and in the study group of diabetics with these complications around 76.89% of the subjects were hypertensive too.

Worldwide every 30 seconds a lower limb is lost due to complications of diabetes. The commonness of lower limb amputations is 10 to 20 times higher in diabetics in comparison to nondiabetics and it is worrisome to know that foot ulcers and lower limb amputation are more common in low-income and middle countries than in economically developed nations (IDF, 2019).

With severe hyperglycaemia, various body organs are affected and one of them is the eye and one of the most prevalent eye diseases among diabetics is diabetic retinopathy and is also a leading cause of blindness in the working population and other ocular diseases that were observed in diabetics are glaucoma, optic neuropathy, cranial nerve palsies, cataract, recurrent corneal erosion syndrome (Henriques, 2015).

KNOWLEDGE AND AWARENESS ABOUT DIABETES

Diabetes is a global epidemic and it is a serious disease which leads to micro and macrovascular complications if left untreated. The prevalence of diabetes is increasing globally because of a sedentary lifestyle, unhealthy eating patterns. Knowledge and awareness about the disease help in its prevention and management.

Niroomand et al (2015)conducted a study to assess the diabetes knowledge, attitude, and practice score among the type 2 diabetes, Iranian patients. The average age of the participants was around 60.7 years and knowledge, attitude, and practice scores of the participants were found to be 50.44%, 52.3%, 61.4% respectively, and also meaningful association was observed between the

knowledge of the complication of diabetes and Knowledge, attitude and practice (KAP) score.

A study was conducted by Anyanti et al (2021) to assess the knowledge about diabetes and hypertension in the population of Nigeria. In the study results, it was reported that the majority of the subjects were aware of diabetes and hypertension around 90.5%, 94.4% respectively. A family history of diabetes and hypertension was reported to be 20.8%, 44.1% respectively. Around 75% of the subjects were engaged in the regular physical activity regime. However, only 33.9% of the study participants were consuming fruits four to seven times a week and about 59.5% of the subjects were consuming vegetables on weekly basis. Knowledge of the complication of diabetes among subjects such as heredity 61%, older age 27.5%, stress 26.8%, insulin resistance 27.6%. Awareness of the risk factors of diabetes such as hereditary, obesity, and smoking was found to be around 62%, 35%, 6% respectively. Awareness of frequent urination and non-healing of wounds as a symptom of diabetes was 73.7%, 50.3% respectively. It was worrisome to know that knowledge of complications of diabetes such as heart failure (27.9%), kidney failure (33.7%), stroke (41%) was also quite low. It was disappointing to know that only 9.9% of the subjects were aware that avoiding intake of excess sugar in the diet can prevent diabetes.

A systematic review study was conducted in South Arabia to assess the overall knowledge of diabetes in their population. On computing the study results researchers found that the general population of South Arabia has a lack of awareness regarding the complication and risk factors of diabetes whereas among health care workers and the medical student's knowledge deficit was observed regarding the usage of the insulin injection and epidemiology of diabetes (Alanazi et al, 2018).

In a study by Kurian et al (2016) to assess the knowledge about diabetes in the general population in the rural areas of Kerala, it was found that most of the study participants had heard of diabetes. Around 78.1% of study participants assumed that a family history of diabetes increases the chances of having diabetes in the future. Awareness regarding obesity (3.5%) and physical

inactivity (4.9%) as risk factors of diabetes was quite low. The average knowledge score of the study participants was found to be 15.06.

A crossectional survey was conducted to assess knowledge, attitude, and practices concerning diabetes among diabetic and non-diabetic subjects visiting a homeopathic hospital in West Bengal. It was observed that knowledge about diabetes was higher among the diabetic study participants in comparison to the non-diabetic study participants (p-value < .0001). Around 46.5% of diabetic study participants and about 35.5% of the nondiabetic study participants knew that diabetes is a preventable condition. Lack of knowledge regarding high blood pressure (21.9% vs 21.7%), physical inactivity (19.8% vs 16.1%), obesity (22.7% vs 13.8 %) as risk factors for diabetes was observed among both diabetic and non-diabetic participants (Koley et al, 2016).

Awareness regarding the long-term complications of diabetes has also been found to be lacking. Barthi et al (2019) conducted a study among diabetes patients to understand their knowledge about the long-term complications of diabetes. Among the study participants, 16 .6 % had adequate knowledge, 30 % had moderate and around 53.33% of the study participants had inadequate knowledge regarding the complications of diabetes.

RISK ASSESSMENT FOR DIABETES

The prevalence of type 2 diabetes is increasing at an alarming rate and more than 90% of diabetics are found to have type 2 DM. The presence of this disease condition leads to high morbidity and mortality that is preventable if modifiable risk factors of diabetes are managed. That can be done by assessing diabetes risk using diabetes risk assessment tools that help us to analyse the risk of diabetes in the general population without conducting any biomedical tests and making them aware of their risk to have diabetes in the near future based on their risk scores (Jayakiruthiga et al, 2018).

A study was conducted in Jordan to assess the diabetes risk in college students using the Finnish diabetes risk score (FINDRISC). In the study results, the risk factors of diabetes that were observed most commonly among the college

students were overweight and obesity around 23.2%, and about 27.3% of the study participants were reported to have central obesity. On computing, the diabetes risk score it was observed that 5.2% of the study participants were at moderate risk and 1.8% of the subjects were in the high-risk category and it was noteworthy that among the subjects that were found to be in the high-risk category when their plasma glucose was taken to know about their actual diabetes risk around 8 subjects were actually found to be diabetic (Shudifat et al (2017).

Risoy et al (2018) conducted a study to assess the diabetes risk in the general population of Norway visiting pharmacies. Three pharmacies were selected for this survey and individuals of the community were made aware of the survey using different modes of communication. To assess the diabetes risk, they had used the Finnish diabetes risk score and the UK diabetes risk assessment tool to assess the diabetes risk in both the European and the non-European population. Around 218 participants filled the questionnaire among them 211 nondiabetic participants were recruited for the study and their diabetes risk scores were calculated. Around 187 participants filled the FINDRISC diabetes risk assessment tool and 24 participants filled the UK diabetes risk assessment tool as per their ethnicity. Corresponding risk score for Finnish diabetes risk score were low risk (28%), slightly elevated risk (37%), moderate risk (15%), high risk (17%), very high risk (1%), and corresponding scores for the UK risk assessment tool were low (17%), increased (25%), moderate (54%), high (4%) respectively.

Dasraju et al (2020) in a study conducted to assess the risk of diabetes in the rural area of Bangalore reported that around 52% of the participants were at moderate risk and around 6% of the participants were at high risk based on their risk scores obtained using the Finnish Diabetes Risk Score. Physical inactivity of around 71%, less consumption of fruits and vegetables were observed to be the most prevalent modifiable risk factors among the study participants.

Vijayakarthikeyan and Sangeetha (2019) conducted a study to assess the risk of diabetes in the rural adult Tamil Nadu population. Based on computed risk scores around 42.7 % of the study participants were at moderate risk, about 29%

of the participants were at high risk and around 28.3% of the participants were at low risk of having diabetes. A meaningful association was observed between obesity, physical inactivity, alcohol consumption as risk factors for diabetes.

A study was conducted to assess diabetes risk using the Indian diabetes risk score in the urban areas of Tamil Nadu. It was observed that the majority (57.6%) of the study participants were at higher risk of getting diabetes in the future. A strong association was observed between increasing age and the risk of getting diabetes (Jayakiruthiga et al, 2018).

DIABETES RISK PERCEPTION

As per health behaviour theories, an increased perceived risk of the disease leads to higher chances of preventive action. Moreover, even though knowledge about diabetes is increasing, even then people perceive that their risk of getting diabetes in the future is quite low (Piccinino et al, 2015).

Heidemann et al (2019) in their survey in the German population including adults in the age group of 18 to 79 years assessed an individual's risk perception about diabetes. They observed that the majority of subjects at higher risk of getting diabetes in the future had low-risk perceptions.

In a pilot study conducted to assess perceived diabetes risk among college students in New York, around 70% of the study participants in the prediabetic stage did not perceive that they were at risk of getting diabetes in the future. Risk factors of diabetes that were observed most common among students were physical inactivity, high BP, family history of diabetes, and high blood glucose levels of around 61.4%, 45.5%, 43.2%, and 15.9% respectively (Antwi et al, 2020).

Literature review reveals that the prevalence of diabetes continues to escalate globally and in India. Unfortunately, many adults may not be aware of the increased risk for type 2 diabetes that results from their lifestyle behaviours. Improving diet and increasing physical exercise are widely endorsed approaches

for reducing diabetes risk. It has been proposed that individuals must perceive that they are at high risk of developing a disease to consider modifying their health behaviours to prevent its onset. However, few studies have assessed risk perception for developing diabetes in the Indian population along with knowledge about diabetes and estimated diabetes risk. Therefore, it was thought worthwhile to assess diabetes knowledge, risk perception, and estimated diabetes risk in the teaching staff of The Maharaja Sayajirao University of Baroda.

BROAD OBJECTIVE OF THE STUDY

To assess diabetes knowledge, risk perception, and the risk of developing diabetes in the teaching staff of The Maharaja Sayajirao University of Baroda.

SPECIFIC OBJECTIVES

- To assess diabetes knowledge in the teaching staff of The Maharaja Sayajirao University of Baroda.
- To assess risk perception for developing diabetes in the teaching staff of The Maharaja Sayajirao University of Baroda.
- To assess the risk of developing diabetes in the teaching staff of The Maharaja Sayajirao University of Baroda.
- To assess the relationship between diabetes knowledge and the perceived risk of developing diabetes.
- To assess the association between the estimated risk of developing diabetes and the perceived risk of developing diabetes.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

DIABETES MELLITUS

Diabetes mellitus is a chronic metabolic disorder characterized and identified by the presence of hyperglycaemia. This disease has heterogeneous pathophysiology. Identified by the presence of a defect in the insulin secretion, action, or both. In diabetes, tissues are not able to utilize carbohydrates, and alterations in protein and fat metabolism are also observed (Classification of Diabetes, 2019).

Typical symptoms of diabetes are excessive thirst, polyuria, blurred vision, and weight loss. In severe cases, a ketoacidosis state can also occur that leads to dehydration and coma, and in the absence of effective treatment, death can also occur.

Diabetes can be diagnosed if the fasting blood glucose level ≥126 mg/dl, 2hrs plasma glucose levels ≥200mg/dl, HbA1c ≥6.5%, and having random plasma blood glucose levels greater than 200mg/dl as shown in Figure 2.1.

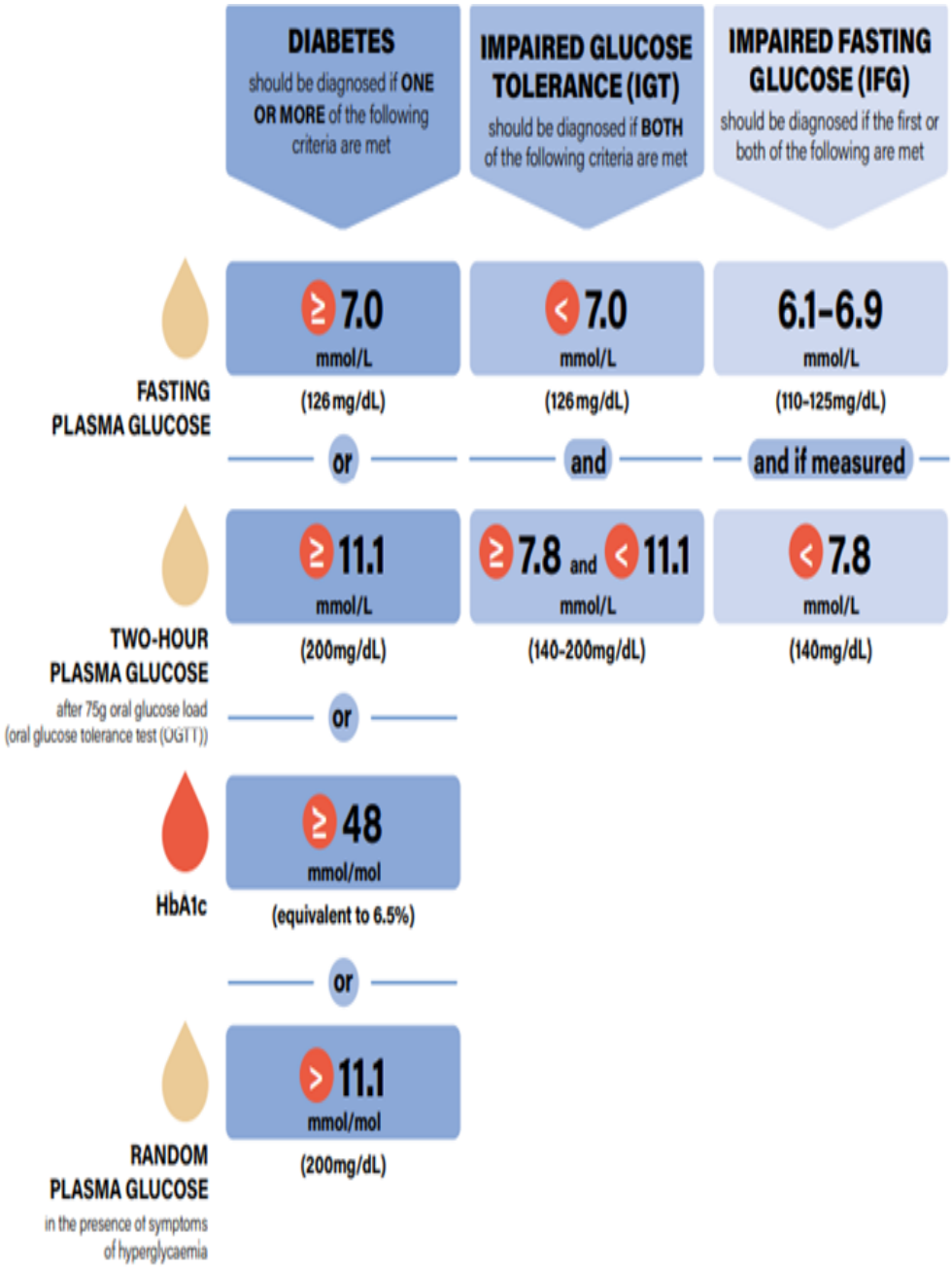
TYPE 1 DIABETES MELLITUS (T1DM)

IDIOPATHIC TYPE 1 DIABETES

Insufficient insulin secretions are observed in type 1 idiopathic diabetes. Individuals with idiopathic type 1 diabetes have more tendency to get diabetes ketoacidosis. This type of diabetes is not associated with human leukocyte antigen (HLA). Family history of diabetes is observed in the majority of the cases and this type of diabetes is most prevalent in Africans and Asians (Diabetes Care, 2020).

FIGURE - 2.1

DIAGNOSTIC CRITERIA FOR DIABETES



Source: IDF Atlas, 2019

IMMUNE-MEDIATED TYPE 1 DIABETES

In this type of diabetes, autoimmune destruction of beta cells of the pancreas occurs. Autoimmune markers of immune-mediated type 1 diabetes are islet cell autoantibodies, autoantibodies to glutamic acid decarboxylase GAD 65, insulin, tyrosine phosphate IA-2, and IA -2β and ZnT8. There is a strong association of the disease with HLA. Quite a variation in the destruction of beta-cell in immune-mediated type 1 diabetes. Beta-cell destruction is rapid in infants and children and slows in adults with this disease. Diabetes Ketoacidosis is reported to be the most common symptom of immune-mediated type 1 diabetes mellitus in children. Immune-mediated diabetes mostly affects children and adolescents (Diabetes care, 2020).

TYPE 2 DIABETES MELLITUS (TYPE 2 DM)

Of all those that are diagnosed with the presence of diabetes among them 90 to 95% had the presence of type 2 diabetes. Relative insulin deficiency and peripheral insulin resistance are observed in type 2 diabetes. The aetiology of type 2 diabetes is not well known. Overweight and obesity are observed in the majority of type 2 diabetes patients. High body fat percentage especially abdominal obesity increases the risk of type 2 diabetes. In most cases, type 2 diabetes remains undiagnosed at the earlier stages of development. The progression of hyperglycaemia is a gradual process. Those with undiagnosed type 2 diabetes are at high risk of developing microvascular and macrovascular complications. Increasing age, physical inactivity is a risk factor for the development of the disease (Diabetes Care, 2020).

OTHER SPECIFIC TYPES OF DIABETES

Monogenic diabetes a rare kind of diabetes associated with genetic syndromes, drugs or chemical induced diabetes, infection-related diabetes, immune system-

mediated diabetes, diabetes caused due to exocrine and endocrine pancreas disorders, and related to other illnesses (IDF, 2019).

PREVALENCE OF DIABETES

GLOBAL PREVALENCE OF DIABETES

Diabetes is a global epidemic. Individuals that are known to have diabetes represent the tip of the iceberg. In the present scenario, prevailing cases of diabetes are increasing at an alarming rate. In the year 1980 around 180 million people were reported to had diabetes but numbers were found to be increased in the year 2014 by about 422 million. In the 1980s diabetes was more prevalent in economically developed countries (5.2% vs 3.3%) but in the 20th-century whole scenario changed sharp rise in the prevailing rate of diabetes was observed in the lower-income and middle-income countries versus high-income countries (7.4% vs 7.0%). Moreover, Upper middle-income countries reported having the highest prevalence of diabetes (9.3%) (WHO global diabetes prevalence report,2016).

In 2019, 463 million adults in the age group (20 –79) had diabetes worldwide and the numbers were anticipated to increase to 578 million by 2030 and 700 million by 2045. It is a matter of concern that around 87% of diabetes-related deaths occur in low-income and middle-income countries and globally 50.1% of the people are unaware of their diabetes status (IDF Diabetes Atlas, 2019).

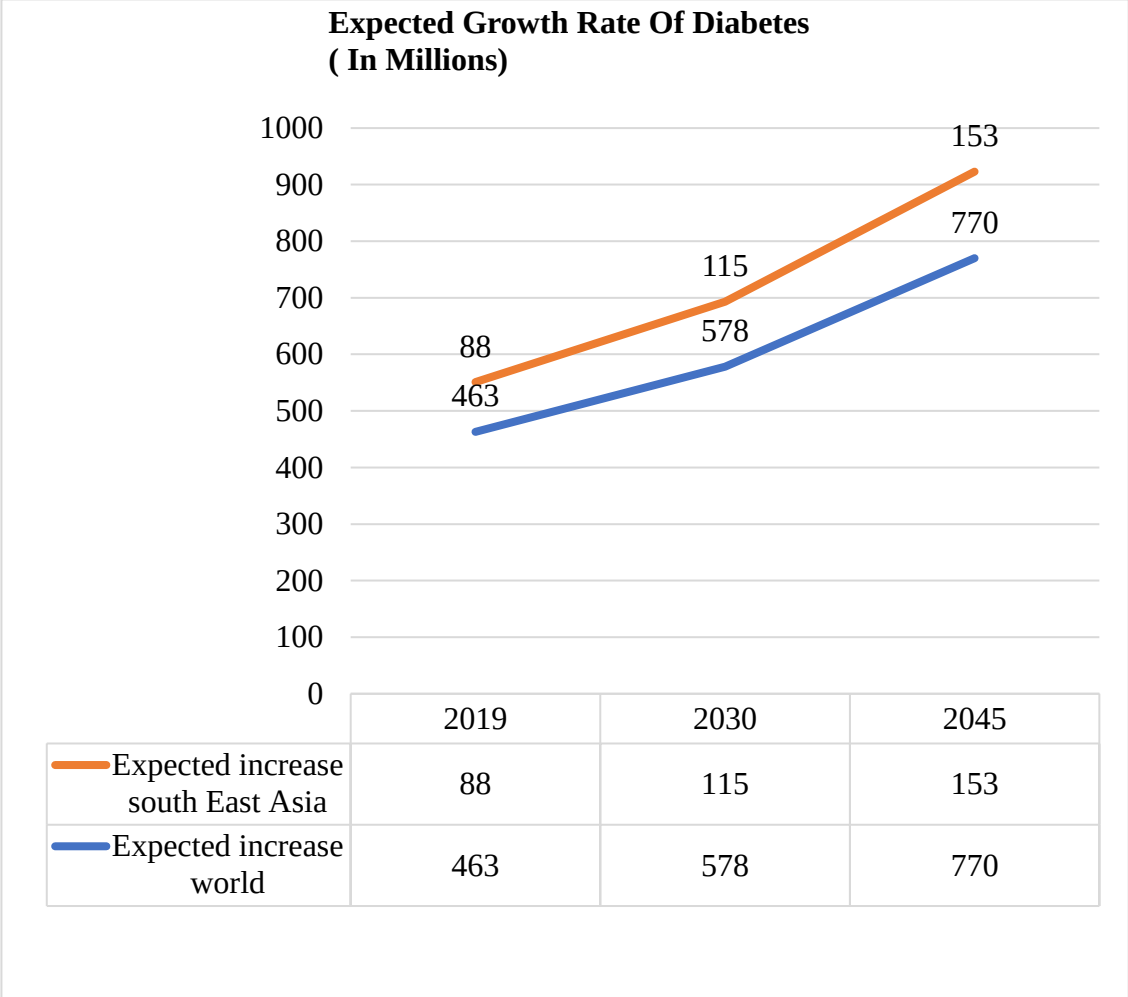
Impaired glucose levels were also rising at an alarming rate. Around 7.5% of the people were glucose intolerant globally in 2019 and numbers were expected to rise by 8% in 2030 and by 8.6% in2045 (Saeed et al, 2019).

As illustrated in Figure 2.2. The expected growth rate of diabetes in South East Asia is around 153 million and across the world around 700 million by 2030 and the estimated prevalence of diabetes in the top 10 countries with undiagnosed diabetes , Indonesia (73.7%), India (57%), China (56%), Bangladesh(56%), Egypt(54.5%), Germany (47.6%), Brazil (46%), Mexico(38.6%) and USA (38%) as shown in Figure 2.3 (IDF, 2019).

FIGURE - 2.2

EXPECTED GROWTH RATE OF DIABETES

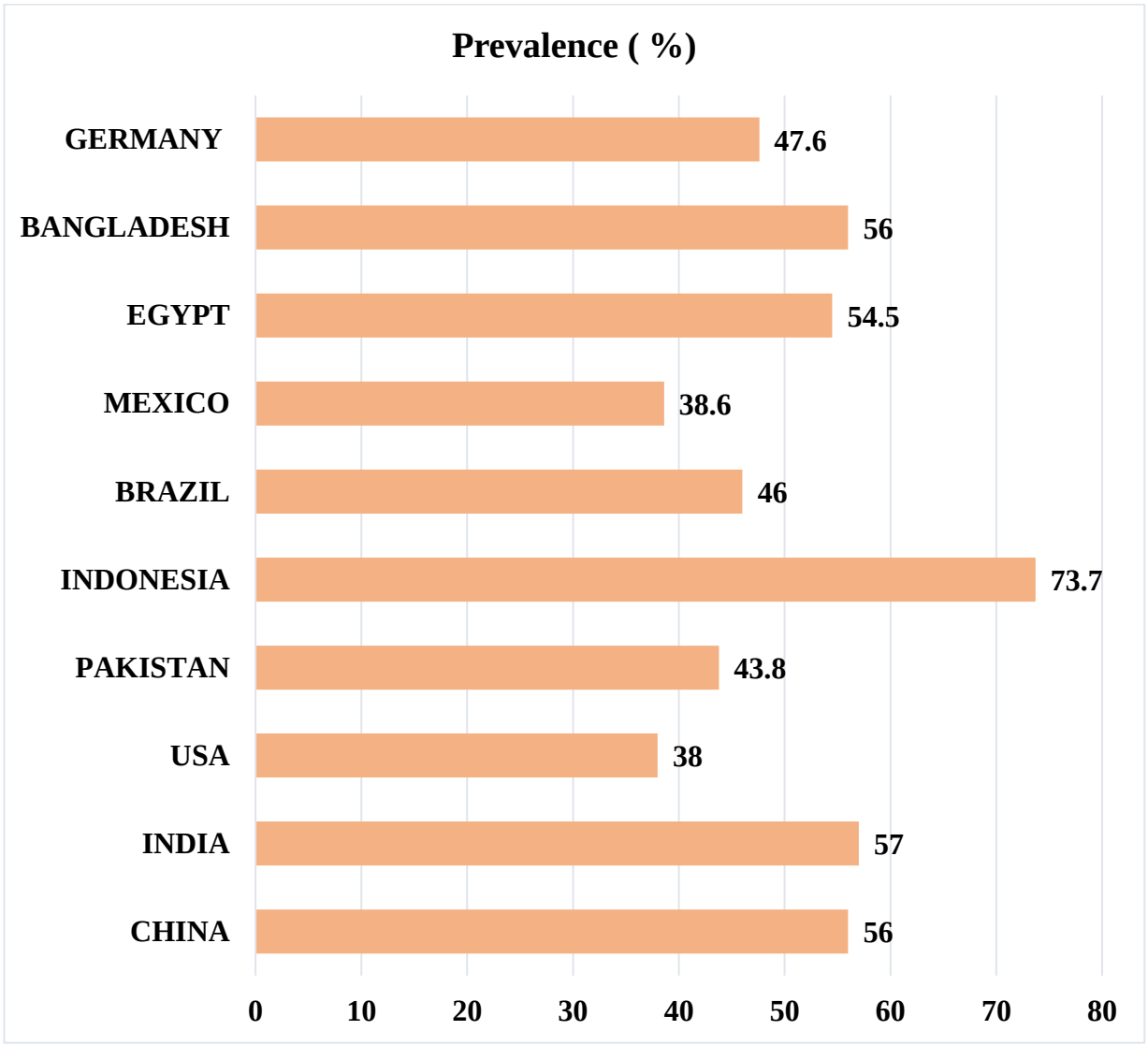
(IN MILLIONS)



Source: IDF Atlas, 2019

FIGURE - 2. 3

TOP 10 COUNTRIES WITH UNDIAGNOSED DIABETES



Source: IDF Atlas, 2019

SOUTHEAST ASIAN PHENOTYPE AND DIABETES

In southeast Asia, 1 in11 adults were reported to have diabetes. Every 5th person with diabetes in the world belongs to South East Asia. One in two persons with diabetes remains undiagnosed. Diabetes also contributes to 1.2 million deaths in the region. Countries like India (77 million), Bangladesh (8.4 million), Sri Lanka (1.2 million), Nepal (0.7 million), Mauritius (0.2 million) were reported to be among the top five countries with a high prevailing rate of diabetes (IDF, 2019).

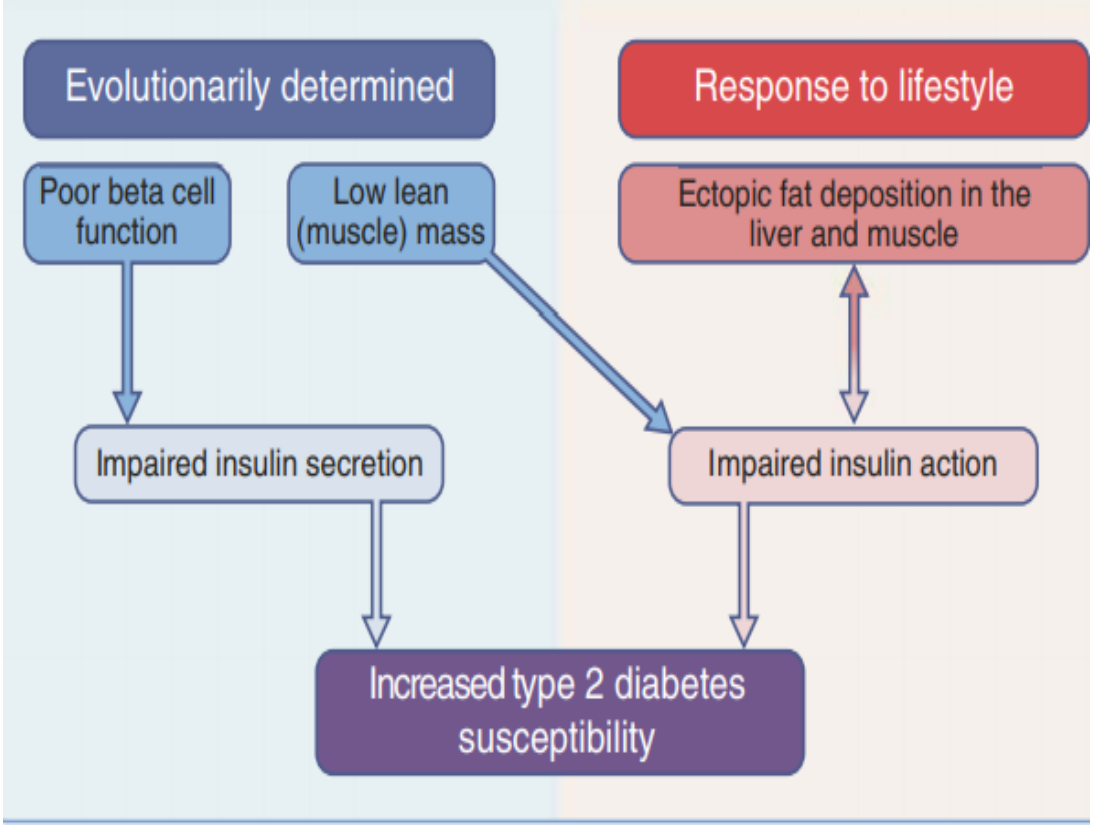
Even at lower BMI South Asians were reported to have a high prevailing rate of diabetes (Gujrat et al 2013). The susceptibility of prediabetics to have diabetes in the future is also increasing at an alarming rate in the South Asian population. Moreover, the prevalence rate of diabetes was found to be rising in rural areas and poor sections of society too (Unnikrisnan et al, 2018).

The pathophysiological pathway for diabetes in South East Asians is quite complex. It may be evolutionary determined or may occur due to response to lifestyle-related habits of individuals such as unhealthy eating patterns and physical inactivity (Figure 2.4) (Narayan and Kanaya, 2020).

Characteristics of the South East Asian phenotype (Figure 2.5) that increase the incidence of type 2 diabetes among southeast Asians are low birth weight, presence of inflammatory markers; CRP (C-reactive protein), increased abdominal obesity and visceral fat, levels of adiponectin's, genetic familial aggregation of diabetes, lower age of the onset of type 2 diabetes, increase serum insulin levels and insulin resistance, decreased high-density lipoproteins (HDL) cholesterol levels, increase in the triglyceride levels, Increase in (LDL) low-density lipoproteins (ICMR draft guidelines on Management of Type 2 (Diabetes,2018).

FIGURE - 2.4

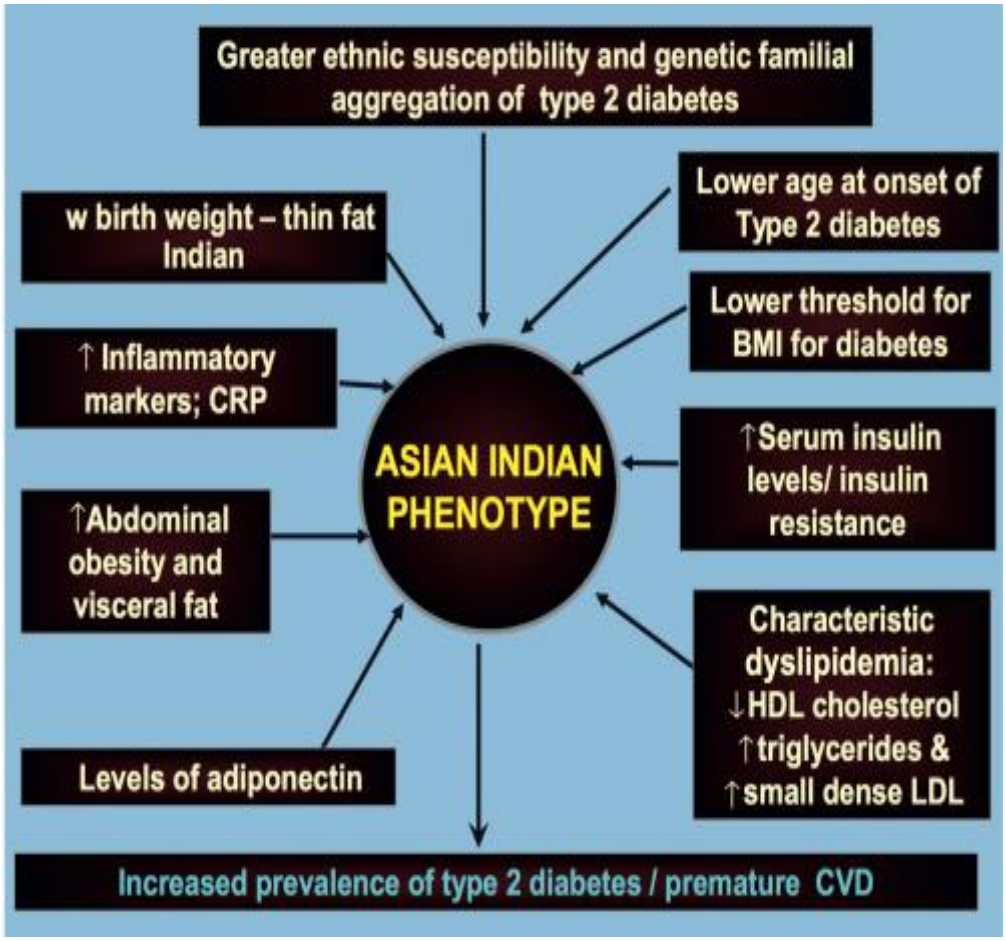
PATHOPHYSIOLOGICAL PATHWAY FOR DIABETES IN SOUTHEAST ASIANS



Source: Narayan and Kanaya, 2020

FIGURE - 2.5

CHARACTERISTICS OF SOUTH ASIAN PHENOTYPE THAT INCREASES THE TYPE 2 DIABETES SUSCEPTIBILITY



Source: ICMR draft guidelines on Management of Type 2 diabetes, 2018

DIABETES PREVALENCE IN INDIA

Diabetes control in India is far from ideal with an average HbA1c level of 9.0%, which is at least 2.0% higher than the HbA1c levels suggested by international bodies (Joshi et al 2015). One in six adults with diabetes in the world comes from India and contributes to the highest cases of diabetes in the South East Asian region. Around 57% of people with diabetes in India remain undiagnosed (IDF Diabetes Atlas, 2019).

The ICMR-INDIAB population-based diabetes prevalence study reported that there were dissimilarities in diabetes prevalence among different states in India. The overall prevalence of diabetes among Indians was reported to be approximately 7.3%. In rural areas, it was observed that prevalence was higher in the high socioeconomic group, and in the urban areas, more cases of diabetes were observed in the low socioeconomic group. About 47.3% of the study subjects were diagnosed to have diabetes during the study phase (Anjana et al,2017).

Mishra et al (2011) reported that in rural South India the prevalence of diabetes increased from 1.9% in 1994s to 12% in 2009. Also increasing trends of impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) levels were also observed in all states of India. In a study conducted among North Indians, the overall prevailing rate of diabetes was around 8.3 % and prediabetes was around 6.3% (Tripathi et al, 2017). The prevalence of diabetes and prediabetes was reported to be around 37.3% and 8.67%, respectively, in a recent study conducted in rural South India (Sethuram et al, 2019). In Gujarat, around 7.1 %of people were diagnosed with diabetes. In rural and urban areas of Gujrat, the prevalence of diabetes was around 5.1% and 9.8% respectively (Anjana et al, 2017).

A study was conducted to study the prevalence of diabetes at the district level across different regions of India using a spatial mapping technique. The prevalence of diabetes was observed to be highest in the coastal region.

A positive association was also observed in the eating pattern and prevalence of diabetes. More cases of diabetes were observed among those with higher consumption of sugars, whereas a negative association was observed in those having an adequate intake of protein-rich foods such as milk, pulses, and poultry (Ghosh et al, 2020).

Anderson et al (2019) Conducted a study in the rural Tehri Garhwal district in Northwest India to study the prevalence of diabetes and pre-diabetes and its associated risk factors. They observed that the prevalence of diabetes was 10% and prediabetes was 56.4%. Prevalence was observed to be lower among the younger age group. A significant association was observed between diabetes status and increasing age (p-value =0.01).

In a study by Padmanbha et al (2017). The overall prevalence of diabetes was reported to be (28.3%). Among the study participants around 6% of the subjects were newly detected with diabetes and 26% were diagnosed with prediabetes during the study period. A meaningful association was observed with the sedentary lifestyle, family history of diabetes, higher BMI, and central obesity among the subjects belonging to (46 – 55)years of the age group (p-value <0.05).

Subramani et al(2019) reported that diabetes and prediabetes prevalence in the Gwalior-Chambal region was found to be 11.4% and 5.7% respectively. Diabetes prevalence was notably higher in the urban population around 12.7% while prediabetes prevailing rate was higher in the rural population about 7.9%. Male subjects reported a higher prevalence of prediabetes (8.2%) in rural and (5.1% in urban) as well as diabetes (rural 9.2%, urban 16.5%). Both prediabetes and diabetes were recorded as being higher in those subjects who had a sedentary lifestyle and were older. The prevalence of hyperglycaemia was much higher in those with a family history of type 2 diabetes (30.6% in rural, 21.5% in urban). Almost half of the diabetics in the rural population were diagnosed for the first time during the study phase.

The multivariate regression analysis identified male gender, age of 30 years and above, and positive family history as notable risk factors for diabetes whereas the age (40 to 79 years) and less physical activity was significantly found to be a risk factor for prediabetes.

A study by Sheikh et al (2019) to estimate the prevalence of diabetes and impaired glucose tolerance in the adult population age 20 years and above in the Srinagar district. It was reported that the prevalence of type 2 diabetes was 9.8% and impaired glucose tolerance was reported to be around 22%. The majority of the study participants were known as diabetic. A meaningful association was observed among modifiable risk factors such as older age, family history of diabetes, education status, BMI, and hypertension (p-value<0.001).

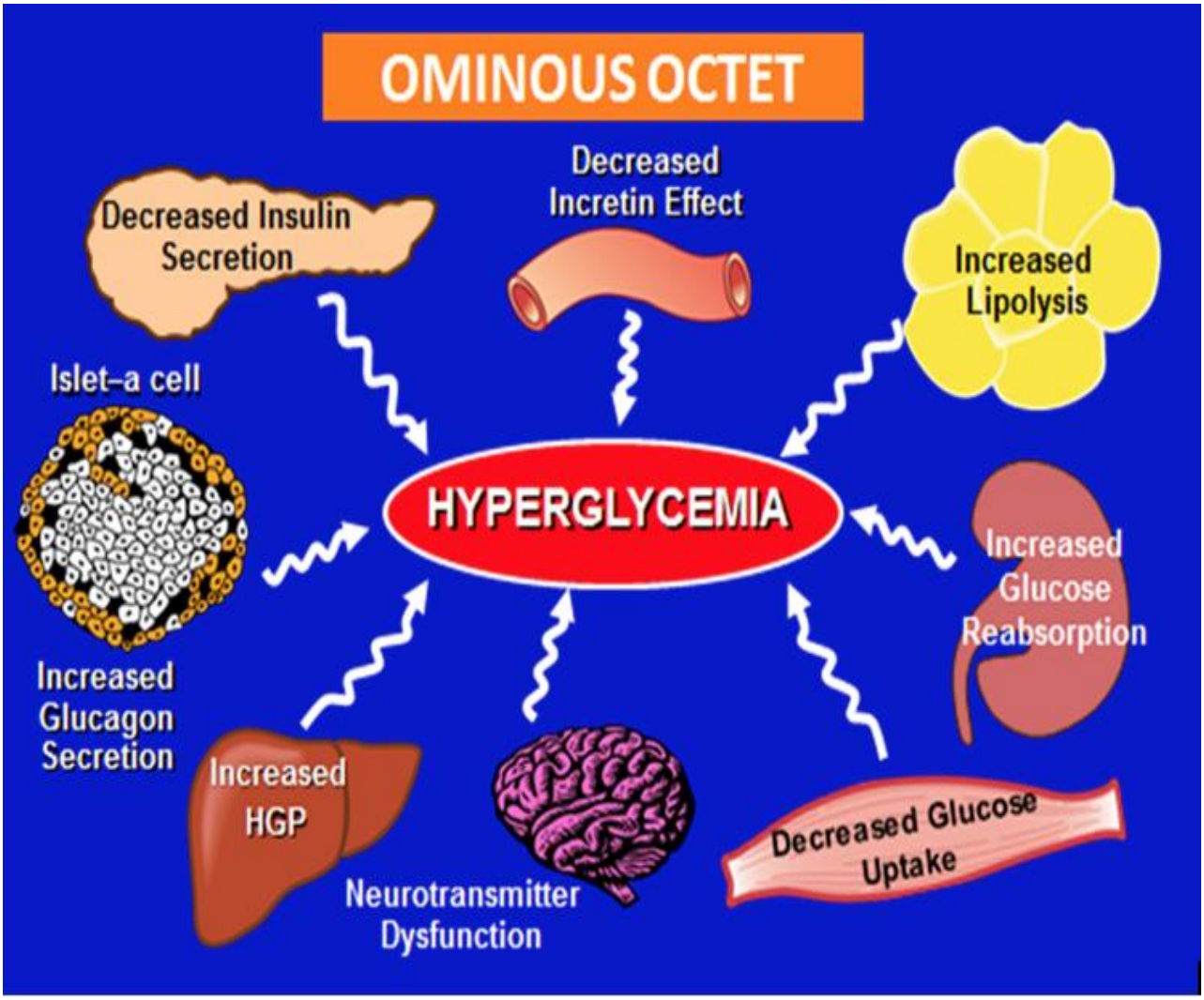
Diabetes burden is increasing at an alarming rate with increased exposure to modifiable risk factors (unhealthy diets, physical inactivity, and consumption of tobacco and alcohol) and lack of awareness about non-modifiable risk factors (genetic predisposition, ethnicity), and lack of knowledge regarding the symptoms of the disease. So, significant actions are needed to be taken for early diagnosis, treatment, and prevention of diabetes.

PATHOGENESIS OF DIABETES

Diverse pathophysiological anomalies are linked with type 2 diabetes as shown in (Figure 2.6) Insulin resistance and decrease in the peripheral glucose uptake especially by muscles with amplified endogenous glucose production. Also, increased lipid breakdown and elevated free fatty acid level along with the accumulation of intermediate lipid metabolites also contributes to further rise in glucose output reduction in the peripheral glucose utilization and decreased beta-cell function. In the initial stages of the disease insulin secretion by the beta cells of the pancreas may help to maintain the normal blood glucose level but with the uncontrolled blood glucose level over time, there is an abnormality in the functioning of beta cells. Alongside there is an inappropriate release of glucagon by the beta cells of the pancreas. It has been hypothesized that the secretion of the glucagon in excess amounts and impaired secretion of the insulin in type 2 diabetes may contribute to incretin defect which is primary defined as inadequacy in the release of incretin hormones after the ingestion of meals. Moreover, hypothalamus insulin resistance also impairs the capability of circulatory insulin to suppress glucose production and renal tubular glucose reabsorption capacity may be heightened despite the high blood glucose levels in type 2 DM (Cersosimo et al,2018). As shown in the Figure 2.7 type 2 diabetes

FIGURE - 2.6

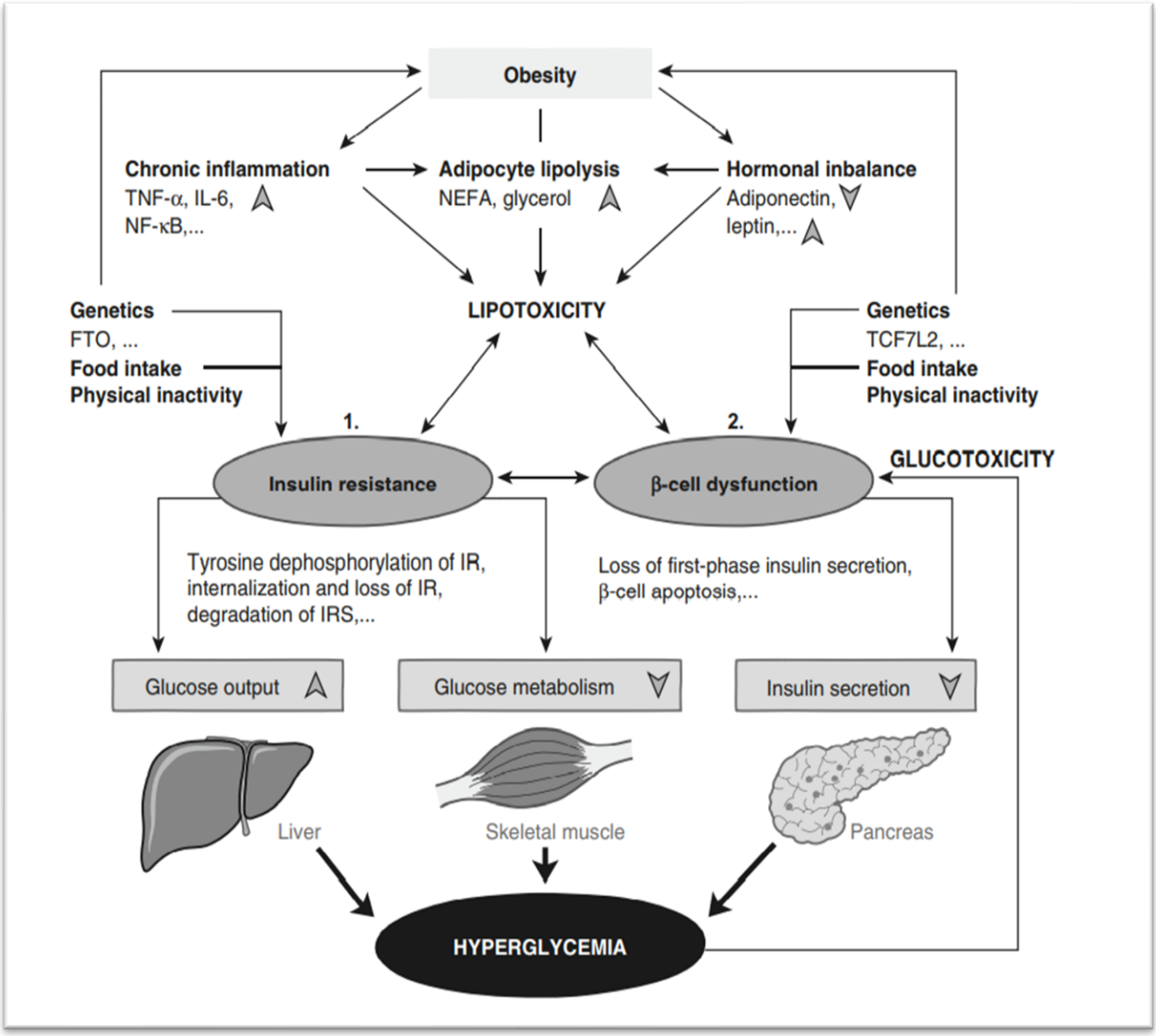
EIGHT DIFFERENT MECHANISMS CONTRIBUTING TO HYPERGLYCEMIA IN TYPE 2 DIABETES



Source: Cersosimo et al, 2018

FIGURE - 2.7

PATHOGENESIS OF TYPE 2 DIABETES



Source: Lammert et al, 2014

may be caused by insulin resistance and beta-cell dysfunction. Genetic factors and environmental factors influence the development of type 2 diabetes. In the initial stages of disease progression, peripheral insulin resistance can be overcome by increased secretion of insulin. Over time this compensatory mechanism fails that leads to hyperglycaemia (Lammert et al, 2014).

RISK FACTORS FOR DIABETES

NON-MODIFIABLE RISK FACTORS AND DIABETES

1. GENETICS AND DIABETES

Type 2 diabetes is a multifactorial anomaly involving 57 genes that are located on 16 different chromosomes. Around 136 single nucleotide gene polymorphisms are linked with diabetes. Genes that are involved in genetic polymorphism among them around six genes are located on chromosome 3, seven genes on chromosome 11, 10 genes are located on chromosome 1. Other chromosomes have two to five genes. No gene linked with diabetes is located on chromosome 13, 14, 16, 18, 21, 22, X, and Alterations in genes associated with diabetes have an impact on the beta-cell function, insulin secretion, insulin resistance, and signalling (Kaul and Ali, 2016).

In a study by khan et al (2019) significant association of KCNJ11 (rs5210) gene polymorphism with T2DM was reported in North Indian diabetes patients as compared to controls using the PCR – RFLP method. Thus, subjects with this gene variant are at risk of developing diabetes.

In a study conducted to know the association between the Apolipoprotein E gene polymorphism and risk of type 2 diabetes and cardiovascular diseases. It was reported that ε4 allele gene polymorphism was independently associated with type 2 diabetes at a p-value=0.04 and the presence of this gene increases the risk of cardiovascular ailments in the type 2 DM patients by 5.9 times (E et al, 2016).

Banerjee et al (2010) conducted a study to know the association of Glutathione S-transferase (GST M1, T1, and P1) gene polymorphism and risk of type 2 diabetes in North Indian patients. It was observed that there is a significant association between the GSTM1 gene, GSTP1 gene polymorphism, and risk of type 2 diabetes at (p-value<0.01). However, no significant association was observed in GSTT1 gene polymorphism and risk of type 2 diabetes.

2. AGE

Earlier type 2 diabetes was observed to affect older adults but presently the scenario is changed diabetes affects younger adults too aged (20-40 years). As per IDF, in 2013 around 382 million deaths were expected to be attributed to diabetes. Among them, the majority of the individuals are from the age group of (40-59 years). Moreover, a severe microvascular complication of diabetes was observed in the individuals with the younger age of onset of diseases such as retinopathy and peripheral neuropathy and quality of life is also affected with increased (DALYs) disability-adjusted life years(Zoungo et al, 2014).

A meaningful association was observed between the increasing age and the prevalence of type 2 DM at a p-value<0.0001 across the categories of the BMI. It was reported that the effect was particularly evident after the age group of 40 years and above with a p-value< 0.0001 (Fazeli et al,2020).

In a study by Ahmad et al (2014) to study the prevalence of diabetes and its association with risk factors. It was found that increasing age may act as a risk factor for diabetes at a p value<0.05.

Subramini et al (2019) found that increasing age>30 years and above may act as a risk factor for diabetes in the urban population at a p-value<0.01 in a study conducted in the Gwalior Chambal region of Central India.

A study was conducted on the time trend in diabetes in the Jordan population between 1994 and 2017. It was observed that the overall prevalence of diabetes has increased from 1.3% in 1994 to 17% in 2004 to 22.2% in 2009 and 23.7% in 2017 in the age group 25 years and above (Aljoni et al, 2017).

3. FAMILY HISTORY

A study was conducted to assess the impact of the family history of diabetes among diabetes patients. Around 68.8% of the study participants were reported having a family history of diabetes. Among those with a family history of diabetes around 25.1% of participants reported had a diabetic mother, 15.3% of the participants had a diabetic father and about 47.7% of the study participants had a sibling with diabetes. About 84.8% of participants with early onset of diabetes were found to had a family history of diabetes. Complications of diabetes were observed in 77.5% of the study participants with a family history of diabetes (A et al, 2017).

In a study by Dash et al (2018) it was reported that subjects with a parenteral history of diabetes among both parents had poor glycaemic control and were more prone to the cardiometabolic ailment risk.

Family history was reported to be a strong independent risk factor for diabetes. The risk of diabetes increases with the presence of diabetes among both parents and parents age at the diagnosis of the disease (Interact consortium, 2013).

In a cohort study by Ustulin et al (2018) among the prediabetic study participants to assess that family history of diabetes was a significant risk factor for diabetes in the future among the prediabetic subjects. It was reported that those with a family history of diabetes had a higher probability of developing diabetes in the future with a (p-value < 0.001).

A study conducted by Iwata et al (2020) among type 2 diabetes patients in Japan to study the relationship between parental diabetes family history and impact on

beta-cell function. It was reported that around 49.4% of the study participants had no family history of diabetes. About 13.4% of the subjects had a sibling with diabetes. Around 34% of the subjects had the presence of diabetes in single-parent and around 3.2% of the study participants had reported the diabetes presence among both the parents. The insulin secretion was found to be significantly lower among those with a family history of diabetes (p-valve<0.05). Patients with parents with diabetes were found to younger at the age of diagnosis (p-value<0.001).

MODIFIABLE RISK FACTORS FOR DIABETES

1. OBESITY AND DIABETES

In a study by Savani et al (2020) to assess the association of diabetes obesity and hypertension. Among the study participants, (168) subjects were reported to have diabetes. Among those having diabetes (96) subjects were found to be obese. A statistically significant association was observed between obesity and diabetes at a p-value<0.0001.

The study was conducted among the non-physician workers employed in the medical college of Kolkata to assess the presence of the risk factors of diabetes among them. In the study, they reported around 31.6% of the study participants were overweight and about 13.5% were obese and the majority(67.9%) of the participants were following a sedentary lifestyle (Sardar et al 2020).

Regmi et al (2020) conducted a cohort study in the gulf state to assess the incidence and risk factors of type 2 diabetes in the overweight and obese study population. The overall incidence rate of type 2 diabetes on follow-up was reported to be 17.7% among male study participants and 15% among female study participants. Older age and obesity in women and prediabetes in men were reported to be independent risk factors for developing diabetes.

In a retrospective study by Aravinda et al (2019) it was reported that a significant association was observed between overweight 88.3% and obesity 11.69% and prevalence of diabetes (p-value<0.0001).

2. PHYSICAL INACTIVITY AND DIABETES

Physical activity plays a key role in the prevention and management of non-communicable diseases. As per WHO recommendations adults in the age group of 18 and 64 years should incorporate at least 150 minutes of moderate physical activity in their weekly schedules or should incorporate 75 minutes of vigorous physical activity throughout the week or perform a combination of both forms of physical activity (Global recommendation on physical activity for health 2010).

It was reported that undoubtedly physical inactivity has been associated with a high risk of occurrence of type 2 diabetes mellitus regardless the age, sex, ethnicity, or BMI (Admiraal et al, 2011). Physical inactivity increases the risk of several other disorders such as hypertension, coronary and cerebrovascular disease, overweight, and obesity. The risk of the incidence of chronic diseases can be reduced by regular physical activity (Knight et al, 2015).

An increase in two hrs/day of the time spend on a sitting job increases the type 2 diabetes risk by 7% (Hu et al 2003). Extra two hrs spend watching television increases the diabetes risk by 14% (Shields et al, 2008).

In a study by Silva et al (2016), it was reported that 736 deaths were estimated to be caused by diabetes mellitus and physical inactivity in (1990), 1337 deaths in (2006), and around 1897 deaths in (2016). Estimations were that nearly 3% of the death could be prevented if the Brazilian population was physically active.

In a review study on the association of physical activity and risk of type 2 diabetes. In result, it was reported that there is an inverse association between

physical activity and the risk of diabetes. Relative risk for the vigorous physical activity (0.61),for moderate physical activity (0.68),low intensity activity (0.66), for walking (0.85) (Aune et al,2015).

3. DIET AND DIABETES

A sedentary lifestyle and increased intake of calorie-dense food also led to insulin resistance and obesity they act as risk factors for diabetes (Yadav et al 2016). Joshi et al (2014) in a nationwide survey on the carbohydrate intake pattern reported that there, not much difference observed in the carbohydrate intake pattern in the type 2 DM and non-type 2 DM study participants (64.1% vs 66.8%) respectively.

Devi et al (2020) conducted a study in the Manipur Meitei population they reported that around 54.2% of the study participants skip breakfast. Prevalence of diabetes and prediabetes among the breakfast skippers were 12.9% and 34.8% respectively and a higher prevalence of diabetes and prediabetes was reported in white rice eaters (29.4% vs 40.5%).

Gow et al (2016) in a review study, reported that reduction in the intake of carbohydrates reduces the risk of type 2 diabetes mellitus in those with the presence of other risk factors of diabetes. It was also reported in the study that a low carbohydrate intake helps in weight reduction also.

Having carbohydrate-rich food last in a meal does not lead to much rise in postprandial blood glucose levels in comparison to the consumption of carbohydrate-rich food first in a meal (Shukla et al, 2017).

Jung et al (2017) in a review study reported that a high carbohydrate diet composed of high glycaemic index food items leads to dyslipidaemia and increases the risk of cardiovascular diseases among diabetics. However,

improvement in the lipid profile can be made with the consumption of the low glycaemic index food and a high fiber diet.

A randomized trial study was conducted to study the efficiency of the low carbohydrate diet in comparison to a calorie-restricted diet among the diabetes patient. The study duration was six months. Diet consultation was also given to

study participants during the study duration every 2 months. In the results, they observed that in subjects that were on a low carbohydrate diet their HbA1c levels had reduced from 7.6%$\pm$ 0.4% to 7.0% $\pm$ 0.7%respectively while those that are on a calorie-restricted diet their HbA1C levels had reduced from 7.7% $\pm$ 0.6% to 7.5 % $\pm$ 0.1% (Yamada et al, 2014).

4. PHYSICAL ACTIVITY, HEALTHY DIET, AND DIABETES

Individuals' nutrient intake has an impact on diabetes prevention. Intake of whole grains, green leafy vegetables, coffee and reduced intake of refined carbohydrates, processed meats, sugar-sweetened beverages, and moderate intake of alcohol is linked with reduced occurrence of type 2 diabetes. A randomized 4-year trial to control diabetes has shown that the intake of the Mediterranean diet and extra virgin oil reduces the incidence of type 2 diabetes by 40% in comparison to the low-fat diets. Physical activity too has a positive association with the reduction in the cases of diabetes among the individuals engaged in 2.5 hrs of physical activity per day (Ley et al, 2018).

A study by Juul et al to study if there is an association between health literacy, physical activity, and type 2 diabetes. It was observed that functional health literacy is associated with following recommended diet and self-directed motivation is associated with following a recommended diet and engaging in the regular physical activity regime (Juul et al, 2018).

COMPLICATIONS IN DIABETES

Consistently rising blood glucose level affects our vital organs. Heart, Blood Vessel, Kidney Nerves, and teeth are mostly affected by diabetes. People with diabetes were at risk of developing complications of the disease such as cardiovascular disease, blindness, kidney failure, and lower limb amputation. Maintaining blood glucose levels, blood pressure, and cholesterol at or close to normal ranges can help in delaying or preventing diabetes complications. Therefore, people with diabetes need regular monitoring of their blood glucose levels.

PREVALENCE OF COMPLICATION OF DIABETES

In a study by Lin et al (2019) in Taiwan, it was reported that they observed changes in the prevailing rate of diabetes complications. The prevalence of kidney diseases had increased from 10.49% in 2005 to 17.92% in 2014 but a reduction in the prevalence of diabetes foot complications was reported. In 2005 the prevalence rate of foot complications was around 1.34% and rates of prevalence were reduced to 1.05% in 2014. A reduction in prevailing cases of serious infections was also observed to be reduced from 50.69% in 2005 to 45.8% in 2014 and a significant reduction in amputation rates were also reported from 24.91% in 2005 to 17. 47% in 2014.

A study by Govindarajan et al (2020) studies the prevailing rates of vascular complications among diabetes patients. The prevailing rate of macrovascular complications was reported to be around 29.7%. Among all the macrovascular complications, coronary artery disease and peripheral vascular diseases were more prevalent with a prevalence rate of 15%. The prevailing rate of microvascular complications was found to be around 52%. Among the microvascular complications, a high prevalence rate was observed for peripheral neuropathy (44%) followed by diabetic nephropathy (12%), and diabetic foot (7.2%).

In a study to know about the presence of diabetes complications among the newly diagnosed type 2 diabetics. About 35% of the study participants reported they had the presence of type 2 diabetes complications. Among them, about 17% were reported to have the presence of macrovascular complications, around 12% had the presence of microvascular complications and only 6% of the study participants were found to the had presence of both (Gedebjerg et al, 2017).

CARDIOVASCULAR DISEASE AND DIABETES

The presence of hyperglycemia increases the risk of cardiovascular diseases. The chances of getting cardiovascular disease can be reduced using drugs called statins that act as lipid-lowering drugs and by keeping a check on blood glucose and blood pressure levels (IDF, 2019).

Heart failure is a serious complication reported in diabetes patients. Increasing age act as a risk factor for heart failure. Among the individuals with age greater than 65 years and above a higher risk of diabetes was reported. The presence of a diabetes condition increases the chances of developing heart failure by 2.5 times than individuals without the presence of a diabetes condition. Worse outcomes of heart failure were reported among (25 to 40%) of the individuals with the presence of diabetes condition than without diabetes condition. Heart failure rises with rising HbA1c levels. Among those with HbA1c levels below 10% the incidence rate of diabetes was found to be around (8 to 9 %) and among those with HbA1c levels greater than 10% the incidence rates of diabetes were around 71 %. No impact on ejection fraction rate was observed with the presence of diabetes conditions (Bahtiyar et al, 2016).

EYE DISEASE IN DIABETES

Diabetic retinopathy is the most common microvascular complication of diabetes and unfortunately, this ailment is common in the working-age group

population with diabetes and is also a cause of blindness in type 2 diabetes mellitus patients.

Oxidative stress also leads to the development of diabetic retinopathy. Reactive Oxygen Species is a free radical with an impaired electron that usually participates in the redox mechanism of some of the body molecules such as proteins, enzymes, and so on. In normal conditions, reactive oxygen species are maintained at equilibrium. However, its overproduction leads to oxidative stress that may act as a risk factor for the pathogenesis of diabetic retinopathy. The retina is susceptible to reactive oxygen species because of the exposure to light and high energy demands (Calderon, 2017).

In a review study on the association of diabetic retinopathy with diet. It was identified that a high intake of fruits, vegetables, fish, the Mediterranean diet may act as a preventive factor for the development of diabetic retinopathy (Dow et al, 2017).

Dry eye disease as a complication of diabetes was observed among diabetes patients. In the conducted study, the overall prevalence of dry eye disease was reported to be around 36% and the researcher had used an ocular surface disease index questionnaire to study the symptoms of the disease and grading of the disease based on severity. Prevalence of the different grades of diabetes was found to be mild (16%), moderate (16%), and severe (4%) (Aggarwal et al, 2020).

NEPHROPATHY AND DIABETES

One of the most common long-term complications of diabetes is diabetic polyneuropathy and it is one of the most common nephropathies in the developed world. It includes several neuropathic syndromes. One of the most common among them is diabetic peripheral neuropathy. The presence of diabetic peripheral neuropathy is a cause of morbidities such as neuropathic pain, ulceration, amputation and is associated with cardiovascular disease and increased mortality. Uncontrolled polynephropathy leads to poor glucose control is also a marker of macrovascular disease such as hypertension. Around (15-26%) of people with type 2 diabetes are affected by painful diabetic

neuropathy. The presence of Diabetes autonomic neuropathic condition leads to considerable morbidity and high mortality and the quality of life is also affected by this condition. It may impact the cardiovascular system, urogenital system, sudomotor function, and thermoregulation (Tesfaye et al, 2010).

NEUROPATHY AND DIABETES

Diabetes neuropathy is a serious complication of diabetes that is often overlooked and misdiagnosed at the early stages of its onset and in the majority of cases, diabetic neuropathy is asymptomatic at an early stage of its onset Verrotti et al (2014).

The prevailing rate of sensory neuropathy among the type 2 study participants was reported to be around 58.7%. A positive correlation was observed in the age and duration of the disease (p-value<0.001). Neuropathy was also found to be more prevalent among the patients reported to had high urinary microalbuminuria (Karki et al, 2016).

STROKE AND DIABETES

Type 2 diabetics are susceptible to cerebral small vessel disease. In the presence of hyperglycemia, the risk of stroke occurrence is enhanced especially the poor clinical outcomes are observed in the subjects with ischemic stroke with the presence of diabetes condition (Chen et al, 2016).

A review study by Mitsios et al (2018) reported that high HbA1c levels increase the risk of ischemic stroke among diabetes patients.

DIABETES KNOWLEDGE

In a study conducted by Mohan et al (2005) to assess the awareness and knowledge about diabetes in the urban Chennai population of total sample size

- 26,001. It was reported that around 75.55% of the study population knew about the condition called diabetes, but only 25% of the study subjects were aware that diabetes was preventable. Around 60.2% of all study participants and 76.7% of the self-reported subjects knew that diabetes prevalence was increasing in India. The majority of subjects were not aware that diabetes was preventable, around 22% of the study participants knew diabetes was preventable. Only 11.9% of study subjects had reported physical inactivity as a risk factor for diabetes. Awareness regarding complications of diabetes was lacking. Around 19.0% of study subjects were aware of the complication of diabetes among non-diabetic study participants.

A study was conducted to know the awareness and knowledge about diabetes in urban and rural India. It was reported that around 43.2% of the study participants were unaware of the disease condition called diabetes. Urban residents were more aware than the rural residents in all four zones of India (North, South, East, West). Awareness varies with the literacy levels, among literate subjects 52.2% of study participants had the awareness that diabetes was preventable as compared to illiterate subjects 23.7%. In the general population, around 80.7% of the study participants were aware that diabetes prevalence was increasing. Nearly 56.3% of the study subjects were aware that diabetes is preventable. Around 51% of the study subjects had an awareness that diabetes can affect other organs. Awareness regarding different risk factors of diabetes varies in the general population. Around 59.8% of study subjects reported consumption of sugar as a risk factor for diabetes. Overweight and obesity, as a risk factor was reported by 35.5 % of the study subjects. A history of diabetes as a risk factor was observed in 17.7 % of the study subjects, lack of physical activity by 16.5%, and mental stress by 12.2 % of the study subjects (Deepa et al,2014).

In a study by Gillani et al (2018). It was observed that the mean age of the respondents was (32.92±11. 4) years that were included in the study. About 85% of the study participants had heard about the disease condition called diabetes, but only 30% of the study participants were aware of the glucose tolerance test. Around 47.3% of the study participants had adequate awareness scored >=6.

Nearly 2.3% of the study respondents had scored zero. Around 11.3% of the study participants scored 9 and above. Higher education, high socioeconomic status was significantly associated with the knowledge scores (p-value < 0.001). Only 8.7% of the study participants had never undergone the screening for diabetes. Pongmesa et al (2019) reported that in the majority of subjects there was a gap in the knowledge regarding the specific aspects of diabetes. General awareness regarding diabetes was moderate.

A study was conducted among college students to assess their knowledge about diabetes and its risk factors in the Latur city of Maharashtra. The sample size taken was 348. Most of the study participants reported excessive tiredness 81.3 %, non-healing of wounds 73.85%, and excessive sweating 72.7% as a symptom of diabetes. Knowledge regarding the complications of diabetes was variable. Around 59.7% reported kidney problems, 57.7% heart problems,54.6% eye problems, 47.13% loss of senses, 46.84% repeated skin infection, 45.69% ulcer of foot, 35.34% stroke, 31.6% impotence as a symptom of diabetes. The majority of subjects were aware that eating sugar was not good for diabetes. But awareness regarding specific risk factors such as genetics was relatively poor. Around 27.3% of the study participants were aware that genetics is a risk factor for diabetes (Gaikwad et al, 2019).

A crossectional study was done by (Amankwah-Poku, 2019) on college students in Ghana. They observed that physically active students had better knowledge than the physically inactive student and those with a family history of diabetes had better awareness regarding the disease. Stream of education had also impacted awareness scores.

K Berhe et al (2014) in a study done among the Ethiopian diabetic patients attending the diabetes care clinic. More than 56% of the study participants had poor knowledge regarding diabetes. Only 44% of the participants had reported having good knowledge. A significant association was observed between family history of diabetes and diabetes knowledge p-value < 0.025.

A study conducted by Majella et al (2017) to knew the knowledge about management of diabetes among diabetes study subjects. It was observed that around 18 % of the study subjects were not aware of the condition called hypoglycaemia. Awareness regarding the complication of diabetes also varies. Around 51 % of the participants were aware that diabetes leads to eye diseases and 44% of participants were aware of renal complications. Awareness regarding the foot and heart disorders was reported being 24% and 9% respectively among the study participants. Nearly 52% of the study participants were aware that their offspring had a risk of developing diabetes. Around 72% of the study participants felt that their offspring need to be screened for diabetes.

Waghachavare et al (2015) in a study conducted to know diabetes knowledge among diabetic patients attending rural health centers in the Sangli district of Maharashtra with the use of a self-aDMinistrative questionnaire. It was reported that only 9% of study subjects had good knowledge, 71.3% had moderate and 19.2% of the study participants had poor knowledge regarding diabetes. In a study among diabetes patients by Aljin et al (2018), it was reported that 24% of study participants were aware that physical inactivity a risk factor for developing diabetes. In a study on awareness among patients with diabetes, around 54.2% of study participants were aware that diabetes can affect the eyes (Chattopadhyay et al, 2017). A study was conducted among northern Saudi Arabia subjects to check the awareness and knowledge about type 2 diabetes. It was observed 60.8 % of study participants did not know anything about diabetes and about 48% of the participants were not sure regarding the known information about diabetes (Ahmed et al, 2018).

A study was conducted among the 200 diabetes patients attending the OPD in a tertiary care center to assess their knowledge, attitude, and practice regarding type 2 diabetes mellitus. As result, it was reported only 36% of the study participants were aware that in diabetes blood sugar levels were high. Around 47% of subjects knew nothing about diabetes. About 40% of study participants were aware that polyuria is a symptom of diabetes, but awareness regarding polyuria, polydipsia, polyphagia together is quite low 15%. Even though

subjects were aware that eating sugar is not good for health around 80%, but awareness regarding the importance of physical activity is quite low. About 40 % of the study participants were aware of the complications of diabetes but awareness regarding eye problems around 25%, heart problem 20%, and renal problems was 15% respectively. Around 30% of the study participants were conscious that normal blood sugar levels help to prevent the onset of complications of diabetes and only 25% of the subjects were aware that diabetes is a serious disease. More than 50% of the study participants were not aware of the impact of Diabetes (Khan et al, 2019).

A study by Ghadge et al (2019) among the diabetes patients attending the tertiary care center reported that many of the subjects had average knowledge of 48%, around 21 % of the study participants had good knowledge, 9% of study participants had poor knowledge about diabetes. Around 66% of the study participants had a positive attitude and 34% of the study participants had a negative attitude. Of most subjects 48% had average practice, 24% had a good practice and around 28% of the study participants had poor practice regarding blood glucose monitoring activities.

DIABETES RISK ASSESSMENT

In a study conducted by Nagalingam et al (2016) to assess the diabetes risk in the study group. Around 45% of the study participants had moderate risk, 37% had high risk, and around 18% of the study participants had a low risk for developing diabetes.

Vardhan et al (2012) reported that around 10.4% of the study participants had one of the parents with a history of diabetes. The mean physical activity score of the participants was (26 ± 4.2) and the mean diabetes risk score was (36 ± 10).

A study by Kaur et al (2020) from North India in the rural and urban areas of Ludhiana District assesses the diabetes risk using the Indian diabetes risk score.

Around 529 study participants were assessed for various risk factors of diabetes. The percentage of the study participants who participated in the research study from the rural and urban areas were 48% and 49% respectively. Most of the subjects were aged 29 years and above. Abdominal obesity was observed in 49% of the rural and 48% of the urban study participants. Around 37% of the rural and 66% of the urban study participants were following a sedentary lifestyle. However, more than 80% of the subjects from urban and rural India reported that they were not having any family history of diabetes. In the urban areas, 69% of the study participants had a high risk of diabetes and 36% had a moderate risk of diabetes. In rural areas, 64% of the study participants had a high risk and 30% of the subjects had a moderate risk of developing diabetes computed using the Indian diabetes risk score.

(Dilara & Rani, 2020) in a study among college students to assess the diabetes risk using the IDRS diabetes risk score. It was reported that around 44% of the study participants had moderate risk, 2.3% were at a high risk of developing diabetes. Around 50% of the study participants were doing moderate physical activity. About 26.8% of the study participants were physically inactive and 20% of the study subjects had a family history of diabetes. Sahai et al (2017) in a study reported that the majority of the subjects had a moderate risk of developing diabetes. A study was conducted among North Indian students to assess their risk of diabetes in near future. The majority of the subjects were reported to have a moderate risk of developing diabetes. Statistically, a significant correlation was observed between the male gender, obesity, and physical inactivity, BMI $\geq$23 kg/m^2 (Singh et al, 2019).

Boya et al (2016) in a study conducted among healthy postgraduate students. Male study participants were found to be at a higher risk than female study participants. The average age of the participants was reported to be 25 years. Around 50% of the study participants found to have some risk of developing diabetes. Among those with some risk around 62.3% of the participants were reported to have moderate risk and 37.7% of the participants had a high risk of developing diabetes. The scores were computed using the IDRS risk score.

DIABETES RISK PERCEPTION

A study was conducted among the Italian population to assess their knowledge about diabetes and its risk factors using a self-administrative questionnaire. It was reported around 97.3%of the study participants had heard about the disease condition called diabetes, but only 16.7% of the study participants knew the risks and protective factors. Those having relatives with diabetes conditions had a higher risk perception for developing diabetes condition. Perception rates increase with education status, a higher educational level higher the perceived risk for developing diabetes was observed. Females aged above 40 years and above had high BMI, at least one of the chronic diseases had a higher risk perception of developing diabetes in the future (Pelullo et al, 2020).

In a study by Kowall et al (2017) among study participants from the general population in Germany about 72% of the participants with presence of prediabetes and around 74% of study subjects with undiagnosed diabetes perceived having a low probability of developing diabetes in the future. Higher risk perception was observed in those with self-reported poor health, parental diabetes history (PR-2.6), higher education status (PR-1.2), lower age (PR- 0.7), presence of obesity (PR-1.5), female sex (PR -1.2).

In the study conducted among (10999) adults as a part of national health and nutritional examination survey. Participants were asked about their risk perception regarding diabetes. Around 86% of participants answered the risk perception questionnaire for diabetes. Among them, 28.3% of the study participants had a high-risk perception of developing diabetes. Among those with a high-risk perception for developing diabetes, around 38.3% were identified as having an actual risk of diabetes and prediabetes according to American diabetic association guidelines. Most of the study participants reported obesity, Poor diet, family history of diabetes as risk factors for diabetes. Those with the presence of risk factors when examined it was observed fewer study participants perceived weight status, physical activity level as a risk factor

for diabetes among the Asian ethnic group as compared to other ethnic groups (Yang et al, 2018).

A pilot study was conducted to know about diabetes perception and awareness regarding risk factors for type 2 diabetes among the college students attending New York college with a sample size of 132 study participants. More than 65% of the study participants were unemployed. Around 61.4%of study subjects were reported to have a family history of diabetes. The majority of the study participants around 74.32% had good nutrition knowledge, but knowledge regarding the intake of fruits and vegetables was relatively poor 36.36%. Nearly 45.5% of study participants were reported to have impaired fasting blood glucose levels. Among those with impaired glucose levels around 70% reported that they were at low risk for developing diabetes. A significant correlation was observed between BMI and risk perception of developing diabetes. Perceived risk was not statistically meaningful concerning physical activity (Antwi et al, 2020).

In a study by Calvin et al (2011) among African Americans regarding the perception of developing diabetes complications. It was observed that the majority of the subjects had physiological symptoms related to diabetes complications but only 33% of the study participants perceived that they were at risk of developing diabetes.

A study was conducted among Chinese preschool children's mothers to assess their perceived and actual risk for developing diabetes. Around 90% of the mothers perceived that they were at low risk of developing diabetes. It was observed that around 50% of study participants had siblings or parents with diabetes conditions. About 70% of mothers had less intake of fruits and vegetables. More than 50% of study subjects not following a regular exercise regime. Most of the women following sedentary lifestyles had a lack of awareness regarding the risk perception for developing diabetes. Educated mothers had a higher risk perception of developing diabetes (Guo et al, 2019).

Mongiello et al (2016) observed that among the subjects that are at high risk of diabetes among them around 61% of the study participants had the perception that they were at high risk of developing diabetes while 39% of subjects with high risk had a perception that they were at low risk. Underestimation of risk was observed more among the male study participants(p-value=0.010).

A study was conducted among non-diabetic adolescent Americans with overweight and obesity. The observation was that there is a correlation between racial discrimination and diabetes risk perception. Among study subjects, African American's (OR- 0.27) and Hispanic American's (OR-0.5) were less likely to perceive that they were at high risk of developing diabetes than non-Hispanic whites. The high-risk perception was observed among those who were informed by their physicians that they were at risk of developing diabetes (Twarog et al, 2020).

Al Shafaee et al (2008) in their study reported that around 63.1%, 43%, and 17.9% of study subjects perceived that diabetes can be prevented by adopting healthy eating patterns, by increasing physical activity, and by avoiding obesity and weight loss respectively. Those with higher consumption of sugar (59.9%) had a higher perceived risk of diabetes.

In a study conducted in the UK to evaluate the perceived risk of type 2 diabetes among individuals at increased familial risk of diabetes, the scores for perceived risk for diabetes became significantly higher as the number of conditions in the family history increased. Perceived risk without a family history of diabetes was 2.58. The perceived risk with a family history of diabetes alone was 3.22 and the perceived risk with a family history of diabetes and coronary heart disease or stroke was 3.26 (Dorman et al 2012). In a study conducted among patients attending primary health care clinics to check their perception of having diabetes in the future and intention to adopt a healthy lifestyle, it was observed that patients with high perceived risk were more likely than those with low perceived risk to have a family history of diabetes (68% vs. 18%) and to have metabolic syndrome (53% vs. 35%). However, patients with high perceived risk were not

more likely to have intentions to adopt a healthier lifestyle in the coming years (high perceived risk 26.0% vs. low perceived risk 29.2% (Hivert et al 2009). In a study conducted in the UK to examine the relationship between unrealistic optimism, sex, and risk perception of type 2 diabetes in college student's participants who reported having a blood relative with diabetes in their nuclear family had a moderately high-risk perception (Reyes et al, 2015).

RATIONALE OF THE STUDY

Literature review reveals that the prevalence of diabetes continues to escalate globally and in India. Unfortunately, many adults may not be aware of the increased risk for type 2 diabetes that results from their lifestyle behaviours. Improving diet and increasing physical exercise are widely endorsed approaches for reducing diabetes risk. It has been proposed that individuals must perceive that they are at high risk of developing a disease to consider modifying their health behaviours to prevent its onset. However, few studies have assessed risk perception for developing diabetes in the Indian population along with knowledge about diabetes and estimated diabetes risk. Therefore, it was thought worthwhile to assess diabetes knowledge, risk perception, and estimated diabetes risk in the teaching staff of The Maharaja Sayajirao University of Baroda.

Broad objective of the study

To assess diabetes knowledge, risk perception, and the risk of developing diabetes in the teaching staff of The Maharaja Sayajirao University of Baroda

Specific objectives

- To assess diabetes knowledge in the teaching staff of The Maharaja Sayajirao University of Baroda.

- To assess risk perception for developing diabetes in the teaching staff of The Maharaja Sayajirao University of Baroda.

- To assess the risk of developing diabetes in the teaching staff of The Maharaja Sayajirao University of Baroda.

- To assess the relationship between diabetes knowledge and the perceived risk of developing diabetes.

- To assess the association between the estimated risk of developing diabetes and the perceived risk of developing diabetes.

METHODS AND MATERIAL

METHODS AND MATERIALS

Diabetes is an iceberg disease and one of the most widespread NCDs in the world. Around 463 million individuals were reported to have diabetes in 2019 and the numbers continue to escalate. It is expected that by 2045 around 700 million people will be diabetic. The prevalence of diabetes varies across the region. In South-East Asia around 88 million people were reported to have diabetes in 2019 and the numbers are projected to upsurge to 153 million by 2045. Unfortunately, one in two people with diabetes in South-East Asia left undiagnosed and diabetes is a cause of 1.2 million preventable demises (IDF, 2019).

In India, also around 77 million people in the age group of (20 -79) years were reported to be diabetic in the year 2019 and it is worrisome that more than 57% of the type 2 diabetes cases remain undiagnosed (IDF, 2019).

Diabetes prevalence also varies in states across India as per NFHS-4(2015-16). A high prevalence of diabetes was reported in the states such as Rajasthan, Jammu, and Kashmir, Maharashtra, Telangana, Kerala. The risk factors that were stated to be the trigger of diabetes are increasing age, high socioeconomic status, overweight, and obesity.

The prevalence of diabetes continues to escalate globally and in India. Unfortunately, many adults may not be aware of the risk of diabetes that results from their lifestyle behaviours even though improving diet and increasing physical activity are widely endorsed approaches to lower the risk of diabetes.

It was also revealed in the various community health interventions programs that among the high-risk individuals increasing awareness about diabetes and its risk factors and the early detection of the presence of the type 2 diabetes risk

factors and modification of the lifestyle at modest levels may aid to avoid the start of the illness (Antwi et al, 2020).

Thus, it has been put forward that individual must perceive that they are at risk of developing diabetes and consider modifying their health behaviour to prevent its onset. However, very few studies have assessed the risk perception of developing diabetes in the Indian population along with knowledge about diabetes and estimated diabetes risk.

Thus, the present study was planned with a broad objective to assess the knowledge about diabetes, diabetes risk perception, and estimated diabetes risk among the teaching staff of The Maharaja Sayajirao University of Baroda. The study will help to increase the scientific knowledge about diabetes and its associated risk factors that could help in the development of effective education intervention tools to reduce the burden of diabetes and its linked complications. The study was approved by the Institutional Ethics Committee for Human Research , Faculty of Family and Community Sciences, The Maharaja Sayajirao University, Baroda .The study has been allotted ethical approval number : IECHR/FCSc/2020/49) (Appendix-I).

Specific objectives of the study:

- To assess the diabetes knowledge in the teaching staff of The Maharaja Sayajirao University of Baroda.

- To assess the risk perception for developing diabetes in the teaching staff of The Maharaja Sayajirao University of Baroda.

- To assess the risk of developing diabetes in the teaching staff of The Maharaja Sayajirao University of Baroda.

- To assess the relationship between diabetes knowledge and the perceived risk of developing diabetes.

- To assess the association between estimated risk and perceived risk of developing diabetes.

SAMPLING

The entire universe of the teaching staff of The Maharaja Sayajirao University of Baroda (N= approximately 1200) was approached for the study.

STUDY DESIGN

The study was a crossectional study to assess the diabetes knowledge, diabetes risk perception, and diabetes risk in the teaching staff of The Maharaja Sayajirao University of Baroda.

ENROLMENT OF SUBJECTS

Those subjects who gave informed consent and filled up the online self-administered questionnaire were enrolled for the study.

INCLUSION CRITERIA

- The teaching staff of The Maharaja Sayajirao University of Baroda.
- Willingness to participate in the study.

EXCLUSION CRITERIA

- Unwillingness to participate in the study

STUDY TOOL

A semi-structured questionnaire (Appendix-III) was designed after reviewing literature on various aspects of diabetes. The contents of the questionnaire were reviewed by experts and were revised after the expert's consultation. Pretesting of the questionnaire was also done. In total there were 33 questions in the questionnaire and the contents of the questionnaire were divided into six

sections. The questionnaire included questions related to demographic details of subjects, anthropometry, medical and family history, physical activity pattern, fruit and vegetable intake, diabetes knowledge, and diabetes risk perception. In the diabetes knowledge section-specific questions were asked to assess the subject's knowledge regarding the diabetes causes, complications, symptoms, and preventive factors, and similarly in the diabetes risk perception section questions related to individual risk perception to have diabetes were asked.

Scoring of the diabetes knowledge section. For the close-ended questions, each yes was scored as 1 and no response including the do not know and not sure response was scored as 0. For the questions with multiple answers, each selected option was scored as 1. Any other answer (in the others option) which made sense was scored 1, while all other answers were scored 0. Thus, the least possible score was 0 if all answers were incorrect and the maximum score was 26 if all answers were correct. The knowledge score were then classified in to three categories :poor (score <60%), moderate (score 60 – 80%), good (score >80%).

As illustrated in Figure 3.1 all the teaching staff of The Maharaja Sayajirao University of Baroda (N= approximately 1200) were emailed the link of the self-administered questionnaire (a google form sent along with the consent form) on their official email address. The description and the purpose of the study was explained in the consent form (Appendix-II). Around 217 subjects have given their consent to participate in the study and filled up, the online questionnaire. Study subjects excluding those from the Department of Foods and Nutrition were contacted by email to obtain consent for assessing their dietary pattern through a personal interview session using the 24-hour dietary recall method. For all those subjects who gave their consent for personal interviews, dietary pattern was assessed using the 24-hour dietary recall method.

FIGURE - 3.1

ASSESSMENT OF DIABETES KNOWLEDGE, DIABETES RISK PERCEPTION, AND DIABETES RISK IN THE TEACHING STAFF OF THE UNIVERSITY

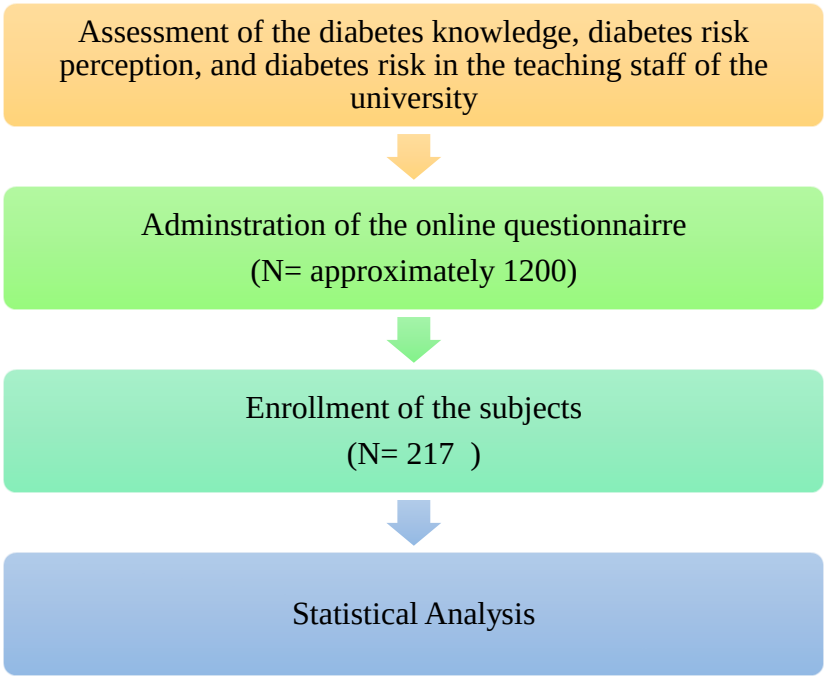


TABLE - 3.1

METHODS TOOLS AND TECHNIQUES FOR DATA COLLECTION

VARIABLE	METHODOLOGY TO COLLECT INFORMATION
General Information **Anthropometry** **Medical and Family History** **Physical activity pattern** **Diabetes knowledge** **Diabetes Risk perception** **Dietary Pattern**	Self-administered questionnaire
Dietary Pattern	24-hour dietary recall

METHODOLOGY FOR DATA COLLECTION

BACKGROUND INFORMATION

Socio-demographic details of the subjects were collected using a pretested self-administered questionnaire for the following information

- Age
- Sex
- Education
- Type of family
- No. of family members
- Total monthly income

ANTHROPOMETRIC MEASUREMENTS

Details regarding the following self-reported anthropometric measurements were taken

- Weight
- Height
- Waist Circumference
- Hip Circumference

MEDICAL AND FAMILY HISTORY

Medical and family history of the subjects was taken to know the presence of diabetes and other comorbidities such as hypertension, dyslipidaemia, hypothyroidism, and presence of any other medical condition and questions related to the family history of diabetes, intake of high blood pressure medication, and history of high blood sugar were asked that helped us calculate the diabetes risk score of the non-diabetic study participants.

DIET AND PHYSICAL ACTIVITY

Information regarding physical activity patterns and frequency of the consumption of fruits and vegetables was obtained to assess diabetes risk among the study participants. Information on the dietary intake of the subjects was ascertained using 24 hr dietary recall method (Appendix-IV). Accordingly, nutrient intake of the subjects such as energy, protein, carbohydrate, fat, calcium, iron, fiber was calculated using Diet Cal Software.

Methodology for data collection shown in Table 3.1

DIABETES KNOWLEDGE

The online self-administered questionnaire was used to collect information regarding the knowledge of diabetes symptoms, risk factors, preventive factors, complications.

DIABETES RISK PERCEPTION

Information about diabetes risk perception among the non-diabetic study participants was taken using the online self-administered questionnaire.

DIABETES RISK ASSESSMENT

Diabetes risk scores were calculated by using the IDF diabetes risk assessment tool which aims to predict individuals' type 2 diabetes risk in the next 10 years. For calculating the risk scores Asia Pacific BMI classification for BMI was used.

DATA MONITORING AND MANAGEMENT

- Data was collected using an online self-administered questionnaire by the investigator.
- The data was kept confidential.
- Information collected using the questionnaire was entered into the Microsoft Excel spreadsheets and was checked for errors.
- Cleaning and appropriate segregation of the data was done before performing any statistical analysis.

STATISTICAL ANALYSIS

Microsoft Excel (2019) was used for statistical analysis. Appropriate segregation of data was done and the following calculations were performed.

- Mean and the standard deviation.
- Percentages
- Analysis of the variance and student t-test was performed to compare the difference between the means of different groups.
- Chi-square test
- Regression

The result was declared to be statistically significant only if the p-value of the analysis was less than 0.05.

The details of the data management, monitoring, and analysis are also given in Table 3.2.

TABLE -3.2

DATA MANAGEMENT, MONITORING, AND ANALYSIS

Data Collection	Through a self-administered questionnaire.
Data Handling	Data was kept confidential and was available to the investigator for statistical analysis purpose only.
Data Entry	Microsoft Excel Spreadsheet
Data Analysis	Microsoft Excel using the appropriate statistical analysis tool

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

Diabetes is a major public health problem in the current scenario. About 8.5% of the total world population is reported to have diabetes. It's worrisome that the prevalence of diabetes is rising abruptly in middle-income and low-income countries. Untreated diabetes leads to serious complications and affects our vital organs. Chief complications that result from diabetes are kidney failure, heart disease, stroke, lower limb amputation that can be managed and prevented if diabetes is detected at the early stage of its onset and treated. Diabetes is also one of the chief causes of preventable deaths. Around 1.5 million demises are attributable to diabetes in the year 2012. Among them, about 43% of the demises occurred underneath the age of 70 years. Even, World Health Organization estimated that diabetes would be the seventh leading cause of death by 2030 (Zheng et al, 2018). The situation is also bothersome in the South East Asian region. Around 96 million people were estimated to have diabetes in the South East Asian region. Among them, 90% are having type 2 diabetes that is preventable (Aljin et al, 2018). In India also, around 77 million people are estimated to be diabetic in the age group of (20-79) years, and it is disturbing to know that about 57% of the population reported having the presence of undiagnosed diabetes, and every sixth adult with diabetes in the World come from India (IDF, 2019).

Literature review reveals that the prevalence of diabetes continues to upsurge globally and in the Republic of India. There are very few studies conducted in India to assess diabetes knowledge along with diabetes risk perception, and diabetes risk assessment. Thus, the present study was planned to assess diabetes knowledge, risk perception, and risk assessment in the teaching staff of the university.

The results of the study are discussed in the following sections –

- Socio-demographic information, anthropometric data and body weight perception, medical and family history, physical activity pattern, and dietary pattern of the subjects.

- Knowledge about diabetes among the teaching staff of The Maharaja Sayajirao University of Baroda.

- Diabetes risk assessment in the teaching staff of The Maharaja Sayajirao University of Baroda.

- Diabetes risk perception in the teaching staff of The Maharaja Sayajirao University of Baroda

SECTION -1

Socio-demographic information, anthropometric data and body weight perception, medical and family history, physical activity pattern, and dietary pattern of the subjects.

BACKGROUND INFORMATION

Background information of the subjects is shown in Table 4.1. The mean age of the subjects was 42.7 years. Around 41% of the study participants were male and 59% were females respectively. Among the subjects who responded to the question on education qualification, most of the subjects had a qualification of postgraduation and above. About 59% of subjects had doctoral degree and around 40% were postgraduates. With respect to their family background, around 61% of the subjects belonged to nuclear families followed by 33% from joint and 6% from extended families. Around 149 subjects responded to the question on total monthly income. Among them, most of the subjects had income in the range of 50000 to 200000.

TABLE - 4.1

BACKGROUND INFORMATION OF SUBJECTS

Variable	N	N (%)
Age (N = 212)		
Age Group		
21- 30 years	42	20
31-40 years	58	27
41- 50 years	46	22
51– 60 years	54	25
>60 Years	12	6
Gender (N = 217)		
Male	88	41
Female	129	59
Education (N= 213)		
Post Graduate	85	40
PhD	125	59
Graduate	3	1
Type of Family (N = 213)		
Nuclear	130	61
Joint	70	33
Extended	13	6
Total Monthly Income (in Rupee) (N = 149)		
<50000	12	8
50000-100000	60	40
100000- 200000	54	36
200000-300000	10	7
300000-400000	4	3
>500000	9	6

PREVALENCE OF OVERWEIGHT AND OBESITY

Obesity is emerging as a public health problem and is one of the key risk factors for non-communicable diseases (NCDs). James et al (2004) in a review study reported that individuals of Asia-pacific region with a BMI of >21kg/m^2 are at risk of developing NCDs such as type 2 diabetes mellitus, hypertension, stroke, hypertensive heart disease, ischemic heart disease, osteoarthritis, breast cancer in the post-menopausal stage, colon cancer and cancer of endometrium and kidney.

In present study population majority of the subjects(74%) were found to be overweight/obesity with BMI ≥23 kg/m^2 as illustrated in Table 4.2. A higher % of males (22%) were found to be overweight as compared to females (15.3%) whereas prevalence of obesity was higher in females (59%) subjects (Figure 4.1) as compared to males (52%).

Bo et al (2018) reported the prevalence of obesity around 80% among the teaching staff of the University of Malaysia comparable to the study results. Also, in a study conducted among teaching staff of the public school of Brazil to assess the prevalence of obesity and to saw the association between obesity and its risk factors the prevalence of overweight/obesity was(78%) (Olivera et al, 2015).

The findings of our study are in line with the study conducted by Undwalli et al (2019) in Andhra Pradesh. They had also observed the prevalence of generalized obesity in their study population around 56%. A study conducted in New Delhi had also reported similar results, with an overall prevalence of generalized obesity of around 50%(Bhardwaj et al, 2011). The ICMR -INDIAB study reported the prevalence of overweight and obesity in the urban adult population to be around 30-65% (Pradeepa et al, 2015).

TABLE - 4.2

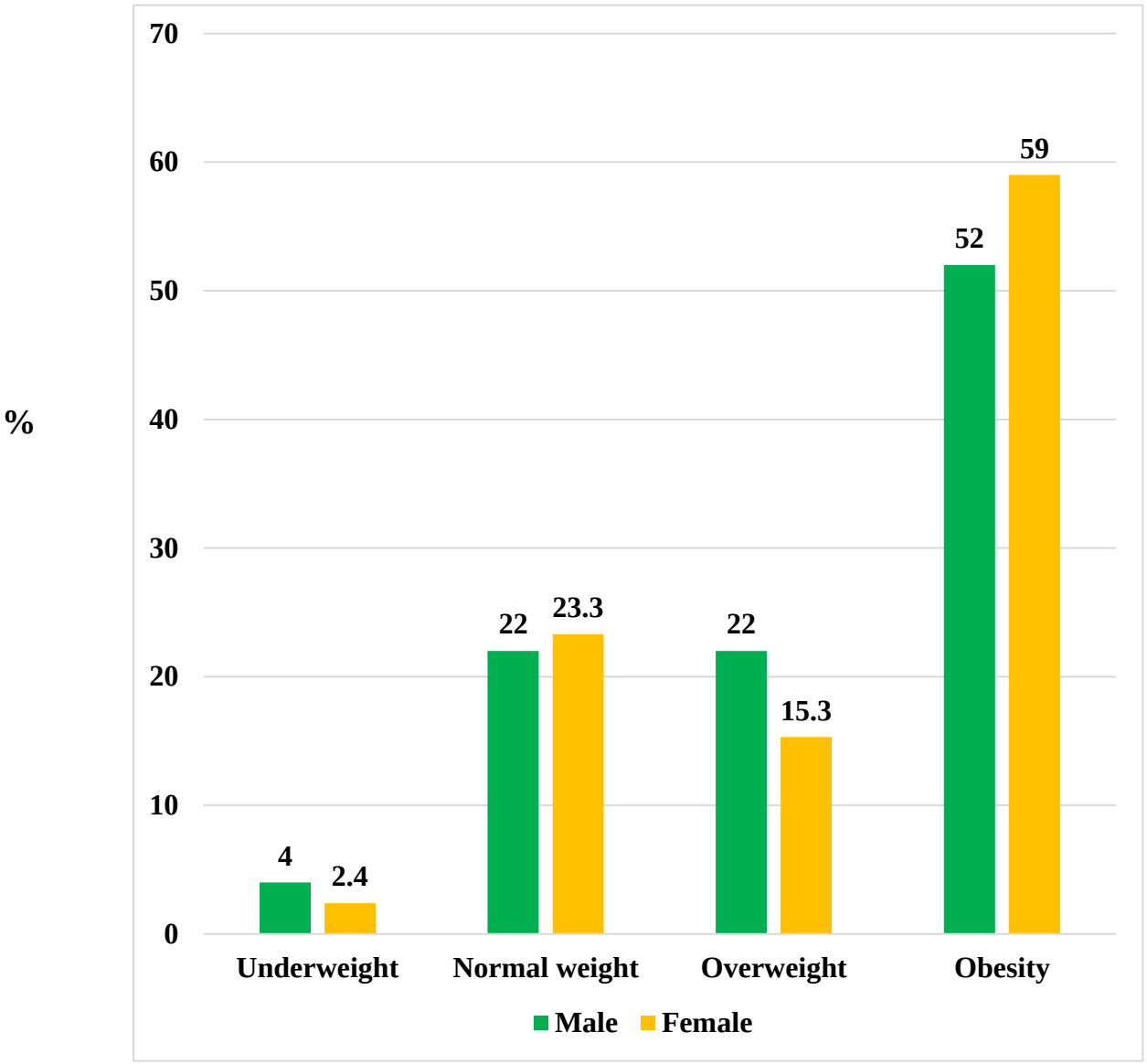
PREVALENCE OF OVERWEIGHT AND OBESITY AMONG THE SUBJECTS BASED ON THE ASIA-PACIFIC CLASSIFICATION
N(%)

Variable		Male (N = 85)	Female (N = 124)	Total (N = 209)
Underweight	**BMI < 18.5**	3 (4)	3 (2.4)	6 (3)
Normal weight	**BMI 18.5 - ≤ 22.9**	19 (22)	29 (23.3)	48 (23)
Overweight	**BMI ≥23 - < 25**	19 (22)	19 (15.3)	38 (18)
Obesity	**BMI ≥ 25**	44 (52)	73 (59)	117 (56)

Values in parentheses indicate percentage

FIGURE - 4.1

PREVALENCE OF OVERWEIGHT AND OBESITY IN MALE AND FEMALE SUBJECTS BASED ON THE ASIA-PACIFIC CLASSIFICATION (%)



As reported by Pradeepa et al (2015), in the present scenario prevalence of abdominal obesity is increasing sharply in the Indian population both in urban dwellers and rural dwellers but the prevalence rate is found to be more in urban dwellers than rural dwellers.

Among the 166 respondents who gave the information regarding their waist circumference measurements, a high prevalence of abdominal obesity was found with about 48% and 81.1% of the male and female subjects respectively being abdominally obese (Figure 4.2).

The waist-hip ratio, waist circumference ratio value more than the ideal reference range is a key predictor of abdominal obesity in comparison to body mass index (Ohlson et al, 1985 as cited in Rexrode et al, 1998).

The results of the present study are in line with the study by Sarma et al (2008) conducted to assess the prevalence of non-communicable disease (NCDs) risk factors in the general population of Kerala, found a high prevalence of abdominal obesity across the gender. Among males and females, abdominal obesity prevalence was around 39.1% and 72.6% respectively.

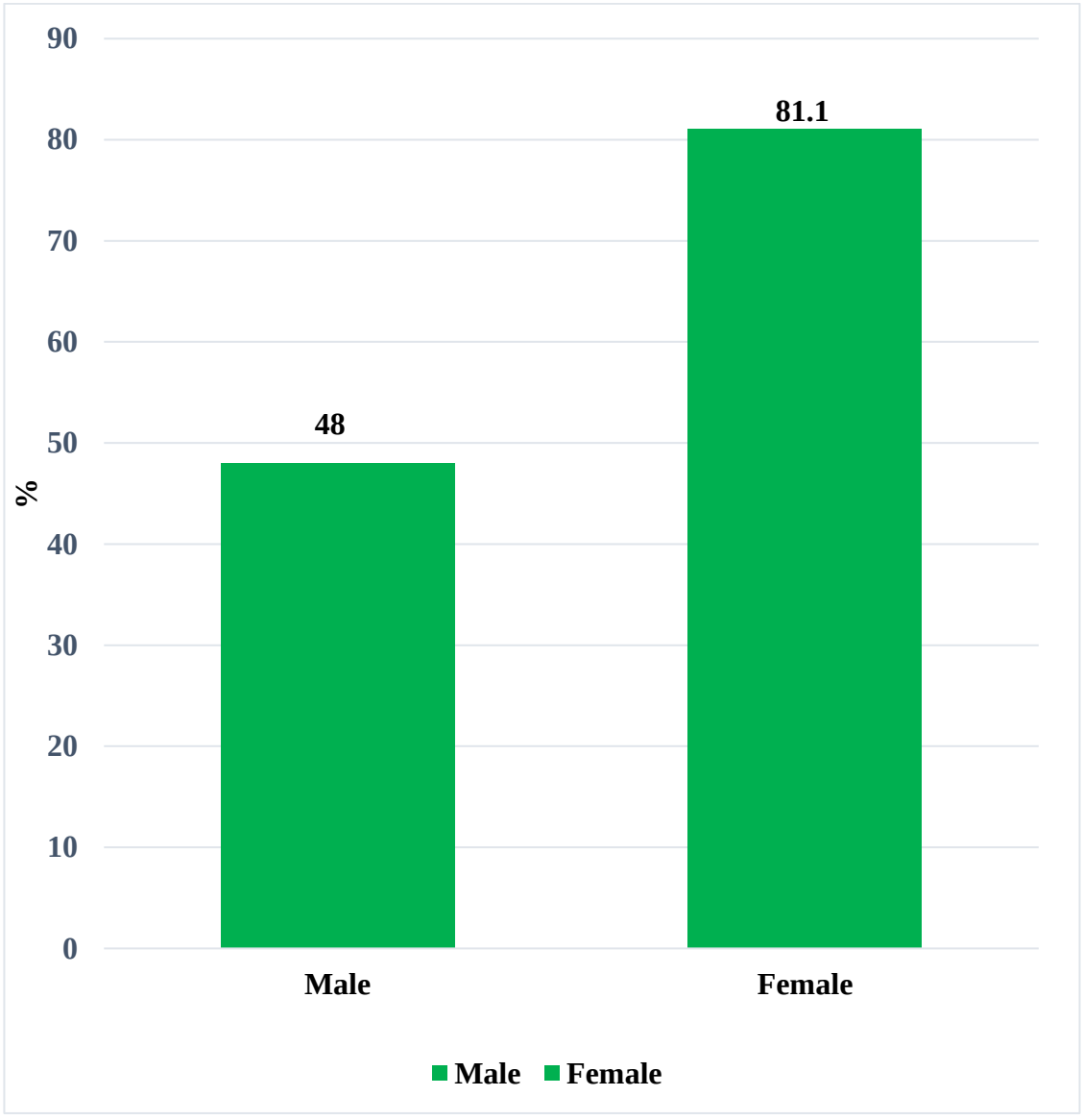
Chauhan et al (2019) in a study to assess the prevalence of obesity in the rural coastal area of Tamil Nadu, reported the overall prevalence of abdominal obesity among the study participants (55%). Furthermore, a high prevalence of abdominal obesity was observed in females as compared to males, (60%) vs (50%) respectively.

ANTHROPOMETRIC PROFILE OF SUBJECTS

The anthropometric profile of the subjects is shown in Table 4.3. The mean weight of the total subjects was 69kg. Across the genders mean weight of males was 73.4kg and for females was around 65.6kg.

FIGURE - 4.2

PREVALENCE OF ABDOMINAL OBESITY IN MALE AND FEMALE SUBJECTS (%)



Not much difference in BMI was observed. The mean BMI of the males and female subjects was 25.4 kg/m^2**,** 26.3 kg/m^2 respectively. The mean Waist to Hip ratio and Waist Stature Ratio of the subjects was around 0.9, 0.5 respectively.

A study was conducted among the professors and other faculty members in the faculty of health at the University of Columbia to assess the cardiovascular risk profile and fitness profile. Average BMI of the teaching faculty was 25.56 $kg/m^2 \pm 3.9$ in line with the present study results (Luna et al, 2016).

PERCEPTION OF BODY WEIGHT AMONG SUBJECTS

Perception of the body weight refers to an individual's perception of their bodyweight as underweight, normal weight, overweight and, obese irrespective of their actual body mass index (BMI) (Cheung P et al, 2007).

An individual's perception of their body weight influences their weight control behaviours (Wang et al, 2009).

Among the individuals that perceived themselves as overweight and obese are more likely to engage in weight reduction activities. Whereas induvial that not perceived themselves as overweight are not engaged in weight-loss behaviours (Wong et al, 2010). Bodyweight perception is also influenced by various factors such as age, gender, family background, ethnicity, media (Gregorg et al, 2008).

TABLE - 4.3

ANTHROPOMETRIC PROFILE OF THE SUBJECTS (Mean ± SD)

Variable	Male	Female	Total
Weight (kg)	73.4 ± 10.6 (86)	65.6 ± 11.9 (127)	69 ± 12 (213)
Height (cm)	169.9 ± 8.0 (85)	157.5 ± 5.9 (125)	162.5 ± 9.1 (210)
BMI (kg/m^2)	25.4 ± 3.6 (85)	26. 3 ± 5.2 (125)	26.1 ± 4.3 (209)
Waist Circumference (cm)	90.4 ± 12.7 (60)	87.9 ± 11.0 (106)	88.8 ± 11.7 (166)
Hip Circumference(cm)	97.4 ± 12.6 (41)	102.3 ± 12.4* (89)	100.8 ±12.7(130)
Waist to Hip Ratio (WHR)	0.9 ± 0.1 (40)	0.9 ± 0.1 (89)	0.9 ± 0.1 (129)
Waist Stature Ratio (WSR)	0.5 ± 0.1 (60)	0.6 ± 0.1 (104)	0.5 ± 0.1 (164)

Values in parentheses indicate the total number of responses for a particular variable

* Significantly different from males at $p<0.05$

Around 215 study subjects responded to the bodyweight perception question in the survey questionnaire. Among them, (44.2%) of the subjects perceive that they were at normal weight followed by (41.9%) overweight, (11.2%) obesity, (2.8%) underweight (Table 4.4).

Muhihi et al (2012) reported perception of underweight, normal weight, overweight, obesity among the study subjects around 19%, 62%, 18%, 1% respectively.

Alarmingly (56%) of the individuals were obese but only 11.2% perceived themselves to be obese. Joh et al (2013) had reported that 24.5% of the subjects had a high prevalence of weight under perception.

Around 52.9% of the male and 42.6% of the female had distorted bodyweight image in the present study. Song et al (2020) reported distorted bodyweight image in the male and female subjects 42.5%, 57.5% respectively.

PERCEIVED BODYWEIGHT ACROSS THE CATEGORIES OF ACTUAL BMI CLASSIFICATION

Around 70.9% of the subjects in the overweight category perceived themselves to be in the normal weight and underweight category and about 37% of the subjects in the obese category actually perceive themselves to be normal weight and overweight (Table 4.5).

MEDICAL HISTORY OF THE SUBJECTS

Medical history data revealed that around 10.6%,18.9%, and 4.1% of the subjects had diabetes, hypertension, and dyslipidaemia respectively (Table 4.6). Around 5% of the diabetic subjects were hypertensive too.

TABLE - 4.4

PERCEPTION OF BODY WEIGHT AMONG SUBJECTS N(%)

	Male (N = 86)	Female (N = 129)	Total (N = 215)
Underweight	2 (2.3)	4 (3.1)	6 (2.8)
Normal Weight	48 (55.8)	47 (36.4)	95 (44.2)
Overweight	35 (40.6)	55 (42.6)	90 (41.9)
Obesity	1 (1.2)	23 (17.8)	24 (11.2)

Values in parentheses indicate percentage

TABLE - 4.5

PERCEIVED BODY WEIGHT ACROSS THE CATEGORIES OF ACTUAL BMI CLASSIFICATION N(%)

Perceived Body Weight	Underweight (N = 6)	Normal Weight (N = 48)	Overweight (N = 38)	Obesity (N = 117)
Perceived Underweight	3 (50)	44 (91.7)	2 (5.2)	1 (0.8)
Perceived Normal Weight	3 (50)	4 (8.3)	25 (65.7)	20 (17)
Perceived Overweight			10 (26.3)	23 (19.6)
Perceived Obesity			1 (2.63)	73 (62.3)

Values in parentheses indicate percentage

Other medical conditions reported by subjects were migraine, hypotension, Chronic acidity, IGA neuropathy, Hyperuricemia, Meniere disease

Various studies have reported a high prevalence of hypertension in the general population of India. Hypertension is one of the key risk factors for non-communicable diseases worldwide and is attributable to (13%) of the demises globally (WHO NCDs report, 2011).

Untreated hypertension with the co-occurrence of diabetes intensifies the risk of morbidity and mortality from cardiovascular ailments and neurological disorders (ICMR Guidelines on Management of Diabetes, 2018).

FAMILY HISTORY OF DIABETES

A family history of diabetes specifically in both parents or in either one of the parents has shown to reduce beta-cell function and lead to a younger age of onset of diabetes and higher risk of comorbidities of diabetes (Iwata et al, 2019).

In the study around (40.7%) of the subjects had a family history of diabetes in the first-degree relative and (17.3%) of the subjects had a family history of diabetes in a second-degree relative (Table 4.7).

Comparable results on diabetes prevalence were reported by Dasaraju et al (2020) with prevalence of diabetes in the first-degree relative and second-degree relative around (26.9%), (3.9%) respectively in a community-based study conducted to evaluate diabetes risk in Andhra Pradesh. Around 54.5% of the self-reported diabetic subjects had a family history of diabetes versus 39% in the non-diabetic subject.

TABLE - 4.6

MEDICAL HISTORY OF THE SUBJECTS N(%)

Medical Condition	
Diabetes	23 (10.6)
Hypothyroidism	13 (5.5)
Hypertension	41 (18.9)
Dyslipidaemia	9 (4.1)
Other	11 (5.1)

Values in parentheses indicate percentages

TABLE - 4.7

FAMILY HISTORY OF DIABETES N(%)

Family history of diabetes	Individuals with self-reported diabetes (N = 22)	Non-diabetic Subjects (N = 192)	Total Subjects (N = 214)
No	5 (22.7)	85 (44.3)	90 (42)
Yes: grandparent, aunt, uncle, or first cousin	5 (22.7)	32 (16.7)	37 (17.3)
Yes: parent, brother, sister	12 (54.5)	75 (39)	87 (40. 7)

Values in parentheses indicate percentage

PHYSICAL ACTIVITY PATTERN OF THE SUBJECTS

Regular physical activity is beneficial in the prevention and management of lifestyle-related disorders. Epidemiological studies have also proposed that regular physical activity such as walking is allied with a risk reduction of diabetes among those engaged in physical activity (Hamasaki et al, 2016).

Results from a diabetes prevention intervention program in a group of individuals with impaired glucose tolerance showed that among individuals that were on an intervention of intensive lifestyle modification the risk of incidence of diabetes reduced to 58% after 2.5 years of follow-up in comparison to subjects on the standard lifestyle modification and placebo and those on standard lifestyle modification and metformin treatment (Pan et al, 1997).

In the present study, around 79.3% of the subjects reported to be engaged in regular 30 minutes of the physical activity during work and leisure time. However, it is noteworthy that around 20.7% of the study participants were not physically active (Table 4.8). A sedentary lifestyle may act as a risk factor for non-communicable diseases such as diabetes and other related comorbidities. In view of the high prevalence of overweight and obesity in the study subjects, there is a need to promote regular physical activity in order to ameliorate the risk for NCDs.

DIETARY PATTERN OF THE SUBJECTS

Fruits, vegetables, and berries intake of the subjects is illustrated in Table 4.9. It was disturbing to know that around 18.43% of the subjects were not consuming fruits, vegetables, and berries in their everyday diet.

The Recommended Dietary Allowances (2020) for Indians recommends an intake of 400 grams of fruit and vegetable for preventing diet-related NCDs (RDA, 2020).

TABLE - 4.8

PHYSICAL ACTIVITY PATTERN OF THE SUBJECTS N(%)

Regular 30 minutes of physical activity during work and leisure time.	(N =217)
Yes	172 (79.3)
No	45 (20.7)

Values in parentheses indicate percentage

TABLE - 4.9

DIETARY PATTERN OF SUBJECTS N(%)

Eating of the fruit Vegetables and berries	(N =217)
Everyday	177 (81.6)
Not Everyday	40 (18.43)

Values in parentheses indicate percentage

NUTRIENT INTAKE OF SUBJECTS

The mean nutrient intake of the subjects is shown in Table 4.10. The average calorie intake of the subjects was about 1588 kcal. Calorie intake was found to be around 1628 kcal in males and 1545 kcal among females. High carbohydrate intake was observed across the gender with an average intake of 210.6 grams that is more than the estimated average requirement (EAR). As per 2020 recommended dietary allowances (RDA) guidelines EAR of carbohydrates was around 100mg/day for the healthy adult population considering the variations in brain glucose utilization (RDA, 2020).

The average fat intake of the subjects was about 57.3grams in males and 52.9grams in females that was almost (215.6%), (206%) of the estimated average requirement (EAR) among the males and females. While comparing calcium intake, the average calcium intake was around 630.4mg in males and 592.3mg in females. Mean iron intake was found to be low in the female(11.8 mg) subjects in comparison to males (12.8 mg). The dietary fiber intake of subjects was adequate (30.92grams). The majority of subjects are meeting more than (80%) of the EAR for total dietary fiber intake and all the subjects met dietary vitamin C requirements too in their usual diets. Calorie contribution from macronutrients among the subject's diet was about (54%) from carbohydrates,(14%) from protein, and (32%) from fat as shown in the pie chart in Figure 4.3.

The mean fat intake in female and male was 52.6 grams, 55.35 grams respectively and the mean carbohydrate intake in male and female was 261.2grams, 244.15grams respectively in a study conducted in the teaching staff of the Punjab Agriculture University, Ludhiana (Kaur et al, 2016) comparable to the present study results.

TABLE - 4.10

MEAN NUTRIENT INTAKE OF THE SUBJECTS (Mean ± SD)

Nutrient	EAR Male	Male (N= 16)	EAR Female	Female (N= 18)	Total (N= 34)
Energy (kcal)	2100	1628 ± 513 (77.52)	1660	1545 ± 492 (93.1)	1588 ± 510
Carbohydrate (g)	100	215.6 ± 68.5 (215.6)	100	206.0 ± 66.9 (206)	210.6 ± 67.6
Fat (kcal)	25	57.3 ± 25.6 (229.2)	20	52.9 ± 22.8 (264.5)	55.7 ± 25.3
Protein (g)	42.9	55 ± 27 (128.2)	36.3	51.5 ± 24.0 (141.87)	54.2 ± 26
Calcium (mg)	800	630.4 ± 214.3 (78.8)	800	592.3 ± 234.4 (74.0)	598.8 ± 229.9
Iron (mg)	11	12.2 ± 6.5 (110.9)	15	11.8 ± 6.4 (78.6)	11.9 ± 6.3
Vitamin C (mg)	65	103.4 ± 75.6 (159)	55	113.8 ± 77.3 (206.9)	112.6 ± 81.3
Total Dietary Fiber (g)	35.7	30.82 ± 12.98 (86.3)	29.7	30.48 ± 12.26 (102.6)	30.92 ± 12.4

Values in parentheses indicate % EAR met by subjects

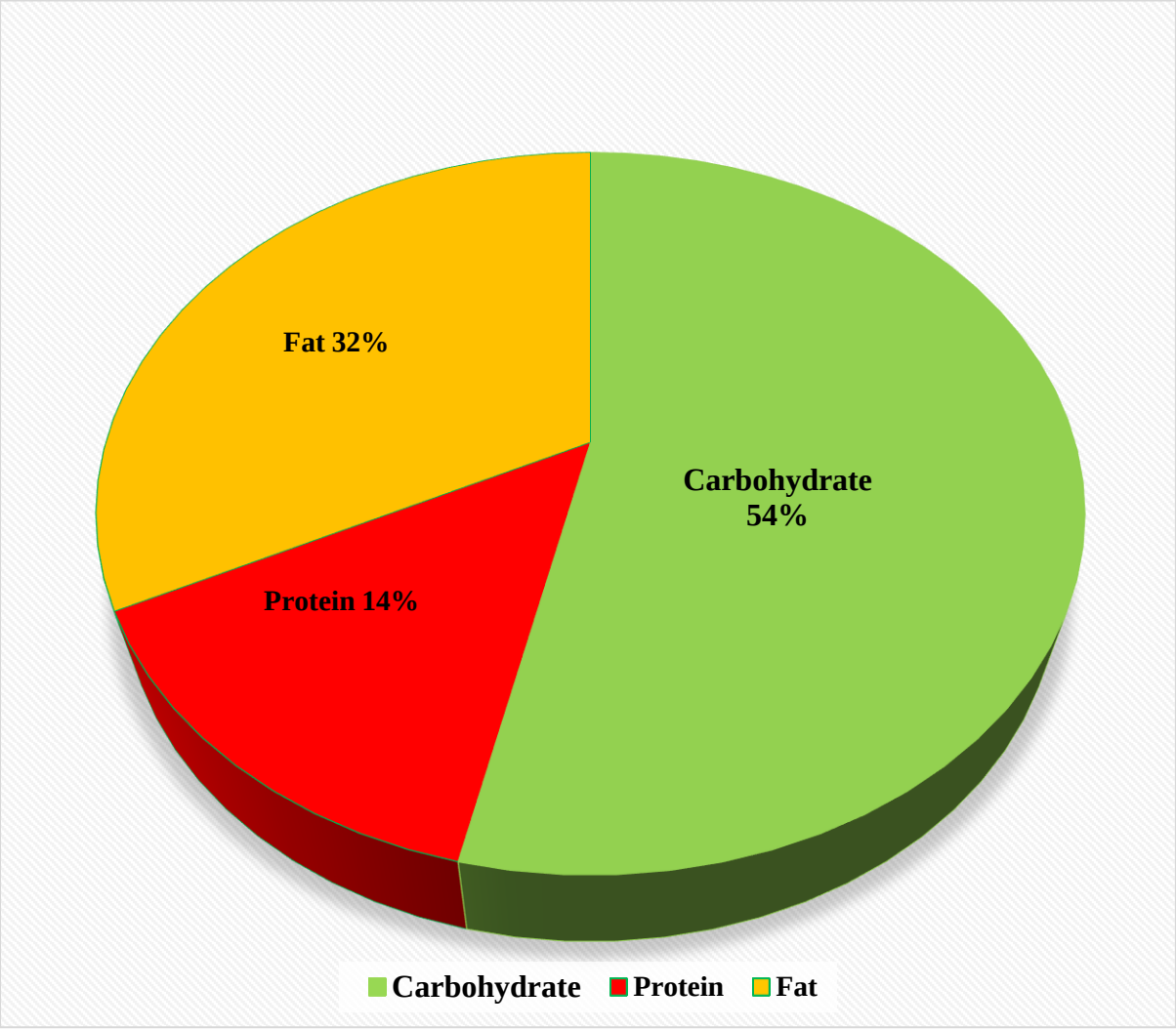
As it was observed that in the study subjects the mean intake of carbohydrates and fat was more than the estimated energy requirements (EAR) and diet was deficient in micronutrients calcium may act as a risk factor for diet-related chronic diseases in nondiabetic subjects and among the diabetic subjects there may increase risk of other diet-related comorbidities since the majority of the study subjects were found overweight or obese.

Intake of refined carbohydrates in excess amount act as a risk factor for chronic diseases. Radhika et al (2009) in a study reported that a significant association was found with the intake of refined carbohydrates in diet with risk of abdominal obesity ($p=0.0001$), high serum triglyceride levels ($p<0.007$), high blood glucose levels ($p<0.007$), insulin resistance ($p<0.001$). Moreover, subjects in the study population that had consumed more refined carbohydrates in their diet were also prone to cardiovascular ailments in comparison to their counterparts those having low refined carbohydrate intake in their usual diets with an odds ratio of 7.83.In a study to assess the impact of type and quality of carbohydrates in the diet and the risk of type 2 diabetes. It was found that a high intake of refined carbohydrates enhances the risk of type 2 DM ($p<0.001$) whereas intake of a high fiber diet was positively associated with a reduced risk of type 2 DM ($p<0.001$) (Mohan et al, 2009).

Adequate calcium intake is essential for the prevention of osteoporosis and a diet deficient in calcium may act as a risk factor for the pathogenesis of the other chronic diseases too. A study by Rani et al (2015) had reported that the mean calcium intake among the study participants was around 632.72mg. Balk et al (2017) reported that Calcium intake across many countries in South East Asia was less than 500mg/ day also in the present study in the South Asian population calcium intake was less than the requirements.

FIGURE - 4.3

DISTRIBUTION OF ENERGY COMING FROM MACRONUTRIENTS (%)



Iron deficiency anaemia is the most prevalent community health problem in the Indian population. While comparing data on iron intake from the national family health survey (NFHS)between (2005-2006) and (2015-2016) the mean iron intake in adult women in the age group of 15-49 years has increased by 3.5% only from 53% to 56.5% (Rani et al,2018). Leonard et al (2014) had reported the mean iron intake among the study participants around (11.2%) comparable to the study results.

Intake of fiber in diet plays an imperative role in reducing the risk of and lowering the incidence of several diseases. Adequate dietary fiber intake reduces the risk of cardiovascular diseases (CVD) by lowering the serum triglyceride levels and low-density lipoprotein (LDL) cholesterol levels among the adult and children and reduces the risk of colorectal cancer and breast cancer too. The glycaemic index of diet is also reduced with the adequate intake of dietary fiber (Mackowaik et al, 2015). The majority of the subjects in the present study were meeting fiber intake requirements that had given their 24 hrs dietary recall.

While comparing the percentage of energy coming from macronutrients results were comparable to a study by Naicker et al (2015) with the percentage of energy from carbohydrate, protein, fat around 48.5%, 36%, 12.4% respectively.

SECTION- 2

Knowledge about diabetes among the teaching staff of The Maharaja Sayajirao University of Baroda.

GENERAL AWARENESS ON DIABETES

Diabetes is a quite prevalent chronic disease across the globe and a reason for high morbidity and mortality of preventable nature. Moreover, it is a serious matter of concern that the number of diabetes cases is quite prevalent in India after China (Rhee, 2015). The majority of the productive age group population is affected by this chronic ailment due to a sedentary lifestyle, and unhealthy

eating patterns. The prevalence varies across the region. As per ICMR-INDIAB study in the rural areas of the nation, diabetes is more prevalent in high socio-economic group people and, in the urban area's majority of diabetes, cases were observed in low socioeconomic group people who work on daily wages to earn the bread and butter and most of them are not able to full fill their families' daily needs. However, such a situation of increasing prevalence of diabetes especially undetected diabetes will highly affect the health status of the people and lead to high morbidity and mortality of preventable nature.

So present study was planned with a broad objective to assess diabetes knowledge, diabetes risk perception, and diabetes risk assessment in the teaching staff of the university. They serve as key advocacy groups to spread awareness and their knowledge plays an important role to make other population groups aware of diabetes and prevent India from this health crisis.

In the present study online survey questionnaire was used to assess the knowledge about diabetes among the teaching faculty of the University. We observed that in the study (99%) of the subjects were aware of diabetes. But only (92%) of the total subjects were aware of how diabetes is detected (Table 4.11).

The results of the study are in line with the KAP study by Rathod et al (2018) conducted in the general population of Vadodara. In their study, they had reported that (100%) of the population is aware of what diabetes is. Also, the results of a study by Kurian et al (2016) in a community-based study on diabetes in the rural population of Kerala were in line with the study results with awareness of diabetes around 97%. But the present study results were contradictory to a study by Deepa et al (2017), a nationwide survey to assess the diabetes knowledge in population across the country. They reported that 43.2% of the general population of India is aware of what diabetes is. Higher knowledge for this survey question in present study population may be due to their academic background and various studies on diabetes knowledge across the nation had shown that as literacy level increases knowledge and awareness

TABLE - 4.11

GENERAL AWARENESS ON DIABETES N(%)

	Individuals with self-reported diabetes (N = 23)	**Non-diabetic Subjects (N = 194)**	**Total Subjects (N = 217)**
Do you know what diabetes is?	23 (100)	192 (98.9)	215 (99)
Do you know how diabetes is detected/measured?	23 (100)	177 (91.2)	200 (92)

Values in parentheses indicate percentage

increase due to increased exposure to more knowledge sources (Mbuya et al, 2014).

KNOWLEDGE OF THE RISK FACTORS OF DIABETES

Knowledge of the disease and its risk factor plays a significant role in its deterrence and management. In the study group as shown in Table 4.12 most of the subjects were aware that family history of diabetes (92.1%), Unhealthy diet (84.8%), overweight (83.8%), not being physically active (76.9%) are risk factors for diabetes. But awareness was lacking regarding older age (27.6%) and high blood pressure (35.7%) as a risk factor for diabetes as illustrated in the graphical representation in Figure 4.4. Other risk factors mentioned by subjects were geographical origin, tension, anxiety improper sleep, etc.

In a study conducted to assess the awareness about diabetes in the high-risk population of London awareness of obesity as a risk factor of diabetes was 83.2% (Kayyali et al, 2019).

Wee et al (2002) conducted a study to assess the awareness of the general public on diabetes in Singapore. Their study results were in line with present study results regarding awareness of family history as a risk factor of diabetes around (90.7%) whereas knowledge of obesity as a risk factor for diabetes was found to be around (67.7%).In a study by Yang et al (2018) also the majority of subjected had awareness regarding family history of diabetes, obesity, unhealthy diet as a risk factor for diabetes.

Rathod et al (2014) conducted a study to assess diabetes knowledge in Wagoria, Gujrat around 100% of the subjects were aware of diabetes and around 91.2% of the subjects were aware that family history of diabetes is associated with increased diabetes risk. It is worrisome to know that in the study group of academicians, most of them were not aware regarding hypertension and older age as a risk factor for diabetes with prevalence rate of hypertension of around (18.9%).

TABLE - 4.12

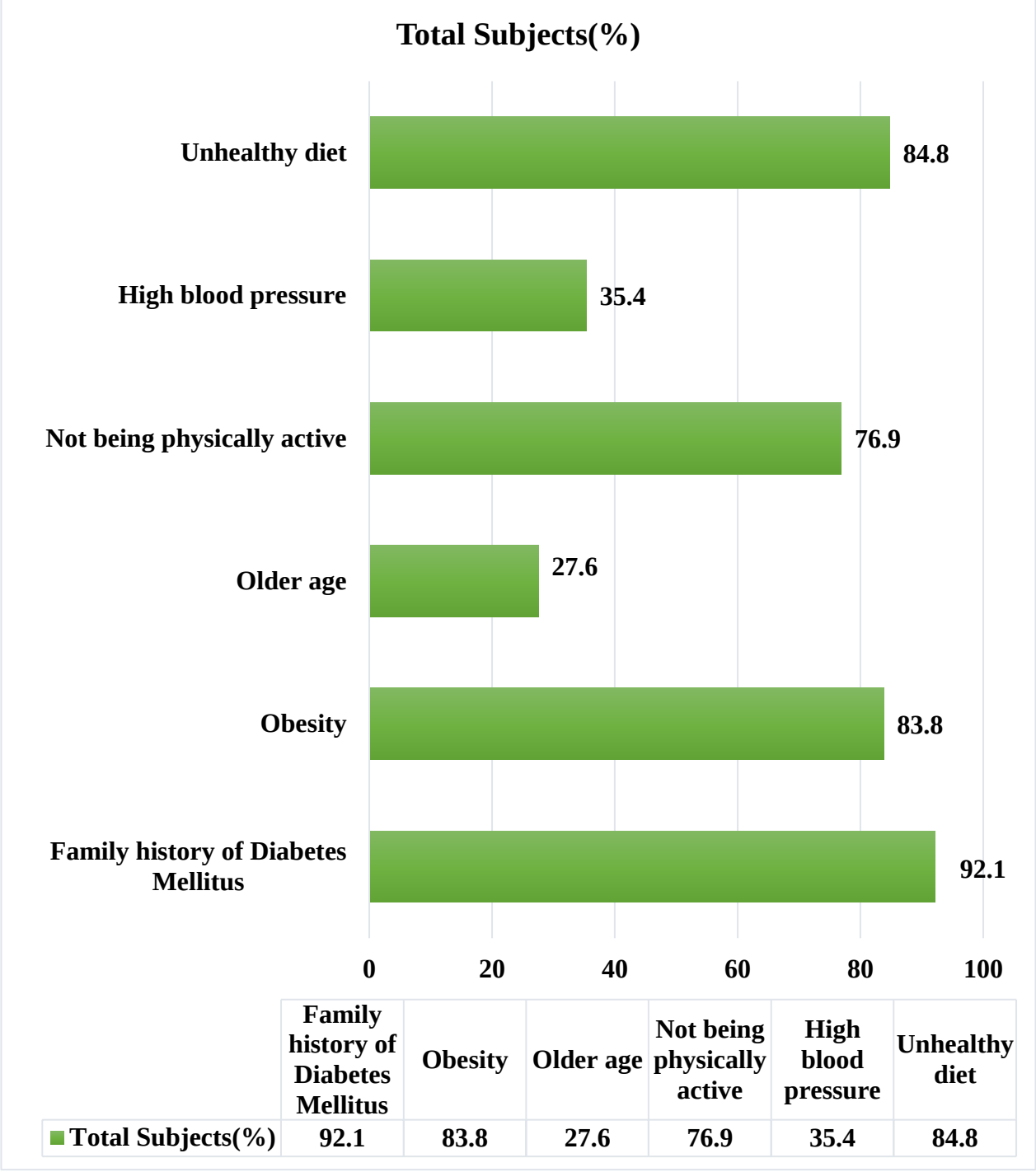
KNOWLEDGE OF THE RISK FACTORS OF DIABETES
N(%)

Risk factor	Individuals with self-reported diabetes (N =23)	Non-diabetic Subjects (N = 194)	Total Subjects (N = 217)
Family history of diabetes	21 (91.3)	179 (92.2)	200 (92.1)
Overweight/Obesity	19 (82.6)	163 (84)	182 (83.8)
Older age	7 (30.4)	53 (27.3)	60 (27.6)
Not being physically active	19 (82.6)	148 (76.2)	167 (76.9)
High blood pressure	10 (43.4)	67 (35)	77 (35.4)
Unhealthy diet	22 (95. 7)	162 (83.5)	184 (84.8)

Values in parentheses indicate percentage

FIGURE - 4.4

KNOWLEDGE OF THE RISK FACTORS OF DIABETES N(%)



	Family history of Diabetes Mellitus	Obesity	Older age	Not being physically active	High blood pressure	Unhealthy diet
Total Subjects(%)	92.1	83.8	27.6	76.9	35.4	84.8

Asmamaw et al (2015) also reported in a crossectional survey on knowledge and attitude about diabetes in their study group that (26%) of the participants were unaware that older age is a risk factor for diabetes.

A study by Deepa et al (2017) to assess diabetes knowledge in urban and rural populations across India also reported that around 37% of the study participants were not aware that hypertension is a risk factor for diabetes. The results agreed with the present study result. In a study conducted to assess the awareness about diabetes in the high-risk population of London. Their study results were comparable to the study results regarding awareness of obesity (83.2%) as a risk factor of diabetes(Kayyali et al, 2019).

KNOWLEDGE OF THE SYMPTOMS OF DIABETES

Diabetes symptoms knowledge data revealed that about (83.4%) of the study subjects had awareness regarding frequent urination being a symptom of diabetes, followed by slow healing of wounds (82%), blurred vision (64.5%), fatigue (59.9%), increased thirst (58.1%), increased hunger (54.8%) (Table 4.13). A significantly higher number of diabetic subjects (78.3% vs 55.7%) were aware of increased thirst being a symptom of diabetes as compared to non-diabetic subjects. The awareness about fatigue being a symptom of diabetes was more in non-diabetic subjects (60.3% vs 56.5%) as compared to diabetic subjects. Other symptoms reported by subjects were numbness of the finger, weight loss, dry skin, disturbed sexual life, diabetes neuropathy.

In the teaching staff of higher education institutes in Dar es salaam, Tanzania Mbuya et al (2014) observed comparable results regarding knowledge of the symptoms of diabetes such as frequent urination (85.6%), increased thirst (58%), slow healing of wounds (82%) and blurred vision (64.5%).

TABLE - 4.13

KNOWLEDGE OF THE SYMPTOMS OF DIABETES N(%)

Symptoms of Diabetes	Individual with self-reported diabetes (N =23)	Non-diabetic Subjects (N=194)	Total Subjects (N=217)
Increased thirst	18 (78.3)	108 (55.7)	126 (58.1)
Increased hunger	15 (65.2)	104 (53.6)	119 (54.8)
Frequent urination	22 (95.7)	159 (82)	181 (83.4)
Fatigue	13 (56.5)	117 (60.3)	130 (59.9)
Slow healing of wounds	18 (78.3)	160 (82.5)	178 (82)
Blurred vision	16 (69.6)	124 (63.9)	140 (64.5)

Values in parentheses indicate percentage

KNOWLEDGE OF COMPLICATIONS OF DIABETES

In a recent report by the NCD alliance, diabetes was reported to amongst the top 10 causes of death globally. Since 2000, diabetes-related deaths have increased by (70%). The majority of people who died due to diabetes had shown the presence of comorbid conditions such as cardiovascular disease and with the coexistence of hypertension severity of this condition is accelerated (NCD Alliance Report, 2021**).**

Data on knowledge about complications of diabetes revealed that all diabetic subjects and majority of the non-diabetic subjects (92.8%) knew that diabetes can cause complications in the body (Table 4.14 (a)). However, awareness regarding specific complications of diabetes was lacking amongst these subjects. Only around (50%) of the subjects were aware that hypertension (50.2%) and stroke (53.9%) were complications associated with diabetes. Around 39.2%, 29%,34.1%,23.5% of the subjects respectively were not aware that foot problems, kidney disease, heart disease, and eye disease were complications associated with diabetes (Table 4.14 (b)). No significant differences were observed upon comparing knowledge of complications of diabetes between diabetic and non-diabetic subjects.

Mohan et al (2005) had also shown similar kind of results in a study on the urban population of Chennai with awareness of hypertension around 9.2%. Alemayehu (2019) also reported in a community survey that around 37.6% of the subjects were not aware that hypertension is a complication of diabetes.

A crossectional study conducted in the high-risk population of London to assess awareness regarding diabetes also reported similar kinds of results. In the study about 53.4% of the subjects were not aware of hypertension is a complication of diabetes (Kayyali et al, 2019). Mubuya et al (2014) in a study on knowledge of diabetes and hypertension among teaching staff of the

TABLE - 4.14 (a)

KNOWLEDGE OF THE COMPLICATION OF DIABETES N(%)

Do you know that diabetes can cause complications in different organs of the body?	Yes (%)	No (%)
Individual with self-reported diabetes	23 (100)	-
Non-diabetic subjects	180 (92.8)	14 (7.2)
Total subjects	203 (93.5)	14 (6.45)

Values in parentheses indicate percentage

TABLE - 4.14 (b)

Complication of Diabetes	Individual with self-reported diabetes (N=23)	Non-diabetic Subjects (N =194)	Total Subjects (N =217)
Eye disease	19 (82.6)	147 (75.8)	166 (76.5)
Heart disease	19 (82.6)	124 (63.9)	143 (65.9)
Foot problem	17 (73.9)	115 (59.3)	132 (60.8)
Kidney disease	20 (87)	134 (69.1)	154 (71)
Hypertension	13 (56.5)	96 (49.5)	1 09 (50.2)
Stroke	10 (43.5)	107 (55.2)	113 (53.9)

Values in parentheses indicate percentage

education institutions in Tanzania reported that knowledge was lacking in teaching staff regarding hypertension, stroke, and heart disease. The results of their study are comparable with the present study results

KNOWLEDGE REGARDING DIABETES PREVENTION

Knowledge regarding diabetes prevention is shown in Table 4.15 (a and b). Around 87% of the subjects were aware of diabetes preventive factors and 9.2% of subjects don't know that diabetes is preventable.

Majority of the subjects in the present study felt that regular physical activity (85.6%) and eating balanced healthy diets (86.1%) could help in preventing the development of diabetes. Disturbingly around 26% of the subjects were not aware that avoiding overweight and obesity could aid in the diabetes prevention. Other preventive factors mentioned by subjects were avoidance of stress, tension, regular rest, mental wellbeing.

Kurian et al (2016) in their study also observed similar kind of results with around 12% of subjects not knowing that diabetes is a preventable condition. Shafaee et al (2008) in their study on diabetes knowledge in the Omani population reported that 78.9% of the study participants perceived that diabetes is preventable and rest were unaware of it.

Active and passive smoking has shown a meaningful association with increased risk of type 2 diabetes but significant risk reduction was seen over time among those who quit smoking (Pan et al, 2015). Majority of the subjects (58.3%) were not aware of the association between smoking and an increased risk of type 2 diabetes.

TABLE - 4.15(a)

KNOWLEDGE REGARDING DIABETES PREVENTION N(%)

Do you know that diabetes can be prevented?	Yes (%)	No(%)	Don't know(%)
Individuals with self-reported diabetes	21 (91.3)	-	
Non-diabetic subjects	167 (86.5)	6 (3.1)	20 (10.4)
Total Subjects	188 (87)	6 (3)	20 (9.2)

Values in parentheses indicate percentage

TABLE - 4.15 (b)

Diabetes Preventive Factors	Individuals with self-reported diabetes (N = 23)	Non-diabetic Subjects (N = 193)	Total Subjects (N = 216)
Regular physical activity	21 (91.3)	164 (85)	185 (85.6)
Eating balanced and healthy diets	20 (87)	166 (86)	186 (86.1)
Avoiding overweight /Obesity	18 (78.3)	142 (73.6)	160 (74)
Quit smoking	8 (34.8)	82 (42.5)	90 (41.7)

Values in parentheses indicate percentage

MEAN KNOWLEDGE SCORE OF DIABETES SYMPTOMS, RISK FACTORS, COMPLICATIONS, PREVENTIVE FACTORS AMONG MALE AND FEMALE SUBJECTS

Table 4.16 shows the mean knowledge of the male and female subjects on diabetes. There was a significant difference in knowledge scores about diabetes among the male and female study subjects. Knowledge across categories such as diabetes symptoms (4.3 vs 3.7;P-value=0.01), risk factor, complication, and preventive factors was found higher in female subjects than the male subjects , (4.2 vs 3.7);p-value=0.004 (5.0 vs 4.3) ;p-value=0.003 ,(4.0 vs 3.3);p-value=0.003 respectively. The mean total diabetes knowledge score among female subjects was 19.5 ± 4.8 whereas among the male subjects the mean knowledge score was 16.8 ± 5.7.

The results of the present study are in line with a study on diabetes knowledge in the Brazilian population. In their study, difference in the knowledge of diabetes was observed among males and females study participants. Knowledge regarding the symptoms of diabetes was found to be on a higher side in females in comparison to male subjects at a p-value < 0.05 (Lemes dos Santos et al, 2014).

Kayyali et al (2019) had also reported in their study that general awareness of the diabetes symptoms was more in females than males at a p-value <0.01. Gillani et al (2018) also observed in a cross-sectional study on general awareness of diabetes that there is a significant difference in awareness regarding symptoms of diabetes across the gender.

TABLE - 4.16

MEAN KNOWLEDGE SCORE OF DIABETES SYMPTOMS, RISK FACTORS, COMPLICATION, PREVENTIVE FACTORS AMONG MALE AND FEMALE SUBJECTS (Mean ± SD)

	Knowledge Score Female (N = 129)	Knowledge Score Male (N = 88)	p-value
Diabetes Symptoms	4.3 ± 1.7	3.7 ± 1.7	0.01*
Diabetes risk factor	4.2 ± 1.7	3.7 ± 1.5	0.004**
Diabetes Complication	5.0 ± 1.7	4.3 ± 2.1	0.003**
Diabetes Prevention	4.0 ± 1.4	3.3 ± 1.7	0.003**
Total knowledge	19.5 ± 4.8	16.8 ± 5.7	0.0004***

*Significantly different from females at $p < 0.05$

** Significantly different from females at $p < 0.01$

*** Significantly different from females at $p < 0.001$

COMPOSITE DIABETES KNOWLEDGE SCORE OF THE SUBJECTS

The mean knowledge score of the teaching faculty of the university was (18.4 ± 5.4). Around 39% of the teaching faculty had obtained good knowledge scores (>80%) whereas 36% received moderate knowledge scores (60-80%) and 25% of the subjects had poor knowledge scores (<60%) regarding diabetes risk factors, complications, symptoms and preventive factors (Figure 4.5). An equal percentage (25%) of the male and female subjects had poor diabetes knowledge. A higher percentage of the male subjects (45%) had a knowledge score in the good (>80%)range as compared to female subjects(34%)as shown in Table 4.17.

About 49.4% of subjects had poor knowledge scores (<40%) whereas 18.2% of the subjects had moderate knowledge scores (40-60%) and 32.5% of the subjects had good knowledge scores (>60%) regarding diabetes in a crossectional study conducted in the Nepalese population (Parajuli et al, 2014).In a study conducted by Srivasneta et al (2019) to assess diabetes knowledge attitude and practice it was found that around 42% of the subjects had good knowledge scores and 58% of the subjects had poor knowledge scores.

MEAN KNOWLEDGE SCORE IN RELATION TO PHYSICAL ACTIVITY

A statistically significant difference was observed in the mean knowledge scores of the physically active versus physically inactive individuals (18.8 vs16.7) at a p-value=0.02 (Table 4.18).

COMPARISON OF KNOWLEDGE SCORE OF PHYSICALLY ACTIVE AND PHYSICALLY INACTIVE INDIVIDUALS N(%)

A higher percentage of physically active individuals (41.8%) had a good knowledge score in comparison to physically inactive individuals(27%). Unaspiringly, poor knowledge scores across the category of physically active

Figure - 4.5

DIABETES KNOWLEDGE SCORES OBTAINED BY SUBJECTS (%)

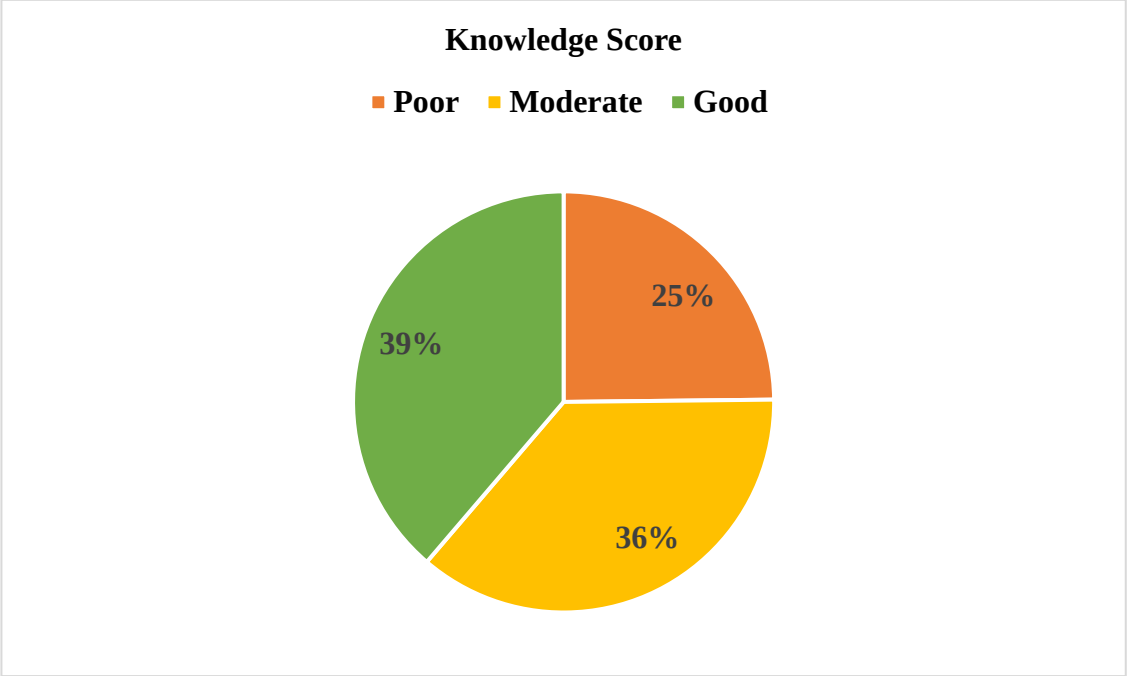


Table - 4.17

COMPOSITE KNOWLEDGE SCORES ON DIABETES N (%)

Knowledge Score	Male Subjects (N=88)	Female Subjects (N=129)	Total Subjects (N= 217)
Poor (< 60%)	22 (25)	32(25)	54 (25)
Moderate (60-80%)	26(30)	53(41)	79 (36)
Good (>80%)	va40(45)	44(34)	84 (39)

Values in parentheses indicate percentage

versus physically inactive individuals were 23.2%, 31% respectively (Table 4.19).

MEAN KNOWLEDGE SCORE FOODS AND NUTRITION FACULTY AND OTHER FACULTY

While comparing knowledge scores of faculty from the Foods and Nutrition department with other faculty members of the university, unsurprisingly the mean score of the Foods and Nutrition faculty members was on the higher side than other faculty members of the university (23.95 vs 17.79) at a p-value=0.000 as illustrated in Table 4.20.

ASSOCIATION OF THE KNOWLEDGE SCORE OF THE STUDY POPULATION WITH SOCIO-DEMOGRAPHIC VARIABLES AND DIABETES RISK FACTORS

As shown in (Table 4.21) no significant difference in knowledge on diabetes across the age group and academic qualification was observed. Mean knowledge score differed significantly in relation to family history of diabetes. Those without a family history of diabetes had significantly lower scores as compared to those who had a first-degree diabetic relative($p<0.05$) and those who had a second-degree diabetic relative ($p<0.01$).

Kurian et al (2016) in their study reported that mean knowledge on diabetes in subjects with a family history of diabetes was on a higher side. Aljin et al (2018) had also reported in their study that knowledge on diabetes among the subjects with a family history of diabetes was on the higher side with a ($p< 0.01$).

We observed that knowledge on diabetes varies across the categories of BMI. Overweight subjects had significantly lower scores as compared to obese subjects ($p<0.01$).

Table - 4.18

MEAN KNOWLEDGE SCORES IN RELATION TO PHYSICAL ACTIVITY (Mean ± SD)

	Knowledge Score ±SD	p-value
Physically inactive individuals (N =172)	16.7 ± 5.67	0.02*
Physically active individuals (N = 45)	18.83 ± 5.2	

*Significantly different from physically active individuals at $p<0.05$

Table - 4.19

COMPARISON OF KNOWLEDGE SCORES OF PHYSICALLY ACTIVE AND PHYSICALLY INACTIVE INDIVIDUALS N(%)

	Poor knowledge score	Moderate knowledge score	Good knowledge score
Physically active individuals (N = 172)	40 (23)	60 (35)	72 (42)
Physically inactive individuals (N = 45)	14 (31)	19 (42)	12 (27)

Values in parentheses indicate percentage

Table - 4.20

MEAN KNOWLEDGE SCORES OF FOODS AND NUTRITION FACULTY AND OTHER FACULTY (Mean ± SD)

	Knowledge Score	p-value
Knowledge Scores of faculty from the Department of Foods and Nutrition (N = 21)	23.95 ± 1.73	0.000***
Knowledge Scores of Other Faculty members (N = 196)	17.79 ± 5.3	

***Significantly different from Foods and Nutrition Faculty at $p<0.001$

TABLE - 4.21

ASSOCIATION OF KNOWLEDGE SCORE OF STUDY POPULATION WITH SOCIODEMOGRAPHIC VARIABLE AND DIABETES RISK FACTORS

Variable	Knowledge Scores (Mean ± SD)	f -value (p-value)
Socio-Demographic Variables		
Age Group		
21- 30 Years	16.5 ± 5.9	1.62 (0.16)
31-40 Years	19.2 ± 4.8	
41- 50 Years	18.4 ± 5.57	
51 – 60 Years	18.8 ± 5.06	
>60 Years	17.8 ± 6.2	
Education		
Post Graduate	18.8 ± 5.6	-0.007 (0.9)
PhD	18.8 ± 5.26	
Diabetes Risk Factors		
Family History of Diabetes		
No family history of Diabetes	17.4 ± 5.9	9.4 (0.0001***)
First Degree Relative	19.2 ± 4.75	
Second Degree Relative	21.9 ± 4.8	
BMI		
BMI < 18.5	17.3 ± 3.5	3.52 (0.01*)
BMI 18.5 ≤ 22.9	18.3 ± 5.32	
BMI ≥ 23 <25	15.9 ± 6.72	
BMI ≥25	19.2 ± 4.79	

*Statistically significant at $p < 0.05$

***Statistically significant at $p<0.001$

SECTION – 3
Diabetes risk assessment in the teaching staff of The Maharaja Sayajirao University of Baroda.

TYPE 2 DIABETES RISK IN NON-DIABETIC SUBJECTS

Diabetes is a non-communicable disease with a high prevalence rate across nations. There is a dire need to assess diabetes risk with non-invasive methods in the general population to lessen the disability-adjusted life years and to prevent the incidence of diabetes in the non-diabetic individuals with the assistance of lifestyle interventions in case of existence of modifiable risk factors such as abdominal obesity, unhealthy eating patterns, and sedentary lifestyle. To assess the diabetes risk various diabetes scores have been developed such as the IDF Diabetes risk score. IDF diabetes risk score was developed to assess diabetes risk in a non-diabetic high-risk population. This score can assess individual type 2 diabetes risk in the next 10 years. This score had shown high validity and reliability. This score classifies individuals at diabetes risk in five categories such as low risk (< 7), slightly elevated risk (7- 11), moderate risk (12- 14), high risk (15- 20), very high risk > 20. A risk score less than 7 means 1 in 100 will develop diabetes. A risk score between 7 and 14 means 1 in 25 will develop diabetes. The risk score of 12- 14 means that 1 in 6 will develop diabetes and the risk score of 15- 20 means that 1 in 3 will develop diabetes (Alberti et al, 2007).Those scoring in the moderate risk category are recommended to modify their lifestyles such as engaging in regular physical activity, eating a balanced and healthy diet, and consulting a medical professional for further tests and treatments. Those having scored in the high-risk and very high-risk category are recommended to undergo tests such as fasting plasma glucose levels and 2 hrs postprandial glucose level and to follow the advice of their consulting physician. In our study, we assessed diabetes risk using the modified IDF diabetes risk score among the nondiabetic subjects. Only 32% of subjects in the present study fell in the low-risk category (Table 4.22). None of the subjects were in a very high-risk category. Disturbingly around 50% of the male subjects

TABLE- 4.22

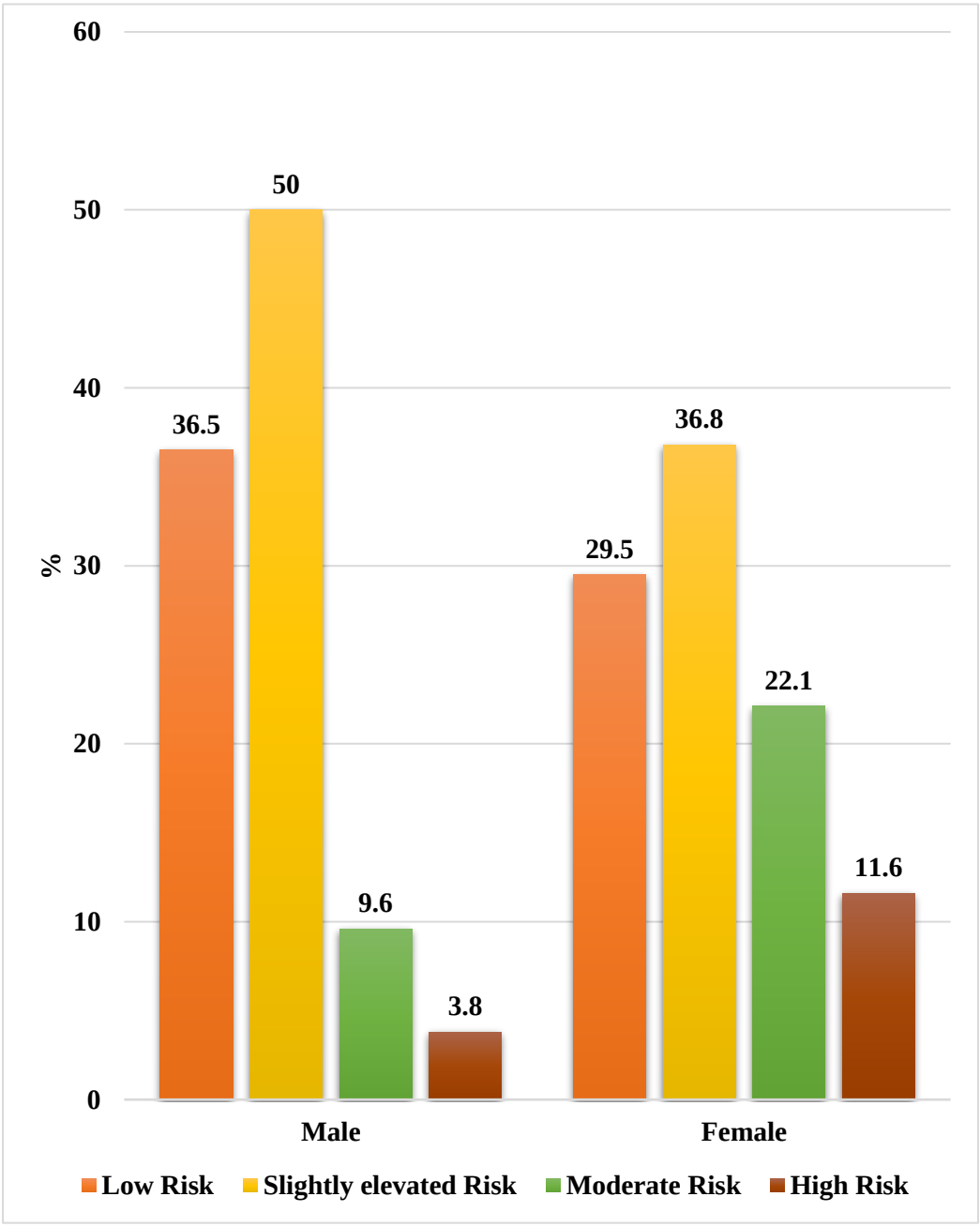
TYPE 2 DIABETES RISK IN NON-DIABETIC SUBJECTS
N (%)

Categories	Cut-offs	Male (N = 52)	Female (N = 95)	Total (N = 147)
Low risk	**Lower than7**	19 (36.5)	28 (29.5)	47 (32)
Slightly elevated risk	**7-11**	26 (50)	35 (36.8)	61(41.4)
Moderate risk	**12-14**	5 (9.6)	21 (22.1)	26 (17.7)
High risk	**15-20**	2 (3.8)	11(11.6)	13 (8.8)
Very high risk	**> 20**			

Values in parentheses indicate percentage

FIGURE – 4.6

SEX WISE PREVALENCE OF DIABETES RISK IN NON - DIABETIC SUBJECTS N (%)



were in the slightly elevated risk category. Roughly one-third (33.7%) of the female subjects in the moderate and high-risk categories.

Study by Dasaraju et al (2020) had reported that only 22.6% of the subjects fell in the low-risk category, 52% were in the moderate risk category and around 24.2% of the subjects fall in a high-risk category. Vijayakarthikeyan et al (2020) found that among the study participants around 42.7% were at moderate risk, 29% were at high risk of developing diabetes and around 28.3% of the subjects were at low risk of developing diabetes.

SOCIODEMOGRAPHIC AND DIABETES RISK FACTORS ACROSS CATEGORIES OF ACTUAL DIABETES RISK AMONG THE STUDY PARTICIPANTS WITHOUT DIAGNOSED DIABETES

As shown in Table 4.23 diabetes risk scores were found to vary significantly across the categories of BMI ($p=0.000$), across age group ($p=0.04$), and with a family history of diabetes($p< 0.001$). Unsurprisingly among most of the subjects in high risk, moderate risk, slightly elevated risk categories BMI was found to be greater than 23 Kg/m^2 (p-value=0.000) (Table 4.24).

So, as per our study results, it can be stated that an upsurge in BMI, age, presence of the family history of diabetes intensifies the risk of diabetes in non-diabetic subjects.

The results of our study are in line with the results of a study by Dasaraju et al (2020) for diabetes risk assessment in the Muttanallur village, Bangalore. They had also described in their study findings that diabetes risk varies across the categories of BMI, across the age group, and with a family history of diabetes at a p-value < 0.001.

TABLE - 4.23

SOCIODEMOGRAPHIC AND DIABETES RISK FACTORS ACROSS CATEGORIES OF ACTUAL DIABETES RISK AMONG THE STUDY PARTICIPANTS WITHOUT DIAGNOSED DIABETES N(%)

	Total	Categories of Actual Diabetes Risk (IDF Risk Score)				
		Low Risk (<7)	Slightly Elevated Risk (7-11)	Moderate Risk (12-14)	High Risk (15-20)	$\chi 2$
Socio-Demographic Factors						
Gender (N =147)						
Male	52	19(36.5)	26 (50)	5 (9.6)	2 (3.8)	7.16 (0.06)
Female	95	28(29.4)	35 (36.8)	21(22.1)	11(11.5)	
Age Group (N= 146)						
21- 30	33	16(48.4)	12 (36.3)	5 (15.1)		25.27 (0.04)*
31- 40	42	19 (45.2)	10 (23.8)	8 (19)	5 (11.9)	
41-50	32	5 (15.6)	19 (59.3)	5 (15.6)	3 (9.3)	
51-60	31	4 (12.9)	15 (48.3)	7 (22.5)	5 (16.1)	
>60	8	2 (25)	5 (63)	1 (12)		
Diabetes Risk Factors						
Family History of Diabetes (N = 147)						
No family history	68	34 (50)	28 (41)	5 (7)	1(2)	38.52 (0.000)***
First Degree Relative	56	6 (10.7)	21 (37.5)	19 (33.9)	10(17.8)	
Second Degree Relative	23	7 (30.4)	12 (52.1)	2 (8.7)	2 (8.7)	
Hypertensive	24	4 (16.7)	9 (37.5)	7 (29.2)	4 (16.7)	6.28 (0.09)
Non-Hypertensive	122	43 (35.2)	51(41.8)	19(15.6)	9(7.4)	
Physically inactive individuals	28	5 (17.8)	13 (46.4)	6 (21.4)	4 (14.2)	4.75 (0.28)
Physically active individuals	119	42 (35.2)	48 (40.3)	20 (16.8)	9 (7.5)	
BMI (N = 147)						
BMI < 18.5	5	5 (100)				52.98 (0.000)***
BMI 18 ≤ 22.9	36	24(66.7)	10 (27.8)	1 (2.7)	1(2.7)	
BMI ≥23<25	32	10 (31.3)	17 (53.1)	3 (9.4)	2 (6.3)	
BMI ≥25	74	8 (10.8)	34(45.9)	22 (29.7)	10(13.5)	

*Significantly different from females at $p < 0.05$

*** Significantly different from females at $p < 0.001$

TABLE - 4.24

AVERAGE BMI ACROSS THE CATEGORIES OF DIABETES RISK (Mean ± SD)

Diabetes risk category (N = 147)	Average BMI	p-value
Low risk (N = 61)	23 ± 3.1	0.000***
Slightly elevated risk (N = 57)	26.1 ± 3.2	
Moderate risk (N = 21)	30.82 ± 4.2	
High risk (N = 8)	26.63 ± 2.62	

***Statistically significant at p<0.001

Similar results were also observed by Heidemann et al (2019) for some of the variables such as the family history of diabetes, BMI, and age. Results of the present study were also in line with a study by George et al (2020). They had also described in their study findings that diabetes risk varies across the age group, with a family history of diabetes and across the categories of BMI at a p-value<0.05.

ASSOCIATION OF DIABETES RISK SCORE WITH BMI and WC

A significant association was observed between BMI, waist circumference, and risk of diabetes at a p-value=0.001(Table 4.25).

Present study results are in line with a study by Hu et al (2015). They had also reported an association between BMI and diabetes risk (p-value=0.0004). Patil and Gothankar(2016) had found that high waist circumference act as a risk factor for diabetes at a (p-value <0.001).

Feller et al (2010) conducted a study to assess the association between BMI, waist circumference, and risk of diabetes. A significant association was reported between the BMI, waist circumference, and the risk of diabetes similar to the present study results (p-value<0.0001). Waist circumference and BMI was found to be associated with diabetes independently (Qiao and Nyamdroj, 2010).

A study conducted in Helsinki, Finland in middle-aged men to assess is waist circumference is an indicator for the risk of diabetes and cardiovascular diseases during a lifetime in an individual. They found that a waist circumference >94 cm increases the risk of diabetes in middle-aged men with a sensitivity and specificity of 84.2%, 78.2% respectively (Siren et al, 2012).

TABLE - 4.25

ASSOCIATION OF DIABETES RISK SCORE WITH BMI and WC

	r	p-value
BMI (N = 147)	0.5	0.001**
WC (N = 146)	0.5	0.001**

**Statistically significant at $p<0.01$

SECTION – 4

Diabetes risk perception in the teaching staff of The Maharaja Sayajirao University of Baroda.

DIABETES RISK PERCEPTION AMONG NON-DIABETIC SUBJECTS

The rising burden of lifestyle-related disorders is a serious public health problem in the existing scenario. With time due to the amplified burden of lifestyle-related diseases that are avoidable, treatment protocols have shifted from the treatment of disease to the prevention of its occurrence by following healthy lifestyle behaviors such as eating a balanced diet and engaging in regular physical activity. Individual's engagement in disease preventive actions depends on their perception for disease susceptibility, perception of disease severity, benefits of taking preventive action, perceived barriers, cue to action on exposure to a specific risk factor, individuals' self-efficacy as per "Health Belief Model" (Orji et al 2012).

To develop an effective disease risk communication tool there is a dire need to understand how individuals perceive the risk to have a particular disease or ailment (Claassen et al, 2011). So, to assess the diabetic risk perception questions regarding diabetes risk perception were asked in the survey questionnaire that was designed to assess the diabetes knowledge, diabetes risk perception, and diabetes risk assessment in the teaching staff of the university.

All the non-diabetic subjects who responded to the diabetes risk perception questions in the questionnaire were included in the diabetes risk perception analysis. Based on lifestyle habits such as diet and, exercise, 29.4% subjects perceived that they were at low risk , 25.7% subjects perceived that they were at moderate risk, 20.6% perceived that they were at no risk, and around 5.15% subjects perceived themselves to be at a very high risk to develop diabetes in

TABLE - 4.26

DIABETES RISK PERCEPTION AMONG NON-DIABETIC SUBJECTS N(%)

Based on your lifestyle habits such as diet and exercise, do you think you are at risk of developing diabetes in the next 10 years?			
	Male (N = 75)	**Female (N = 119)**	**Total (N = 194)**
Very high risk	2 (2.6)	8 (6.7)	10 (5.15)
Moderate risk	14 (18.6)	36 (30.2)	50 (25.7)
Low risk	22 (29.3)	35 (29.4)	57 (29.4)
No risk	21 (28)	19 (15.9)	40 (20.6)
Not sure	16 (21.3)	21 (17.6)	37 (19.07)
Based on your lifestyle habits such as diet and exercise, do you think you are at risk of developing type 2 diabetes in your lifetime?			
	Male N (%) (N = 75)	**Female N (%) (N = 119)**	**Total N (%) (N = 194)**
Very high risk	3 (4)	9 (7.5)	12 (6.1)
Moderate risk	18 (24)	41 (34.4)	59 (30.4)
Low risk	22 (29.3)	28 (23.5)	50 (25.7)
No risk	12 (16)	21 (17.6)	33 (17.01)
Not sure/ Don't Know	20 (26.6)	20 (16.8)	40 (20.6)
Based on your family history, do you think you are at risk of developing type 2 diabetes in your lifetime?			
	Male N (%) (N = 75)	**Female N (%) (N = 119)**	**Total N (%) (N = 194)**
Very high risk	7 (9.3)	11 (9.24)	18 (9.27)
Moderate risk	18 (24)	37 (31.0)	55 (28.3)
Low risk	17 (22.6)	25 (21.0)	42 (21.6)
No risk	19 (25.3)	35 (29.4)	54 (27.8)
Not sure/ Don't Know	14 (18.6)	11 (9.24)	25 (12.8)

the next 10 years (Table 4.26). Alarmingly 50% of the subjects believed themselves to be at 'no to low risk' of developing diabetes. The risk perception to have diabetes based on lifestyle habits was observed to be more in females than males in the next 10 years in both the very high-risk perception category(6.7% vs 2.6%) and moderate risk perception (30.2% vs 18.6%) category. About 19.07% of the subjects were not sure whether they were at risk of developing diabetes.

Based on lifestyle habits such as diet and, exercise, 25.7% subjects perceived that they were at low risk, 30.4% subjects perceived that they were at moderate risk, 17% perceived that they were at no risk, and around 6.1% subjects perceived themselves to be at a very high risk to develop diabetes in the lifetime (Table 4.26). Alarmingly 43% of the subjects believed themselves to be at 'no to low risk' of developing diabetes. The risk perception to have diabetes based on lifestyle habits was observed to be more in females than males in the lifetime in both the very high-risk perception (7.5% vs 4%) and moderate risk perception (34.4% vs 24%) category and one-fifth of the subjects were not sure whether they were at risk of developing diabetes.

Based on family history of diabetes,21.6% subjects perceived that they were at low risk, 28.3% subjects perceived that they were at moderate risk, 27.8% perceived that they were at no risk, and around 9.27% subjects perceived themselves to be at a very high risk to develop diabetes in the lifetime (Table 2.26). Alarmingly 49.4% of the subjects believed themselves to be at 'no to low risk' of developing diabetes. There was not much difference in diabetes risk perception between males and females. Surprisingly,12.8% of the subjects were not sure of their diabetes risk.

In response to the question about whether the subjects were worried about developing type 2 diabetes in their lifetime. Around 46.3% of the subjects reported that they were slightly worried, about 45.7% of the subjects reported that they were not worried at all. Only 7.8% of the subjects reported that they

Are you worried about developing type 2 diabetes in your lifetime?			
	Male N (N =71)	**Female N (N = 119)**	**Total N (N = 190)**
Very worried	3 (4.2)	12 (10.08)	15 (7.8)
Slightly worried	28 (39.4)	60 (50.4)	88 (46.3)
Not worried	40 (56.3)	47 (39.4)	87 (45.7)
Do you plan to make any changes in your lifestyle habits such as diet and exercise in the near future that you think will decrease your risk of getting type 2 diabetes?			
	Male (N = 73)	**Female (N = 119)**	**Total N (N = 192)**
Yes	58 (79.4)	103 (86.5)	161 (83.8)
No	15 (20.54)	16 (13.4)	31 (16.1)
If yes, I which?	**Male (N = 73)**	**Female (N = 104)**	**Total (N = 177)**
Diet	5 (8.4)	5 (4.8)	10 (6.1)
Exercise	6 (10.1)	9 (8.6)	15 (9.2)
Both	48 (81.3)	90 (86.5)	138 (84.6)

were very worried about developing diabetes. When subjects were asked if they were ready to make changes in their lifestyle habits to decrease their risk of developing type 2 DM, about (83.8%) of the subjects replied in the affirmative and were ready to make changes in their lifestyle to reduce the risk of the occurrence of diabetes. Among them, the majority of the subjects (84.6%) were planning to make changes in their dietary habits and physical activity pattern.

KNOWLEDGE OF DIABETES ACROSS THE CATEGORIES OF DIABETES RISK PERCEPTION FOR THE NEXT 10 YEARS

Table 4.27 shows the knowledge level of the subjects across the categories of diabetes risk. No significant difference was observed in knowledge scores of the subjects across the categories of diabetes risk perception. The total knowledge scores in very high risk, moderate risk, low risk, no risk perception categories were 16.9 ± 6.64, 17.2 ± 2.43, 17.3 ± 4.9,16.4 ± 4.3 respectively.

PERCEIVED DIABETES RISK ACROSS THE CATEGORIES OF ACTUAL DIABETES RISK IN NEXT 10 YEARS

In the present study, approximately 46% of the subjects in the high-risk category perceived themselves to be at 'no to low' risk of developing diabetes. In the moderate risk category majority of the subjects (69%) perceived themselves to be at moderate risk of developing diabetes. It is disturbing to know that around 68% of the subjects in the slightly elevated risk category had no to low perceived risk of having diabetes. Only 15% of the subjects in high risk category perceived themselves to be at a high risk of developing diabetes as given in Figure 4.7.

In a study by Heidemann et al (2019) in the low actual risk category around 41.2% of the subjects perceived themselves to be at slight risk to have diabetes and about 47.8% of the subjects had no risk perception to have diabetes and around 41% of the subjects in the slightly low actual risk category had slight perceived risk to develop diabetes similar to the present study.

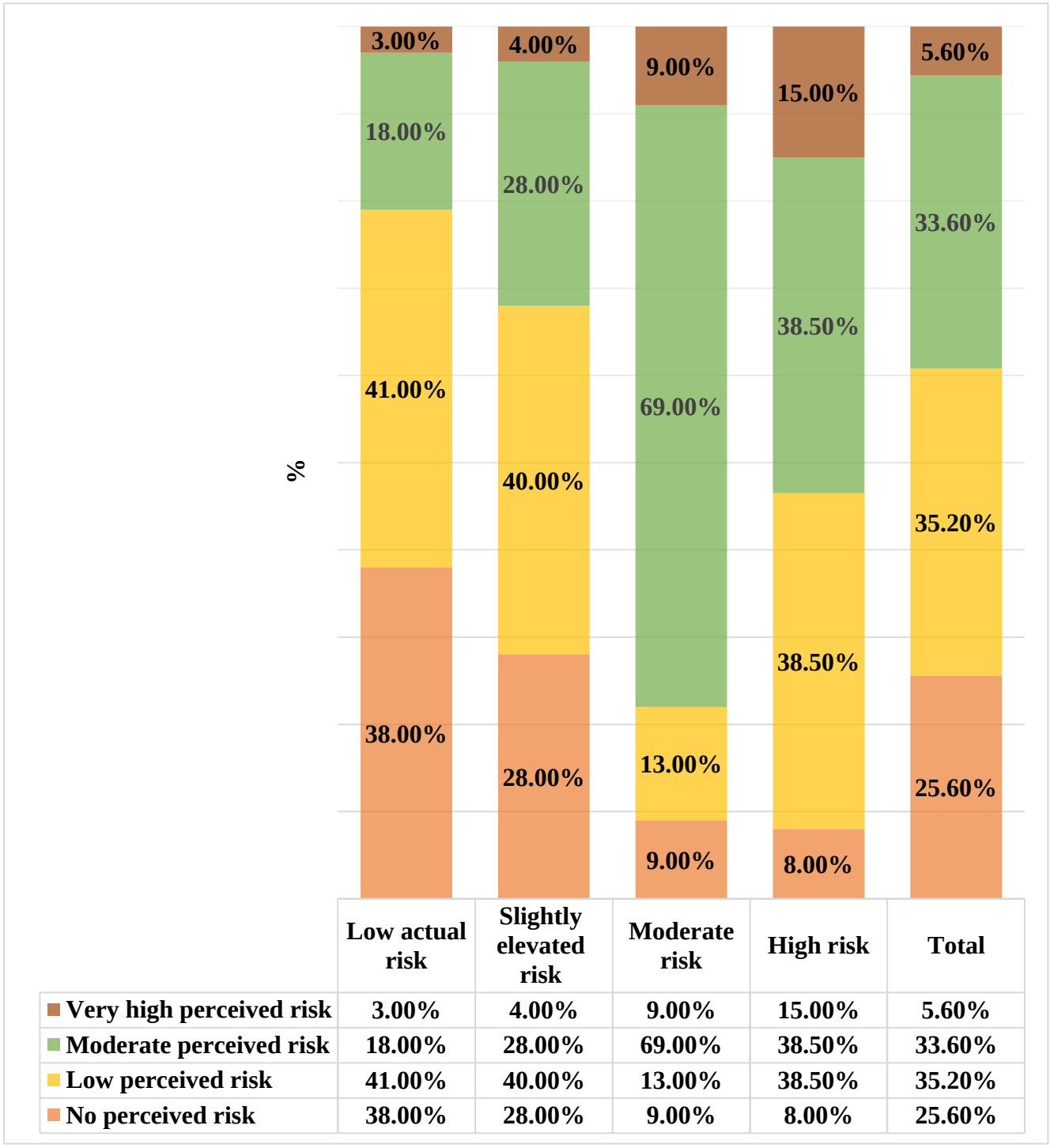
TABLE - 4.27

KNOWLEDGE OF DIABETES ACROSS THE CATEGORIES OF DIABETES RISK PERCEPTION FOR NEXT 10 YEARS (Mean ± SD)

Diabetes Knowledge	Very High Risk (N =10)	Moderate Risk (N = 50)	Low Risk (N = 57)	No-Risk (N = 40)
Symptoms	4.4 ±1.35	4.24 ± 1.56	4.36 ± 1.59	3.85 ± 1.62
Complications	4.6 ± 2.5	5 ± 1.64	4.98 ± 1.73	4.67 ± 1.69
Risk Factors	4 ± 1.54	4.22 ± 1.18	4.15 ± 1.23	3.9 ± 1.33
Preventive Factors	3.9 ± 1.57	3.76 ± 1.56	3.87 ± 1.42	3.97 ± 1.17
Total Knowledge Score	16.9 ± 6.64	17.2 ± 2.43	17.3 ± 4.9	16.4 ± 4.33

FIGURE - 4.7

PERCEIVED DIABETES RISK ACROSS THE CATEGORIES OF ACTUAL DIABETES RISK IN NEXT 10 YEARS



	Low actual risk	Slightly elevated risk	Moderate risk	High risk	Total
Very high perceived risk	3.00%	4.00%	9.00%	15.00%	5.60%
Moderate perceived risk	18.00%	28.00%	69.00%	38.50%	33.60%
Low perceived risk	41.00%	40.00%	13.00%	38.50%	35.20%
No perceived risk	38.00%	28.00%	9.00%	8.00%	25.60%

COMPARISON BETWEEN THE PARTICIPANTS WITH NO TO LOW DIABETES RISK PERCEPTION VERSUS MODERATE AND HIGHER DIABETES RISK PERCEPTION

In the study results, a meaningful difference in the perceived risk for diabetes was observed with a family history of diabetes at a p-value=0.0001 and with gender at a p-value=0.02 as shown in Table 4.28.

The results of our study are in line with the study by Joiner et al (2016). They had reported in their study that, a significant difference was observed in diabetes perceived risk with a family history of diabetes at p-value<0.007.

Vormanen et al (2016) had found in their study that there is an association between family history of diabetes and perceived risk of diabetes at p-value<0.0001.

In a study by Goetsch et al (1997), it was reported that subjects with a family history of diabetes perceived themselves at a higher risk to have diabetes in comparison to their counterparts (p-value<0.001).

Even in a study in the UK on diabetic risk perception, it was reported that around 37.9% of the siblings of diabetic patients perceived themselves to have diabetes, and having a family history of diabetes in the parents was found to be strongly associated with high-risk perception to have diabetes at a p-value <0.000001 Farmer et al (1999). Reyes et al (2015) also reported in their study results that in subjects with a family history of diabetes. Most of the subjects perceived themselves to have a moderate or high risk of diabetes in comparison to their counterparts.

A statistically significant difference in type 2 diabetes risk perception across the gender was observed at a p-value<0.05 in line with present study results from a study conducted among overweight and obese college students to assess their diabetes risk perception (Amuta et al, 2016).

TABLE - 4.28

COMPARISON BETWEEN THE PARTICIPANTS WITH NO TO LOW DIABETES RISK PERCEPTION VERSUS MODERATE AND HIGHER DIABETES RISK PERCEPTION

Variable	Perception of no and low risk for diabetes	Perception of the moderate and high risk for diabetes	$\chi 2$
Age Group			
21 -30 (N = 32)	19(59)	13(41)	0.194 (0.6)
30-40 (N = 46)	25(54)	21(46)	
40-50(N = 36)	21(58)	15(42)	
50-60 (N = 34)	23(68)	11(32)	
>60 (N = 6_)	6(100)	-	
Gender			
Male (N = 59)	43(73)	16(27)	4.93 (0.02)*
Female (N = 98)	54(55)	44(45)	
Diabetes Family History			
Family history of diabetes (N = 90)	44(49)	46(51)	14.38 (0.0001)***
No Family history of diabetes (N = 66)	52(79)	14(21)	
BMI			
< 18.5 (N = 4)	3 (75)	1(25)	0.05 (0.8)
18.5 <=22.9(N = 36)	25(69.4)	11(30.5)	
>=23 <25 (N = 33)	14(42.4)	19 (57.5)	
>25 (N = 89)	49 (55)	40 (44.9)	
Diabetes Knowledge			
Poor (N = 36)	24 (66.6)	12(33.3)	0.22 (0.6)
Moderate(N = 55)	34(61.8)	21(38.1)	
Good (N =65)	39(60)	26(40)	

*Statistically significant $p<0.05$

***Statistically significant $p<0.001$

In our study group, only 21% of the subjects without a family history of diabetes perceived themselves to have a high or moderate risk to have diabetes. The study results are comparable with a study by Adriaanse et al (2003) to assess the risk perception of diabetes in the general population of the Netherland, about 20% of the subjects without a family history of diabetes perceived themselves to have diabetes risk.

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

In today's era, lifestyle-related syndromes have turned out to be a main community health problem and diabetes is one among them. The overwhelming burden of diabetes is escalating steeply in developing nations. It is disturbing to know that majority of diabetes cases around 80% are from developing nations (IDF 2011). The situation is also not so good in India. According to the findings of the ICMR-INDIAB study about 62.4 million individuals were anticipated to be diabetic, and they had projected that diabetes cases will surge to 101.2 million by 2030 (Deepa et al 2014).

Numerous investigations have also revealed that educating the population about diabetes and its consequences may aid to control the spike in cases of diabetes and support in reducing the complication associated with uncontrolled diabetes by increasing awareness about this ailment (Visser et al 2004, Rani et al, 2008).

So, the present study was designed to assess diabetes knowledge, diabetes risk perception, and diabetes risk in the teaching staff of the university.

The objectives of the study were as follows-

- To assess the knowledge about diabetes in the teaching staff of the university.
- To assess the diabetes risk in the teaching staff of the university.
- To assess the risk perception of developing diabetes in the teaching staff of the university.
- To assess the relationship between diabetes knowledge and the perceived risk of developing diabetes in the teaching staff of the university

- To assess the association between the estimated risk of developing diabetes and the perceived risk of developing diabetes.

The results of the survey are discussed in the following sections-

- Socio-demographic information, anthropometric data and body weight perception, medical and family history, physical activity pattern, and dietary pattern of the subjects.

- Knowledge about diabetes among the teaching staff of The Maharaja Sayajirao University of Baroda.

- Diabetes risk assessment in the teaching staff of The Maharaja Sayajirao University of Baroda.

- Diabetes risk perception in the teaching staff of The Maharaja Sayajirao University of Baroda.

SECTION – 1

Socio-demographic information, anthropometric data, body weight perception, medical and family history, physical activity pattern, and dietary pattern of the subjects.

OBSERVATIONS

Background information of subjects

- The mean age of the subjects was 42.7 ± 11.5 and most of them were from the age group of 25 to 60 years. Around 41% of subjects were males and 59% of the subjects were females.
- About 59% of the subjects had a doctorate degree and 40% of the subjects were postgraduates.
- Majority (61%) of the participants were from nuclear families.

Anthropometric profile of the subjects

- Overweight or obesity (74%) were quite widespread in the study population. Based on the Asia Pacific Classification the prevalence of overweight and obesity was 74% and 64.3% in females and males respectively. Abdominal obesity was also quite common, around 48% in males and 81.1% in females.
- The mean BMI, waist-hip ratio, waist stature ratio amongst the subject were 26.1± 4.3, 0.9 ± 0.1, and 0.5 ± 0.1 respectively.

Perception of bodyweight

- Perception of underweight, normal weight, overweight, obesity among the subjects was 2.8%, 44.2%, 41.9%, 11.2% respectively.

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Medical history of subjects

- The prevalence of hypertension, diabetes, and dyslipidaemia in the study population was around 18.9%,10.6%, and 4.1% respectively.
- Other medical conditions reported by the subjects were hypothyroidism, hypotension, hyperuricemia, anxiety, chronic acidity, asthma, IGA neuropathy respectively.

Family history of diabetes

- Around 17.3% of subjects had a family history of diabetes in second-degree relative, 40.7% of the subjects had a family history of diabetes in the first-degree relative and about 42% of subjects reported no family history of diabetes.

Physical activity pattern of subjects

- Nearly 21% of the subjects reported not engaging in least 30 minutes of daily physical activity at work and/or during leisure time.

Dietary pattern and mean nutrient intake of subjects

- Around 18.43% of the subjects were not incorporating fruits, vegetables, and berries in their daily diets.
- Overall high fat intake of 55.7 ± 25.3 was observed amongst the study participants. The percentage of energy from fat in males and females diet was 229.2%, 264.5% respectively. That is more than double of estimated energy requirements.

CONCLUSION

- A high prevalence of overweight and obesity was observed in the study subjects. The prevalence of abdominal obesity which is a risk factor for diabetes and other chronic diseases was also found to be high among the study population.
- Average fat intake of the subject was more than twice of estimated average requirements.

SECTION – 2

Knowledge About Diabetes Among the Teaching Staff of The Maharaja Sayajirao University of Baroda.

OBSERVATIONS

General awareness on diabetes

- Almost 99% of the subjects had awareness of what diabetes is and around 92% of the subjects were aware about how diabetes is detected.

Knowledge of the risk factors, symptoms, complications, and diabetes preventive factors among the subjects

- Almost 92.1%, 84.8%, 83.8%, and 76.9% respectively subjects were aware of family history of diabetes, unhealthy diet, obesity, and not being physically active are risk factors for diabetes. But, there is a lack of awareness regarding older age (27.6%) and hypertension (35.4%) being a risk factor for diabetes.

- Among the study participants, 54.8% of subjects had awareness regarding increased hunger as a symptom of diabetes followed by increased thirst (58%), fatigue (59.9%), blurred vision (64.5%), slow healing of wounds (82%), and frequent urination (83.4%).

- Only around 50% of the subjects were aware that hypertension(50.2%) and stroke(53.9%) were complications related to diabetes.

- Approximately 9.2% of the subjects were unaware that diabetes is preventable and almost 58.3% of subjects were not aware that smoking is a preventable risk factor for diabetes.

Mean knowledge scores of male and female subjects

- Mean knowledge score of the female subjects was higher than male subjects regarding knowledge on diabetes symptoms (p-value=0.01), diabetes risk

  factors (p-value=0.004), diabetes complication (p-value=0.003), diabetes preventive factors (p-value=0.003). A statistically noteworthy difference was also observed in the overall knowledge scores of females subjects in comparison to males (p-value=0.0004).

Composite knowledge scores on diabetes

- Around 39% of the subjects obtained good knowledge scores (>80%) whereas 36% received moderate knowledge scores (60-80%) and 25% of participants had poor knowledge scores (<60%).
- A higher percentage of the male subjects (45%) had a good knowledge score than the female subjects (34%). An equal percentage (25%) of male and female subjects had poor knowledge scores on diabetes.

Knowledge of diabetes in physically active and physically inactive individuals

- Physically active individuals had significantly higher knowledge scores as compared to physically inactive individuals(p=0.02).
- A higher percentage of physically active individuals (41.8%) had a good knowledge score in comparison to physically inactive individuals(27%). Unsurprisingly, poor knowledge scores across the category of physically active versus physically inactive individuals were 23.2%, 31% respectively .

Association of the knowledge score of the study population with socio-demographic variables and diabetes risk factors

- Mean knowledge score were found to differ significantly across BMI (P=0.01) and family history of diabetes (p=0.0001).

CONCLUSION

- Though most of the study participants were aware about what diabetes is and how diabetes is measured but awareness about risk factors, symptoms, preventive factors, and sequelae of diabetes such as hypertension, stroke, foot problems, heart disease was deficient. Knowledge of diabetes was found to be higher in females and in physically active subjects.

SECTION – 3

Diabetes Risk Assessment in the teaching Staff of The Maharaja Sayajirao University of Baroda.

OBSERVATIONS

Type 2 diabetes risk in non-diabetic subjects

- Around 8.8% of the subjects were in the high-risk category, 17.7% in the moderate risk category, 41.4 % in the slightly elevated risk category, and 32% in the low-risk category. Alarmingly around 50% of the male subjects were in the slightly elevated risk category and approximately one-third (33.7%) of the female subjects were in the moderate and high-risk categories.

- Among the subjects, diabetes risk varied across the age group at a p-value=0.04, across the categories of BMI at a p-value = 0.000, and with a family history of diabetes at a p-value=0.000.
- A significant association was observed between the BMI and waist circumference and diabetes risk score at a p=0.001.

- Average BMI across the categories of diabetes risk such as slightly elevated risk, moderate risk and high risk was > 23 kg/ m^2 at a p-value =0.000.

CONCLUSION

- Most of the subjects were in the moderate risk and slightly elevated risk categories and approximately one-third of the subjects were in the low-risk category.
- A significant association was observed between age group, BMI, family history of diabetes, and risk of diabetes.

SECTION -4

Diabetes risk perception in the teaching staff of The Maharaja Sayajirao University of Baroda

OBSERVATIONS

Diabetes risk perception among non-diabetic subjects

- Alarmingly 50% of the subjects perceived themselves to be at 'no to low risk' of developing diabetes based on lifestyle habits and family history of diabetes.
- Based on lifestyle habits such as diet and exercise very high diabetes risk perception in next 10 years (5.15%) and in a lifetime (6.1%) .

- Based on family history of diabetes around 9.27% of the subjects had very high diabetes risk perception in lifetime.
- Only 7.8% of the subjects reported that they were very worried about developing diabetes in lifetime.
- Around 56.3% of males and 39.4% of the females reported that they were not worried to develop diabetes in a lifetime.

Knowledge of diabetes across the categories of diabetes risk perception for the next 10 years

- Diabetes knowledge score in the very high risk, moderate risk, low risk, and no risk perception categories were 16.9 ± 6.64, 17.2 ± 2.43, 17.3 ± 4.9, 16.4 ± 4.33 respectively.
- Diabetes knowledge did not vary significantly across the diabetes risk perception categories.

Perceived diabetes risk across the categories of actual diabetes risk

- Approximately 46% of the subjects in the high-risk category perceived themselves to be at 'no to low' risk of developing diabetes. In the moderate risk category majority of the subjects (69%) perceived themselves to be at moderate risk of developing diabetes.
- Around 68% of the subjects in the slightly elevated risk category had no to low perceived risk of having diabetes.
- Only 15% of the subjects in high-risk category perceived themselves to be at a high risk of developing diabetes**.**

Comparison between the participants with no to low diabetes risk perception versus moderate and higher diabetes risk perception

- In the present study results, a meaningful difference in the perceived risk for diabetes was observed with a family history of diabetes (p= 0.0001)and with gender at a (p=0.02).

CONCLUSION

- Alarmingly 50% of the subjects perceived themselves to be at no to low risk of developing diabetes in 10 next years based on their lifestyle and family history of diabetes.
- Not a significant difference in diabetes risk perception was observed across the categories for diabetes knowledge.
- Approximately 46% of the subjects in high risk category perceived themselves to be at 'low to no risk' of developing diabetes and only 15% of the subjects in the high risk category perceived themselves to be at high risk of developing diabetes.

RECOMMENDATIONS

- Community awareness plays a key role in curbing diabetes and its complications. There is a need to improve diabetes knowledge and create awareness both among the general population as well as diabetic subjects in order to prevent the development of diabetes and achieve better control of diabetes and its complications. Thus, there is a need to develop effective, innovative education modules to generate awareness about diabetes and its sequelae.

- Also, creating awareness about risk factors for diabetes may promote more accurate perceptions of diabetes risk. Nutrition health education using appropriate IEC materials needs to be imparted to sensitize and encourage the people to make healthy lifestyle choices which may aid in preventing the development of diabetes and its associated comorbidities.

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APPENDICES

APPENDIX - I

Institutional Ethics Committee for Human Research (IECHR)

FACULTY OF FAMILY AND COMMUNITY SCIENCES
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

Ethical Compliance Certificate 2020 – 2021

This is to certify that **Ms. Sanchita Khanna**'s study titled, "**Diabetes knowledge, risk perception and diabetes risk assessment in teaching staff of the Maharaja Sayajirao University of Baroda**" has been approved by the Institutional Ethics Committee for Human Research (IECHR), Faculty of Family and Community Science, The Maharaja Sayajirao University of Baroda. The study has been allotted the ethical approval number **IECHR/FCSc/2020/49.**

Prof Mini Sheth
Member Secretary
IECHR

Prof Shagufa Kapadia
Chairperson
IECHR

APPENDIX – II

INFORMED CONSENT FORM

STUDY TITLE: **DIABETES KNOWLEDGE, RISK PERCEPTION, AND DIABETES RISK ASSESSMENT IN TEACHING STAFF OF THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA**

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PURPOSE OF THE STUDY

The prevalence of diabetes continues to escalate globally and in India. In 2019, 463 million adults in the age group (20–79) had diabetes worldwide and the numbers are expected to increase to 578 million by 2030 and 700 million by 2045. Unfortunately, many adults may not be aware of the increased risk for type 2 diabetes that results from their lifestyle behaviours. It has been proposed that individuals must perceive that they are at high risk of developing a disease to consider modifying their health behaviours to prevent its onset. This study aims to assess knowledge about diabetes, risk perception, and the risk of developing diabetes in the teaching staff of the Maharaja Sayajirao University of Baroda.

PROTOCOL FOR THE STUDY

If you decide to join this study, you will be asked to complete an online questionnaire which will take up to 15-20 minutes of your time and will collect information on your anthropometric measurements (height, weight, waist circumference and hip circumference), diabetes knowledge, risk perception for developing diabetes and will include questions for assessing diabetes risk. If you do not wish to answer any of the questions included in the questionnaire, you may skip them and move on to the next question.

EXPENSES

This study requires only your time and co-operation. All the expenses incurred will be borne by the researcher and there is no financial compensation for your participation in this research.

POSSIBLE BENEFITS AND RISKS

The study will help to increase scientific knowledge about diabetes and its associated risk factors which could help in the development of effective educational interventions to reduce the burden of diabetes and its associated complications. We believe there are no risks associated with participation in this research study.

CONFIDENTIALITY

In the study your identity will be kept confidential. The results of the study may be published for scientific purposes but will not reveal your name or include any identifiable references to you.

VOLUNTARY PARTICIPATION

Your decision to join this study is voluntary. Your co-operation is important to the success of this study. Unless many volunteers like you agree to join; this study will not be possible. We hope you will take part in the study because we need all the information, we can get to draw correct conclusions.

RIGHT TO WITHDRAW

Your decision to join this study is voluntary. If you choose to participate, you may elect to withdraw your consent at any time.

AVAILABILITY OF RESULTS

At the end of the study, relevant information will be shared with you.

CONTACTS

If you have any questions about any part of the study or your rights as a volunteer, you can contact the investigators.

PARTICIPANT'S STATEMENT

I certify that I have read and understood the description of the study. I give my consent to be included as a participant in the study being carried out by Dr. Shonima Venugopal and her student, Ms. Sanchita Khanna in The Maharaja Sayajirao University of Baroda on diabetes knowledge, risk perception, and diabetes risk assessment.

I understand that the study requires the participants to complete an online questionnaire. I understand that I may ask questions about the study at any time. I am also aware of my right to opt out of the study any time.

_____

Participant name

Date:

By clicking "I agree" below you are indicating that you have read this consent form and agree to participate in this research study. You are free to skip any question that you choose.

I Agree

I Do Not Agree

APPENDIX- III

QUESTIONNAIRE

CODE NO: _____ **DATE: _____**

BACKGROUND INFORMATION:

1. Name:
2. Age:
3. Date of Birth:
4. Sex: (a) Male (b) Female
5. Education: (a) Post Graduate (b) PhD (c) Others (Please specify)
6. Faculty/College:
7. Department:
8. Mobile Number:

9.Type of family:

a) Nuclear

b) Joint

c) Extended

10. No. of family members:

11.Total family income (monthly):

ANTHROPOMETRY

1. Weight (Kg): _____

2. Height (cm/ft): _____

3. Waist Circumference (cm): _____

4. Hip Circumference (cm): _____

1. How would you describe your body weight?

a) Underweight

b) Normal weight

c) Overweight

d) Obese

MEDICAL AND FAMILY HISTORY:

1. Do you have any of the following conditions? (Select all that apply)

a) Diabetes

b) Hypothyroidism

c) Hypertension

d) Dyslipidaemia (High Total Cholesterol/ High LDL- Cholesterol / High Triacylglycerols/Low HDL - Cholesterol)

e) Any other (Specify)

2. Have any members of your immediate family or other relatives been diagnosed with diabetes? (Type 1 or Type 2).

a) No b) Yes: grandparent, aunt, uncle or first cousin c) Yes: parent, brother, sister or own child

3. Have you ever taken medication for high blood pressure on a regular basis?

a) No b) Yes

4.Have you ever been found to have high blood glucose? (eg. in a health examination, during an illness, during pregnancy).

a) No b) Yes

DIET AND PHYSICAL ACTIVITY:

1. Do you usually do at least 30 minutes of daily physical activity at work and/or during leisure time? (including normal daily activity)

a) Yes b) No

2. How often do you eat vegetables, fruits or berries?

a) Every day b) Not every day

DIABETES KNOWLEDGE:

1. Do you know what diabetes is? Yes

   No

2. Do you know how diabetes is detected/measured? Yes

   No

3. What are the risk factors that can increase the chances of someone getting diabetes? (Select all that apply)

a) Family history of diabetes
b) Overweight/Obesity
c) Older age
d) Not being physically active
e) High blood pressure
f) Unhealthy diet
g) Others (Please specify) _____

4. What are the symptoms of diabetes? (Select all that apply)

a) Increased thirst
b) Increased hunger
c) Frequent urination
d) Fatigue
e) Slow healing of wounds
f) Blurred vision
g) Others (Please specify) _____

5. Do you know that uncontrolled diabetes can cause complications in different organs of the body?

   Yes No Don't know

   If yes, what are they? (Select all that apply)

a) Eye disease
b) Heart disease
c) Kidney disease
d) Foot problems

e) Hypertension
f) Stroke
g) Others (Please specify) _____

6. Is it possible to prevent diabetes? Yes No Don't know
   If yes, how can diabetes be prevented? (Select all that apply)

a) Regular physical activity
b) Eating balanced healthy diets
c) Avoiding overweight/obesity
d) Quit smoking
e) Others (Please specify) _____

DIABETES RISK PERCEPTION:

1.Based on your lifestyle habits such as diet and exercise, do you think you are at risk of developing type 2 diabetes in the next 10 years?

a) Very high risk
b) Moderate risk
c) Low risk
d) No risk
e) Not sure/Don't know

2. Based on your lifestyle habits such as diet and exercise, do you think you are at risk of developing type 2 diabetes in your lifetime?

a) Very high risk
b) Moderate risk
c) Low risk
d) No risk
e) Not sure/Don't know

3. Based on your family history, do you think you are at risk of developing type 2 diabetes in your lifetime?

a) Very high risk
b) Moderate risk

c) Low risk
d) No risk
e) Not sure/Don’t know

4. Are you worried about developing type 2 diabetes in your lifetime?

a) Very worried
b) Slightly worried
c) Not worried

5. Do you plan to make any changes in your lifestyle habits such as diet and exercise in the near future that you think will decrease your risk of getting type 2 diabetes?

Yes No

If yes, in which?

a) Diet
b) Exercise
c) Both

APPENDIX- IV

24 HOUR DIETARY RECALL

Meal Time	Name of the food stuff	Ingredients	Raw weight (g)	Cooked Volume (ml)
Early-morning				
Breakfast				
Mid-morning				
Lunch				
Evening Tea				
Dinner				
