Pure Appl. Biol., 12(2):1111-1119, June, 2023
http://dx.doi.org/10.19045/bspab.2023.120113

Research Article

Prevalence of type2 diabetes, its associated complications and risk factors in District Dera Ismail Khan-Pakistan

Gohar Abbas[1], Hadia Gul[1], Muhammad Shakeel[2], Hafiz Ullah[2], Iftikhar Ahmed[2], Muhammad Mohibullah Khan[3] and Muhammad Yasin[2*]

1. Institute of Biological Sciences, Gomal University, Dera Ismail Khan, Pakistan
2. Gomal Center of Biochemistry and Biotechnology, Gomal University, Dera Ismail Khan, Pakistan
3. Department of Plant Breeding and Genetics, Faculty of Agriculture, Gomal University, Dera Ismail Khan, Pakistan

**Corresponding author's email: drmywazir-biotech@gu.edu.pk*

Citation

Gohar Abbas, Hadia Gul, Muhammad Shakeel, Hafiz Ullah, Iftikhar Ahmed, Muhammad Mohibullah Khan and Muhammad Yasin. Prevalence of type2 diabetes, its associated complications and risk factors in District Dera Ismail Khan-Pakistan. Pure and Applied Biology. Vol. 12, Issue 2, pp1111-1119.
http://dx.doi.org/10.19045/bspab.2023.120113

Received: 21/03/2023 Revised: 15/05/2023 Accepted: 17/05/2023 Online First: 18/05/2023

Abstract

Diabetes is a chronic disease that affects millions of people worldwide and is associated with several complications that can lead to severe health problems. Objectives of the study were to investigate the age-wise, gender-wise prevalence of diabetes, its risk factors in district Dera Ismail Khan and aimed to examine several diabetic complications by gathering pertinent information about the patients, such as their name, age, gender, height, weight, age of onset, family history of the illness, and any other visceral organ problems. A total of 600 subjects were included in the study and blood samples were collected randomly through a disposable syringe, from different tehsils of district Dera Ismail Khan. Blood glucose levels were analyzed using glucose reagent and a chemistry analyzer machine. The collected data was analyzed using statistical tools like SPSS. Total prevalence of diabetes was found 38%, indicating that diabetes had reached epidemic proportions in the area and the majority of diabetic patients were between the ages 41 to 60 years due to obesity, improper diet, and sedentary lifestyle. Combined therapy was found to be the most effective treatment for controlling blood glucose levels. The study also found that diabetic retinopathy was present in 28.5% of diabetic patients, with men being more prone to ocular disorders than women. Overall, this study highlights the urgent need for diabetes prevention and management in the Dera Ismail Khan district, as healthy lifestyle, regular screening and early detection can help reduce the burden of diabetes, its associated complications on individuals and society.

Keywords: Blood glucose level; Complications; Diabetic Retinopathy; Obesity; Prevention

Introduction

Diabetes, often identified as diabetes mellitus, is a collection of metabolic disorders marked by continually upraised blood sugar levels **[1]**. Numerous urinations, extreme thirst, and increased hunger are all signs of elevated blood sugar. Diabetes can lead to a wide range of consequences if ignored. Ketoacidosis, a hyperosmolar hyperglycemic condition, or death are models of acute consequences. Cardiac disease, strokes, renal problems, foot ulcers, and eye destruction are examples of severe penalty **[2]**. Diabetes outcome starting with either inadequate insulin synthesis from the pancreas or inaccurate insulin uses by cells of

body. Diabetes mellitus has three major types [3]. The metabolic syndrome, which is defined by insulin confrontation or decreased insulin synthesis and linked to a number of risk factors, has diabetes as one of its manifestations. A significant shift in the reason for death and disability owing to diabetes mellitus has been brought about by epidemiological change. A significant financial and capacity problem for the global healthcare system of the twenty-first century is the emergence of diabetes epidemics [4]. Since a few decades ago, diabetes has become more common worldwide and is currently epidemic in developed nations [5]. The various illnesses that make up diabetes mellitus frequently manifest as bouts of hyperglycemia and sugar intolerance as a result of inadequate insulin production, improper insulin action, or both [6]. These issues arise from changes in the systems that regulate the mobilization and preservation of metabolism fuels, such as the catabolism and anabolism of carbs, lipids, and proteins as a result of insufficient insulin secretion, action, or both [7].

Type 2 diabetes is becoming more frequent throughout the world, with 80 percent of individuals impinged present in developing nations. In 2011, Diabetes Mellitus (DM) generated 4.6 million fatalities [7]. It is predictable that 439 million people will have type 2 diabetes by 2030 [8]. Chronic metabolic disease elevated sugar levels, glucose intolerance, and a relative lack of insulin are the hallmarks of Type II Diabetes Mellitus [9]. A tiny percentage of persons with type II diabetes can have a hyperosmolar hyperglycemic state, which is characterized by extremely high blood sugar levels, reduced consciousness, and low blood pressure [10]. Type II diabetes is often a chronic condition that reduces life expectancy by ten years. This is partially a result of the consequences it is linked to 2 to 4 times increased the chance of cardiovascular disease, including ischemic cardiac disease and stroke and higher rates of hospitalization. The most often identified risk factors for diabetes include body mass index (BMI), lipids, stress, tobacco, lack of physical activity, poor education, food patterns, family history, and, more recently specific genes [11].

In Pakistan as well as other parts of the world, diabetes and its complications are a leading cause of high premature death. By identifying those who are at-risk and launching primary prevention interventions in the study region, it will be possible to stop the diabetes epidemic by monitoring trends in prevalence and risk variables. The development of successful strategies to prevent and control diabetes and associated risk factors is crucial for policy makers, program managers, and researchers. Consequently, the current study sought to ascertain the incidence of diabetes mellitus and its related risk factors among residents of Dera Ismail Khan, moreover with the help of this study we can find the latest status of the disease and its major leading complications and also conclude the protective measure against the disease.

Materials and Methods

Study area

The study has been conducted in district Dera Ismail Khan which is often called D.I. Khan. Dera Ismail Khan is a city in Khyber Pakhtunkhwa that is situated on the Indus River bank. The present study includes following three tehsils of District Dera Ismail Khan.

1. Dera Ismail Khan
2. Paroa
3. Paharpur

Place of sample collection

The order of sampling for collection of data was random and samples were collected from different tehsils of district Dera Ismail Khan. The samples were collected through indirect method from District Headquarter (DHQ) and Tehsil Headquarter (THQ) hospitals of respective tehsils. These samples were analyzed in different laboratories of Dera

Ismail Khan (Sarhad Lab, Dera Lab, Biomed Lab). Samples were collected from different areas of district and then these samples were further processed. The total 600 samples were collected from different tehsils.

Several diabetic complications were examined in the current survey-based investigation.

Patient's data collection

Patients were asked to complete a questionnaire with pertinent information, including their name, age, gender, height, weight, age of onset, family history of the illness, and any other visceral organ problems.

Blood collection and serum separation

Tourniquet was tied on the arm of person and 2-3 ml of blood was collected from the vein with the help of disposable syringe and blood was placed in gel tube.

Gel tube was placed in centrifuge machine for the separation of serum from blood. Blood of 2ml was centrifuged at 3000rpm for 4 minutes. After centrifugation two phases was formed i.e. solid phase and liquid phase (serum). Serum was separated into a test tube.

Analysis of blood glucose level

1ml glucose reagent (Merck Company, Germany) was mixed with the help of micropipette in serum of 10µl present in small test tube and was incubated in water bath for 10 minutes at 37 ºC. After this pinkish colored compound was observed in the test tube due to reaction of reagent and serum glucose then it was introduced to chemistry analyzer machine (Microlab Company) and this machine had given the correct reading of blood glucose level of the person on digital screen.

Statistical analysis

A suitable sample well representing the population of District D.I. Khan, obtained through carefully collected data on blood glucose levels, was incorporated into a statistical tool like Microsoft Excel. The data inserted into the tool was used to calculate sample statistics.

Results

In current survey-based study, several diabetic complications were examined. Patients were asked to complete a questionnaire with pertinent information such as their name, age, gender, weight, height, age of onset, family history of the disease, and any complications brought on by diabetes.

Overall prevalence of diabetes in district D.I. Khan

In the present research work the total 600 samples have been collected randomly from different tehsils of district D.I. Khan in order to check the gender and age wise prevalence and also some of the complications that are related to diabetes. Out of these 600 samples, 372 people were free from diabetes and 228 were diabetic patients, so the general prevalence of diabetes throughout the district is 38% which clearly indicate that approximately every third person is diabetic patient, whereas 62% people are non-diabetic (Table 1).

Gender wise prevalence of diabetes in different tehsils of D.I. Khan

The prevalence of diabetes in tehsil D.I. Khan, Paroa, and Paharpur is 41%, 31.3% and 38.6% respectively. In present analysis as in most cases but not all, diabetes is more common in male than in female but in tehsil Paharpur diabetes is more common in female than in male according to this research. The gender wise prevalence of diabetes in male and female in tehsil D.I.Khan and Paroa is 43% (male), 35% (female) and 37% (male), 18% (female) respectively. In tehsil Paharpur the gender wise prevalence is 34% (male) and 45% (female). The gender wise prevalence of diabetes in different tehsils of D.I.Khan (Table 2).

Age wise prevalence of diabetes in different tehsils of D.I. Khan

The patients were divided into three age groups in order to find age wise prevalence of diabetes in different tehsils of district D.I. Khan. The

result showed that the prevalence of diabetes in age group 20-40 years is about 28% and 41-60 years is about 64% and 61-80 years is about 31% throughout the tehsil Dera Ismail Khan. According to our findings, the majority of diabetic patients are between the ages of 41 to 60 years. The age wise prevalence of diabetes in different tehsils of D.I. Khan (Table 3 & Fig. 1).

Fasting blood glucose level

Data analysis revealed that 62% of diabetes individuals had fasting blood glucose readings under 200 mg/dl, whereas the remaining 38% had readings above 200 mg/dl (Fig. 2).

Complications associated with diabetes

Blood pressure

Two out of three people living with diabetes also report blood pressure (hyper-tension) or take medication to lower their blood pressure. Our study finds the following outputs.

About 61(64%) male and 7(25%) female of tehsil D.I. Khan, 70% male and 38% female of Paroa Tehsil, while 64% male and 52% female of Paharpur were having high blood pressure respectively (Fig. 3).

Diabetic nephropathy

One frequent consequence of both type 1 and type 2 diabetes is diabetic nephropathy. Diabetes that is not properly managed over time can harm renal blood vessel clusters that filter blood waste. High blood pressure and renal damage may result from this. By putting more strain on the kidneys' sensitive filtering system, high blood pressure can exacerbate existing kidney disease. A total of 12 males (13%) and 4 females (14%) of Dera tehsil; 15% male and 12% female of Paharpur while 18% male and 12% female of Paroa tehsil were having diabetic nephropathy respectively (Fig. 3).

Diabetic retinopathy

Diabetes' consequence, diabetic retinopathy, is brought on by elevated levels of blood sugar harming the retina (retina). If undetected and mistreated, it can result in blindness. About 31(32%) male and 6(21%) female of Dera tehsil, 21% male 20% female of Paharpur, 28% male and 25% female of Paroa tehsil were having eye problems respectively (Fig. 3).

Cardiac disease

High blood sugar levels over time can harm blood vessels and the nerves that control the heart. Also, people with diabetes are more susceptible to other illnesses that increase the chance of developing heart disease. Blood flows through arteries with more power under conditions of high blood pressure, which can harm arterial walls. About 7 men (7.3%) and 1 woman (3.5%), 6% male and 8% female of Paharpur, 8% male and 12% of Paroa had diabetes-related heart illness respectively (Fig. 3).

Treatment

A total of 600 persons were examined and 228 were diagnosed with diabetes. The affected persons were taking the following treatment for diabetes.

About patients (32%) were taking monotherapy which includes sitagliptin/ glimepiride. About patients (60%) were taking combine-therapy and consuming sitagliptin/ glimepiride and about patients (8%) were treated with insulin (Fig. 4).

Risk factors for diabetes

The risk factors for diabetes in present study include family history, physical inactivity, obesity, hypertension, smoking, high cholesterol and low education. Out of total 228 diabetic patients about 104 reported a family history of diabetes while 149 patients were found physically inactive, 90 were found obese, 41 were smokers, 88 were of low education background. About 159 patients were reported with hypertension and 145 were having high cholesterol level. So hypertension and physical inactivity and high cholesterol level were found the key risk factors for type 2 diabetes (Fig. 5).

Pure Appl. Biol., 12(2):1111-1119, June, 2023
http://dx.doi.org/10.19045/bspab.2023.120113

Table 1: Overall prevalence of diabetic and non-diabetic in district D.I. Khan

Total samples	Diabetic	Non-diabetic	Diabetic Percentage
600	228	372	38%

Table 2: Gender wise prevalence of diabetic and non-diabetic in different tehsils of D.I. Khan

Tehsil	Total	Male	Female	Diabetic		Percentage of Diabetic Patients	
				Male	Female	Male	Female
D.I.Khan	300	220	80	95	28	43%	35%
Paroa	150	105	45	39	08	37%	18%
Paharpur	150	95	55	33	25	34%	45%

Table 3: Age wise prevalence of diabetes in different tehsils of D.I. Khan

Tehsils	Age Group	Total Samples	Diabetic	Percentage
D.I.Khan	20-40	100	28	28%
	41-60	100	64	64%
	61-80	100	31	31%
Total		**300**	**123**	
Paroa	20-40	50	6	12%
	41-60	50	26	52%
	61-80	50	15	30%
Total		**150**	**47**	
Paharpur	20-40	50	9	18%
	40-60	50	36	72%
	60-80	50	13	26%
Total		**150**	**58**	

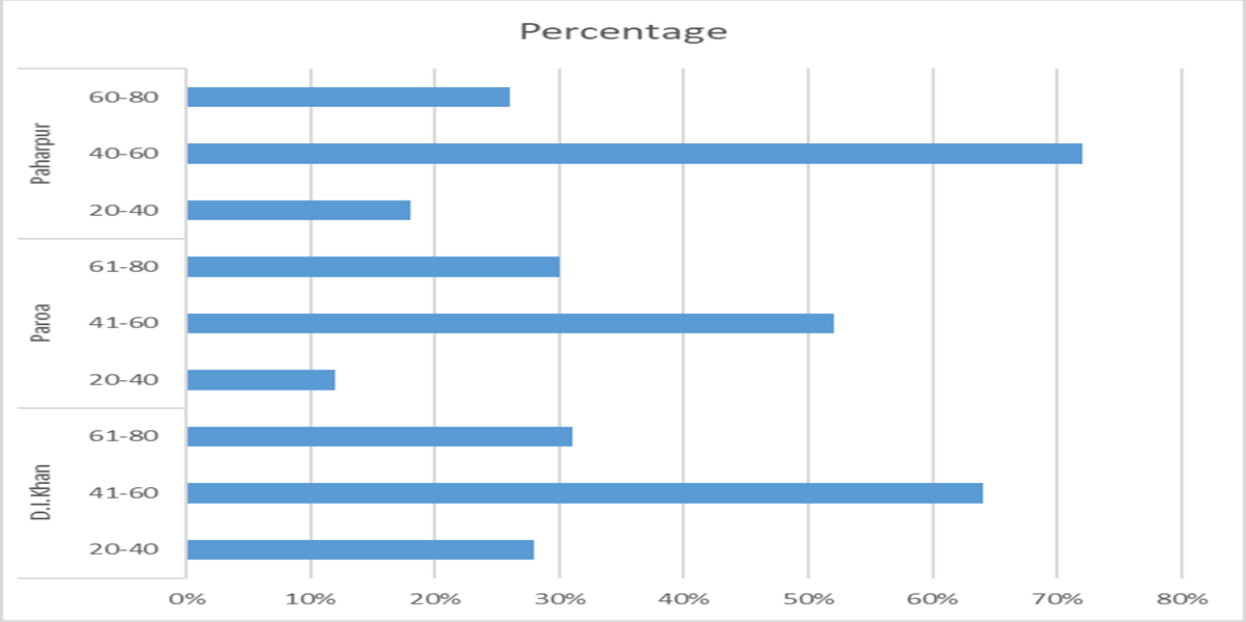

Figure 1: Age wise prevalence of diabetes in different tehsils of district D.I. Khan

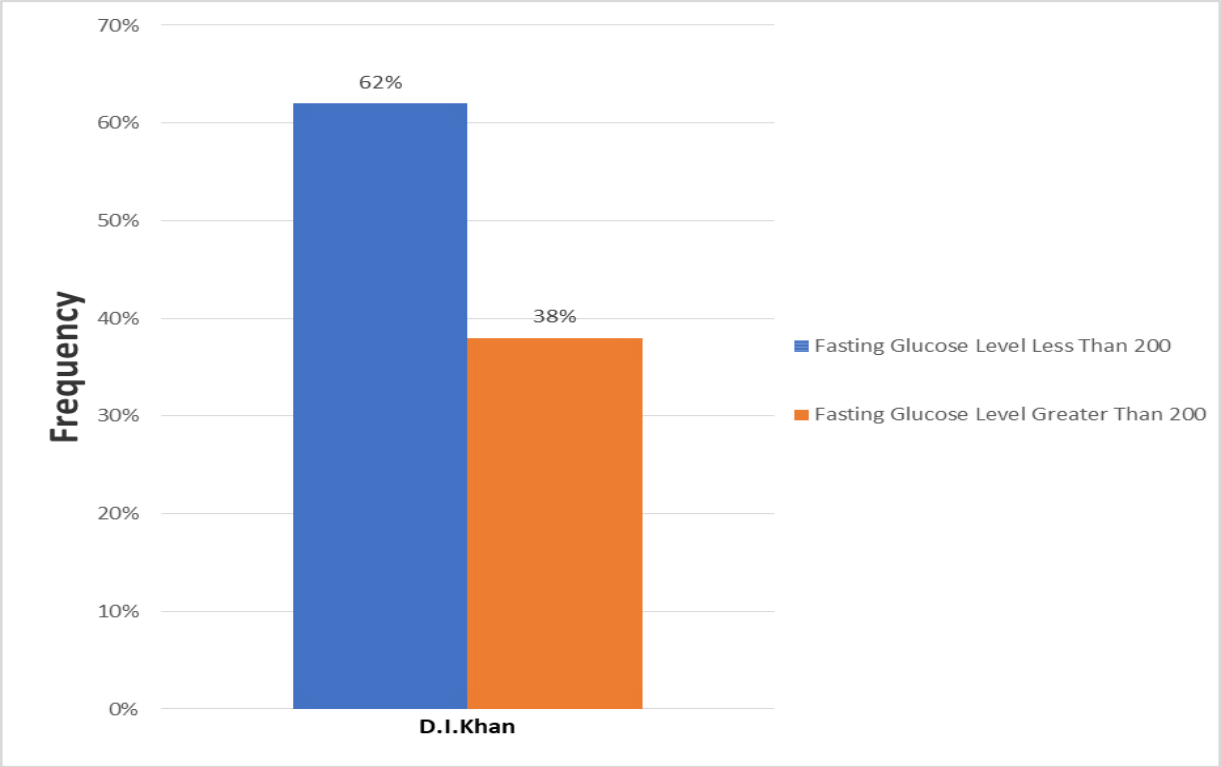

Figure 2: Fasting Blood glucose level in diabetic patients of district D.I. Khan

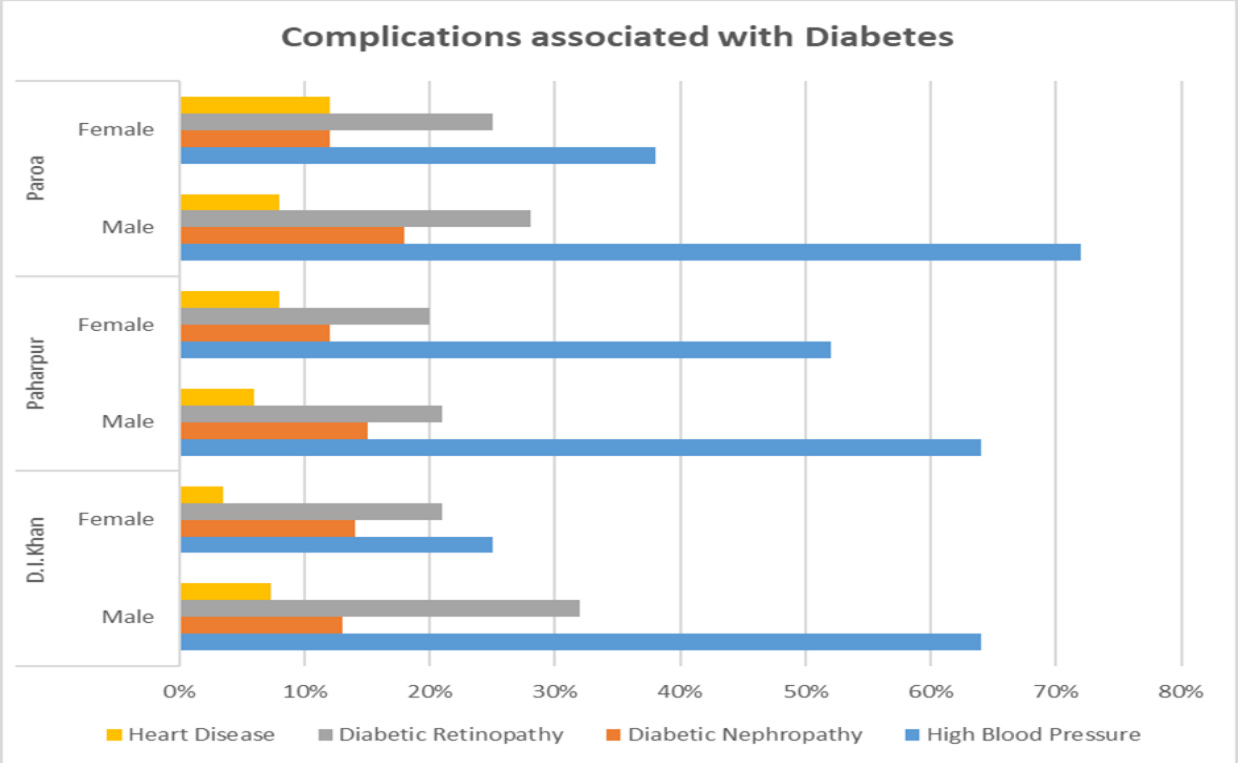

Figure 3: Gender wise prevalence of diabetes associated complications in different tehsils of D.I. Khan

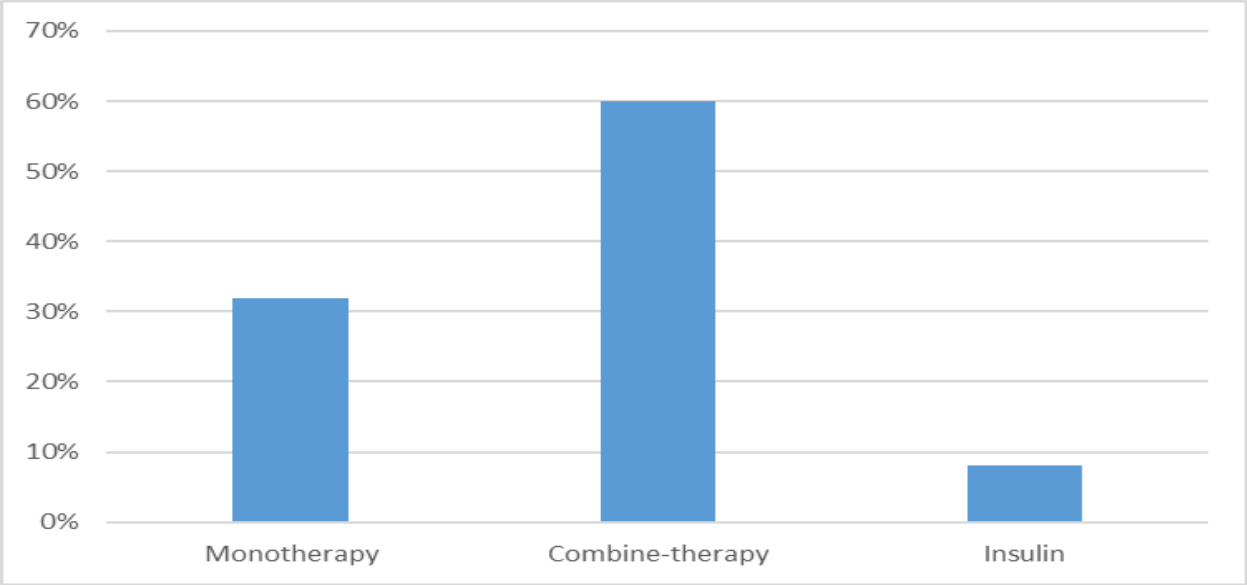

Figure 4: Total percentage of Diabetic patients of district D.I. Khan taking monotherapy, Combine therapy and insulin

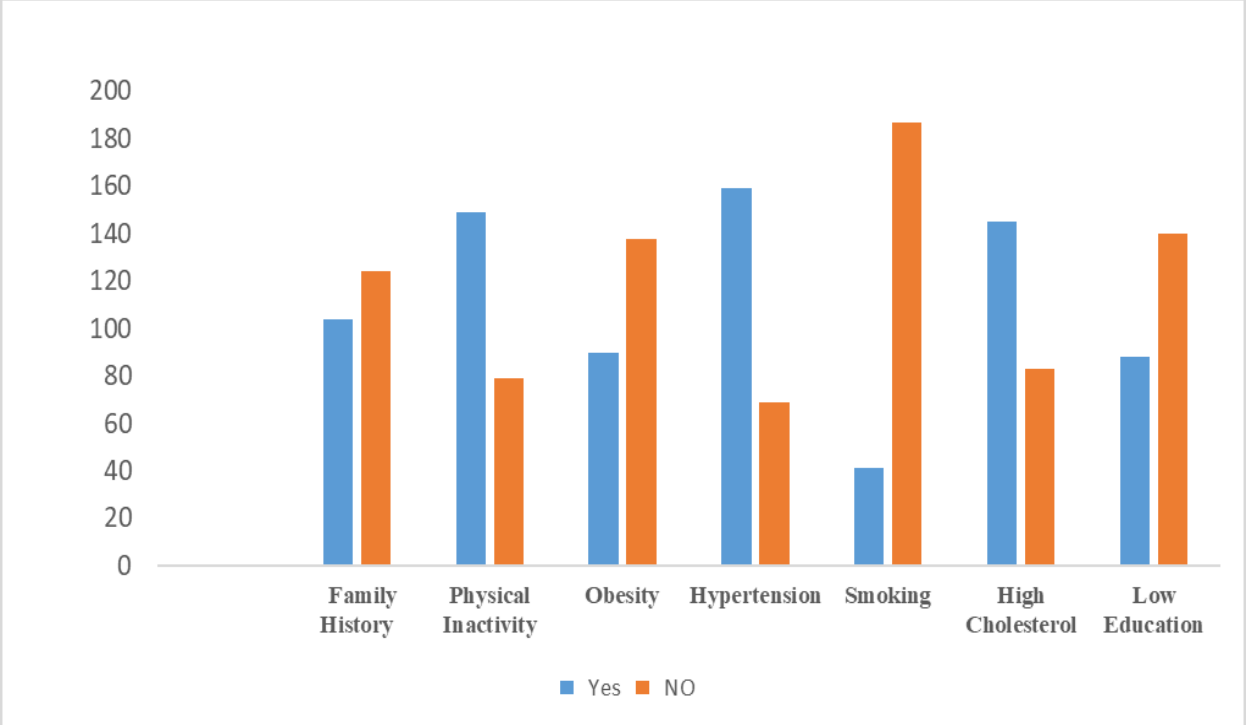

Figure 5: Ratio of risk factors found in type2 diabetic patients of district D.I. Khan

Discussion

Diabetes is a debilitating disease that has now reached epidemic proportions. In the present research work the total 600 samples have been collected randomly from different tehsils of district D.I. Khan in order to check the gender and age wise prevalence and also some of the complications that are associated to diabetes. Out of these 600 samples, 372 people were free from diabetes and 228 were

diabetic patients, so the general prevalence of diabetes throughout the district is 38% which clearly indicate that approximately every third person is diabetic patient, whereas 62% people are non-diabetic. The prevalence of diabetes in tehsil D.I. Khan, Paroa, and Paharpur is 41%, 31% and 38% respectively which shows that diabetes is more common in urban area due to lack of physical activities [12]. The recent studies showed that the prevalence of diabetes in age group 20- 40 years is about 28% and 41-60 years is about 64% and 61-80years is about 31% throughout the district Dera Ismail Khan. According to our findings, the majority of diabetic patients are between the ages of 41 to 60 this is because of obesity, improper diet and sedentary mode of life [12]. While physical inactivity, obesity, high cholesterol level, hypertension, smoking and low education are also the main risk factors for diabetes. As high percentage of the patients had a family history of diabetes, it is clear that this condition has genetic role and can be passed on from parent to child [13].

Research also shows that the majority of diabetic people (60%) were taking combined therapy and few were taking mono therapy 32% and very small no of patients were taking insulin injections 8%. From survey it is verified that glucose level is well controlled by combined therapy [13].

Conclusion and Recommendations

The prevalence of diabetes has touched widespread proportions and is a major health concern globally. This study aimed to conclude the ratio of diabetes in the Dera Ismail Khan district, Pakistan, and its associated complications. The findings revealed that diabetes is a significant health issue in the district, with a general prevalence of 38%. The prevalence of diabetes was higher in urban areas due to a lack of physical activity. The majority of diabetic patients were between the ages of 41 to 60, indicating the importance of lifestyle modifications and a healthy diet to prevent the onset of diabetes. Additionally, diabetes was more common in males than females in most areas, and a family history of diabetes has raised the risk of developing the condition. The majority of diabetic patients were taking combined therapy, which was found to be effective in controlling glucose levels. High blood pressure was more prevalent in males than females, and diabetic nephropathy was more common in males in some areas. Diabetic retinopathy was found to be prevalent in diabetic patients, particularly in males, emphasizing the need for regular eye check-ups in diabetic patients. Overall, this study highlights the urgent need for diabetes prevention and management programs in the Dera Ismail Khan district and other areas with a high prevalence of diabetes. Education on healthy lifestyle habits, regular screening for diabetes, and early detection of complications can help prevent and manage diabetes and its associated complications. It is essential to raise awareness about the risk factors and symptoms of diabetes to encourage early diagnosis and timely management. Additionally, healthcare professionals need to provide effective treatment options and regular monitoring to control glucose levels and prevent diabetes-related complications. Further research is needed to investigate the underlying causes of the high prevalence of diabetes in the district and develop effective prevention strategies to reduce the burden of diabetes on individuals and society.

Authors' contributions

Conceived and designed the experiments: H Gul, Performed the experiments: G Abbas, Analyzed the data: H Gul, MM Khan & M Yasin, Contributed materials/ analysis/ tools: M Yasin, M Shakeel, H Ullah & I Ahmed, Wrote the paper: H Gul.

Acknowledgements

The authors are grateful to the Institute of Biological Sciences, Gomal University, Dera

Ismail Khan, different laboratories of Dera Ismail Khan i.e. (Sarhad Lab, Dera Lab, Biomed Lab), Pakistan for facilitating this research by providing resources. No Funds were availed for this research work.

References

1. Kitabchi AE, Umpierrez GE, Miles JM & Fisher JN (2009). Hyperglycemic crises in adult patients with diabetes. *Diabetes Care* 32: 1335–1343.
2. Vasista P, Tziaferi V, Greening J & Sundaram P (2016). G472(P) Glycosylated haemoglobin (HbA1c): Is it a reliable measure of glycaemic control in all patients with type 1 diabetes mellitus? *Arch Dis Child* 101(39): 281-288.
3. Rother KI (2007). Diabetes Treatment, Bridging the Divide. *N Engl J Med* 356: 1499–1501.
4. Rudnicka E, Napierała P & Podfigurna A (2020). The World Health Organization (WHO) approach to healthy ageing. *Maturitas* 139: 6-11.
5. King H, Aubert RE & Herman WH (1998). Global burden of diabetes, Prevalence, numerical estimates, and projections. *Diabetes Care* 21: 1414–1431.
6. Cho NH, Shaw JE & Karuranga S (2018). IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Res Clin Pract* 138: 271-281.
7. Chamnan P, Simmons RK & Forouhi NG (2011). Incidence of type 2 diabetes using proposed HbA1c diagnostic criteria in the european prospective investigation of cancer-norfolk cohort: Implications for preventive strategies. *Diabetes Care* 34(4): 950-956.
8. Pasquel FJ & Umpierrez GE (2014). Hyperosmolar hyperglycemic state: A historic review of the clinical presentation, diagnosis, and treatment. *Diabetes Care* 37(11): 3124-3131.
9. Al-Goblan AS, Al-Alfi MA & Khan MZ (2014). Mechanism linking diabetes mellitus and obesity. *Diabetes, Metab Syndr Obes* 7: 587-591.
10. Deshpande AD, Harris HM & Schootman M (2008). Epidemiology of diabetes and diabetes-related complications. *Phys Ther* 88(11): 1254-1264.
11. Weinstein AR, Sesso HD & Lee IM (2004). Relationship of physical activity vs body mass index with type 2 diabetes in women. *JAMA* 292(10): 1188-1194.
12. Baptiste RK, Gary TL & Beckles GL (2007). Family history of diabetes, awareness of risk factors, and health behaviors among African Americans. *Am J Public Health* 97(5): 907-912.
13. Patil P, Patil S, Mane A & Verma S (2013). Antidiabetic activity of alcoholic extract of neem (Azadirachta indica) root bark. *Natl J Physiol Pharm Pharmacol* 3(2): 142-146.