Research Article

The risk factors analysis of diabetes mellitus and hypertension in the population of district Swabi, Khyber Pakhtunkhwa, Pakistan

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Abstract

Diabetes is the major non-contagious, long-lasting epidemic disease caused by abnormal blood glucose levels resulting from the disablement in insulin action and secretion. The objective of the study is to estimate diabetes mellitus and risk factors of diabetes mellitus in the population of district Swabi, Khyber Pakhtunkhwa, Pakistan. A total of 150 blood samples are collected from March-July 2021. All diabetic patients are screened randomly using a spectrophotometer (Micro Lab 300). At the same time, data regarding subjective information, socioeconomic status, and behavioural risk factors are collected by personal interviews, which are further statistically analysed. Results show that the frequency distribution of diabetes is n= 107 (71.3%) while n= 43 (28.7%) of the total n=150 are normal. Mean±sd of the data is 1.29±0.45. There is a significant association between diabetes mellitus and hypertension (n= 95, 63%, Cl 95%, and P-value 0.041). Hyperglycaemia is n= 109 (72.7% and P-value 0.00), and anxiety/depression is n= 95 (63% and P-value 0.004). Gender, age, education, and smoking (p-value > 0.05) are non-significant risk factors for diabetes. The findings show a significant association among diabetes mellitus, hypertension, hyperglycaemia, and depression.

Keywords: non-contagious disease, epidemic disease, abnormal blood glucose, hypertension, hyperglycaemia, spectrophotometer, anxiety, glucose, plasma, insulin, secretion.

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1.   Introduction

Diabetes mellitus is a prolonged disease that is caused by an abnormal blood glucose level which is resultant from disablement in insulin action and secretion. Around 425 million people are affected by diabetes worldwide (Sonne & Hemmingsen, 2017). According to the projected numbers, it will be increased to 629 million by 2045 (International Diabetes, 2017). In type I diabetes (TID) insulin producing β-cells are destroyed by the immune system. The body attacks itself mistakenly furthermore insulin cannot be synthesized by the body. It usually quickly develops as well as diagnosed at an early age moreover in young adults. Type II diabetes (TIID) develops over a period of time, resulting from the combination of β-cell destruction and insulin resistance. Moreover, the body doesn't use insulin properly while keeping blood sugar high. Insulin deficiency or malfunction is the main cause of diabetes (Ali *et al.*, 2022). Excessive thirst, abnormal weight loss and hyperglycaemia are the signs and symptoms of diabetes mellitus (Haque *et al.*, 2011). Several diseases such as loss of vision and cardiac diseases like stroke, heart attack, renal failure, nervous disorders, and diabetes foot are complications caused by diabetes mellitus (Al-Hakami, 2016).

The diabetes is the major non-contagious, long-lasting epidemic disease globally and is related to complexities. By the interval, high blood glucose level can harm blood vessels, resulting in high hazard for microvascular in addition to macrovascular complications (Beckman & Creager, 2016). Many health conditions such as microvascular, macrovascular and metabolic alterations comprising of peripheral arterial, cardiovascular disease, cerebrovascular disease, retinopathies, neuropathies and nephropathies are associated with diabetes mellitus. Many factors like imbalanced food habits, obesity, inactive lifestyle, growing age, insulin resistance and hereditary factors are very important risk factors for type II diabetes mellitus (Abbott *et al.*, 2002). As a result of a study carried out on more than 1.3 million adults having type II diabetes mellitus, revealed that 98% of them had at least one comorbid incurable disease and approximately 90% had at least two (Yang *et al.*, 2006). The most widespread state in the patients and 90% of them had at least two such diseases. The common state of the patients having under mentioned diseases are hypertension (82.1%), overweight (78.2%), hyperlipidaemia (77.2%), chronic kidney disease (24.1%) and cardiovascular disease (21.6%) (Iglay *et al.*, 2016).

It is estimated that in Pakistan 8 million individuals are diabetic, thus adding it 4th leading state on the list in addition to these numbers rendering to WHO will double by the year 2025. An increase in age is a huge factor for the increase in type II diabetes mellitus. Obesity is an important risk factor for type II diabetes mellitus. Lack of physical activities leads to being overweight and causes diabetes mellitus. Diabetes mellitus is one of the major causes of morbidity globally and is likely to rise significantly over the next decades (American Diabetes Association, 2014). Globally each year 6 million individuals develop diabetes and every 10 seconds a person dies from its associated causes therefore, it is deemed approximately that the number of diabetic patients will become around 300 million in the year 2025 (Ali *et al.*, 2022). Asians are 3.8 times more vulnerable to cause diabetes than white Caucasia (Mather & Keen, 1985). It is estimated that in the district Mardan, Khyber Pakhtunkhwa, Pakistan prevalence of diabetes mellitus is 50% (Fatima *et al.*, 2022).

The hypertension is famous for one of the major reasons of high blood pressure which means the blood pressure in the arteries is greater than of standard per normal range set for healthy

individuals. The Joint National Committee 7 (JNC7) stated that the standard systolic blood pressure is less than < 120 mmHg while the diastolic blood pressure is < 80 mmHg. The pre-hypertensive individuals have systolic blood pressure from 120 to 139 mmHg while the diastolic blood pressure is from 80-89 mmHg. The pre-hypertensive individuals are at risk of developing hypertension. High blood glucose level is specified as systolic blood pressure (SBP $\geq$ 140 mmHg) and diastolic blood pressure (DBP $\geq$ 90 mmHg). Hypertension is a common, long-term, age-linked disorder, which mostly carries exhausting renal as well as cardiovascular complications.

Blood pressure is generally considered together with remaining other cardiovascular risk factors. Recognition of high blood pressure increasingly relies upon computerized strategies of blood pressure assessment. Hypertension is usually asymptomatic, however up to fifty percent of the patients may report one or more symptoms, most commonly headaches. In young athletes, headaches may occur after a hard workout. Indications such as seizures, nose bleeds, dizziness and syncope are less and. if found suggest that the BP rise has been aggravated by consumed substance or by emotional distress. On the contrary, if these signs arise together with elevated BP in an adolescent, they may be a signal to the existence of secondary hypertension. The family history must encompass not only hypertension but linked conditions and complications like dyslipidaemia, stroke, myocardial infarction and diabetes. A lot of substances usually used or abused can elevate BP, including prescribed and non-prescribed medication (e.g., corticosteroids or decongestants) and street drugs namely amphetamines and cocaine (Staessen *et al.*, 2003).

The aim of the current study is to investigate type II diabetes mellitus and its important risk factors in the population of district Swabi, Khyber Pakhtunkhwa, Pakistan. As type II diabetes mellitus has become a major health problem in district Swabi. It is of great significance to estimate diabetes, hypertension and explore their risk factors for the prevention and control of chronic diseases in the population of Swabi. This study has predominant implications for the design of an educational programme for diabetics and a fitness promotion programme as a primary safety measure for the general population. The findings of the current study might be beneficial for future studies about the diabetes mellitus.

2. Literature review

Shera *et al.* (2007) said that the frequency of type II diabetes mellitus and Impaired Glucose Tolerance (IGT) along with the causative chance of reasons were projected via appearing an irritated sectional survey performed previously on the rural and urban population of Pakistan. By using SPSS model 12 the statistical research was completed from the obtained outcomes. The general type of topics tested changed into 5433 which included 1893 guys (1208 in rural and 685 in metropolis areas) and 3540 ladies (2243 in rural and 1297 in metropolis areas). The superiority of diabetes within the town as opposed to the agricultural regions was 6.0% in guys and 3.5% in ladies towards 6.9% in guys and 2.5% in girls. The newly identified diabetes is modified into 5% in men and 68% in girls in the metropolis areas and 5% in men and 4.8% in girls in the rural areas. In the urban areas, as opposed to the rural regions the IGT turned into 6.3% in guys and 14.2% in ladies in opposition to 7% in guys and 10.9% in women. Common glucose intolerance turned to 22.04% in the urban and 17.15% in the rural areas. The main hazard issues recognized were age, own personal history moreover specifically principal over body weight.

Basit *et al.* (2018) reported a survey performed by the use of a multistage clustering approach in all four provinces (Balochistan, Khyber Pakhtunkhwa, Punjab, and Sindh) of Pakistan. The 10800-sample size was intended for the usage of chance sampling as well as a multistage stratified sampling approach. Out of a total of 213 clusters, 27 clusters were decided from all four provinces of Pakistan. The total 46 sub-clusters were decided from 12,486 beleaguered people, 1083 discovered topics eventually participated in the research study (87% reaction charge). The widespread weighted incidence of diabetes changed to 26.3%, of which 19.2% had recognized diabetes and 7.1% have been newly recognized individuals of diabetes mellitus. Incidence of diabetes mellitus in urban and rural regions become 28.3% and 25.3%, respectively. Pre-diabetes occurrences changed to 14.4% (15.5% in city areas and 39% in pastoral regions). Forty-three years, or greater than forty-three years circle of relative's records of diabetes mellitus, hypertension, obesity, and dyslipidaemia were vital related danger elements for diabetes mellitus.

The diabetes mellitus superiority as well as IGT with their connection to oldness and overweightness was anticipated in Punjab, Pakistan with the aid of a populace-based survey. Oral glucose tolerance exams have been executed in a pattern of stratified random of 1852 grown-ups old ≥ 25 years. The diagnosis of diabetes in addition to the IGT had been made based on WHO standards. The prevalence of diabetes changed to 12.14% in grownup men and 9.83% in females. In total 16.68% of males and 19.37% of girls the glucose intolerance as well as the IGT found. The fundamental weight problems and the high blood pressure level in addition to an effective own family history had been intensely related to diabetes mellitus (Shera *et al.*, 2010).

Akhtar *et al.* (2019) reported the frequency distribution of pre-diabetes as well as diabetes mellitus and risk factors of diabetes mellitus in Pakistan. The study was conducted by scientific literature through meta-evaluation during 1995-2018. Age, high blood pressure and weight were the significant risk factors for diabetes mellitus in Pakistan. There was a continuous growth in the dominance of pre-diabetes and diabetes in Pakistan. Fatima *et al.* (2022) reported the occurrence and distribution of diabetes mellitus in district Mardan, Pakistan. The prevalence of diabetes mellitus was found dominant in females (52%) compared to males (48%). Moreover, the age groups of 30-40 years were most affected. Fasting Blood Sugar (FBS) range was high at the age of 10-20 years and Random Blood Sugar (RBS) range was high at the age of 40 years and above.

Zuhaid *et al.* (2012) reported the knowledge and perceptions of diabetes in a sample population of Peshawar. This cross-sectional, descriptive study was carried out in seven different localities of Peshawar. A sample of 305 residents were interviewed aged from 15–60 years and above, using a questionnaire. An excessive sugar intake, obesity, family history, lack of physical activities and stress were acknowledged by 46.2%, 42.3%, 39.3%, 33.4%, and 31.8% of the subjects respectively.

The literature shows that the presence of family history and level of education were recognised to be associated with more knowledge and awareness. There is lack of awareness of major risk factors and some complications of diabetes mellitus. Level of education and awareness is a significant predictor regarding knowledge of diabetes and its prevention. Prevalence of diabetes has significantly increased in Pakistan.

3. Material and methods

3.1. Study area

The present study was conducted from March-July 2021 at the District Headquarter Hospital (DHQ), Swabi, and the Seena Medical and Surgical Complex Swabi, in the district Swabi, Khyber Pakhtunkhwa, Pakistan.

3.2. Data collection method

A total of 150 samples were collected randomly. The current study was conducted over a period of 5 months from March-July 2021. Personal information, socioeconomic status along with behavioural risk factors was collected by personal interview. All of the demographic facts had been collected from participants via a self-designed proforma including variables like sex, age, lifestyle, blood pressure and glucose level.

3.3. Experimental protocol

All the diabetic patients were screened randomly by plasma glucose (mg/dl) using a spectrophotometer (Micro Lab 300) Model (46956 AV Spankeren by the Netherland). Within one hour of blood collection blood samples were mixed with sterilized disposable visitor tubes containing sodium fluoride (Glucose tube). After that samples were centrifuged at 3000 rpm and transported for more examination. The individuals, whose random blood glucose level was 200 mg/dl or high, were referred as a patient of diabetes mellitus. Blood pressure was measured with a sphygmomanometer manually (Model CE0483 CERTEZA Germany). The pressure meter scale ranges from 0-300 mmHg. The reading was compared with the standard blood pressure readings, systolic blood pressure less than >140 mmHg as well as diastolic blood pressure less than >90 mmHg. Pearson chi-square turn was also used for the statistical analysis of diabetes mellitus risk factors amongst the residents of district Swabi.

4. Results

The study was conducted to determine prevalence and risk factors of type II diabetes mellitus in district Swabi, Khyber Pakhtunkhwa, Pakistan. A total of 150 blood samples were collected randomly. Table-1 reveals that the frequency distribution of diabetes among the population of district Swabi, the frequency of diabetic patients was n= 107 (71.3%) while n= 43 (28.7%) of the total n=150 are normal. Mean±SD of the data was 1.29±0.45 and the variance 0.206.

Table-1: Frequency distribution of diabetes mellitus in District Swabi

Variable	Frequency	Percentage	Mean±SD	Variance
Diabetes	107	71.3%		
Non-diabetes	43	28.7%	1.29±0.45	0.206
Total	150	100%		

Figure 1 shows the frequency distribution of diabetes among the population of district Swabi, the frequency of diabetic patients was (n= 107, 71.3%) while (n= 43, 28.7%) of the total (n=150) were normal.

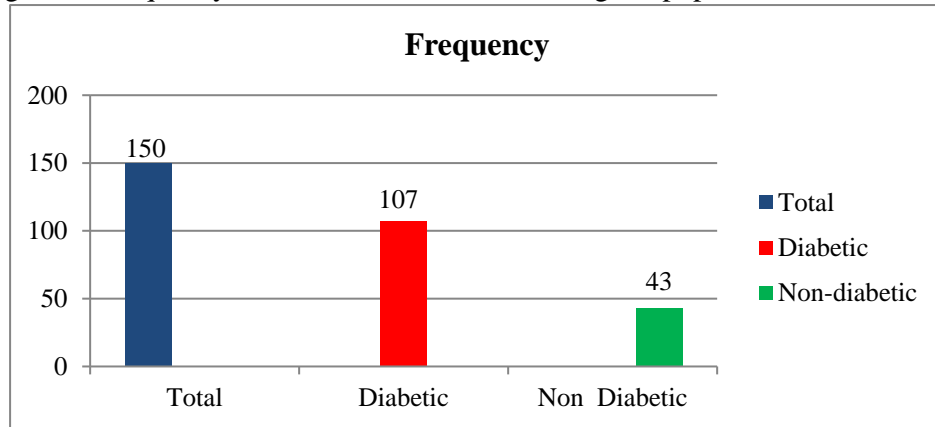Figure 1: Frequency distribution of diabetes among the population of district Swabi

Table-2 shows the association between blood glucose level and diabetes. The blood glucose level is divided into three categories. The frequency of patients who have blood glucose level from 200 to 300 (n=84, 56%), out of this (n=59, 39.3%) were diabetic and (n=25, 16.7%) were non-diabetic. 301 to 400 (n=56, 37.3%), out of this (n=43, 28.7%) were diabetic and (n=13, 8.7%) were non-diabetic individuals, 401 to 500 (n=10, 6.7%) out of this (n=7,4.7%) were diabetic and (n=3, 2%) were non-diabetic individual. Mean±SD of the data was 1.51±0.621 and variance was 0.718. The p-value was 0.000. Therefore, there was strong association of blood glucose level and Diabetes mellitus.

Table-2: Blood glucose level-wise frequency distribution of diabetic and non-diabetic population of Swabi

Variable	Blood glucose level			Total	Mean±SD	Variance	P-value
	200-300	301-400	401-500				
Diabetic	59 (39.3%)	43 (28.7%)	7 (4.7%)	109 (72.7%)			
Non-diabetic	25 (16.7%)	13 (8.7%)	3 (2%)	41 (27.3%)	1.51±0.621	0.386	0
Total	84 (56%)	56 (37.3%)	10 (6.7%)	150 (100.0%)			

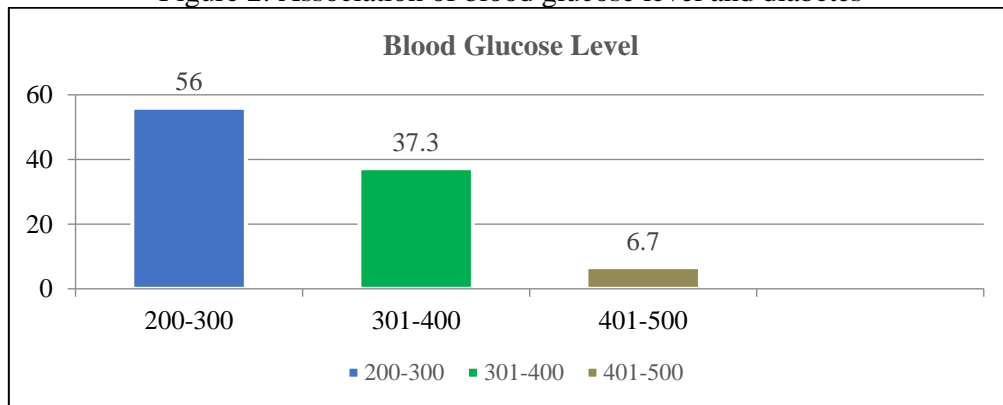Figure 2: Association of blood glucose level and diabetes

Table-3 shows the blood pressure level via diabetic mellitus. The blood pressure level was less than 140/90 (n= 23, 15%), out of this n= 13 (8.7%) were diabetic and n= 10 (6.7%) were non-diabetic individuals, 140/90-160/110 (n= 79, 52%), out of this 64 (42.7%) were diabetic and n= 15 (10%) were non-diabetic individuals, 161-180 (n= 30, 20%), out of these n= 21 (14%) were diabetic and n= 9 (6%) were non-diabetic participants of the study. Greater than 181 (>181) are n= 18 (12%) out of this n= 11 (7.3%) were diabetic while n= 7 (4.7%) were non-diabetic population of the total n=150. This shows that 140/90-160/110 was more affected than other age groups. Mean±SD of the data was 151±0.621 and variance was 0.386 while the P-value was 0.069. Therefore, there was no absolute association between blood pressure level and Diabetes mellitus.

Table-3: Blood pressure level wise frequency distribution of diabetic and non-diabetic population

Variable	Blood Pressure level				Total	Mean±SD	Variance	P-value
	>140/90	140/90-160/110	161-180	<181				
Diabetic	13 (8.7%)	64 (42.7%)	21 (14%)	11 (7.3%)	109 (72.7%)	1.51±0.621	0.386	0.069
Non-Diabetic	10 (6.7%)	15 (10%)	9 (6%)	7 (4.7%)	41 (27.3%)			
Total	23 (15%)	79 (52%)	30 (20%)	18 (12%)	150 (100.0%)			

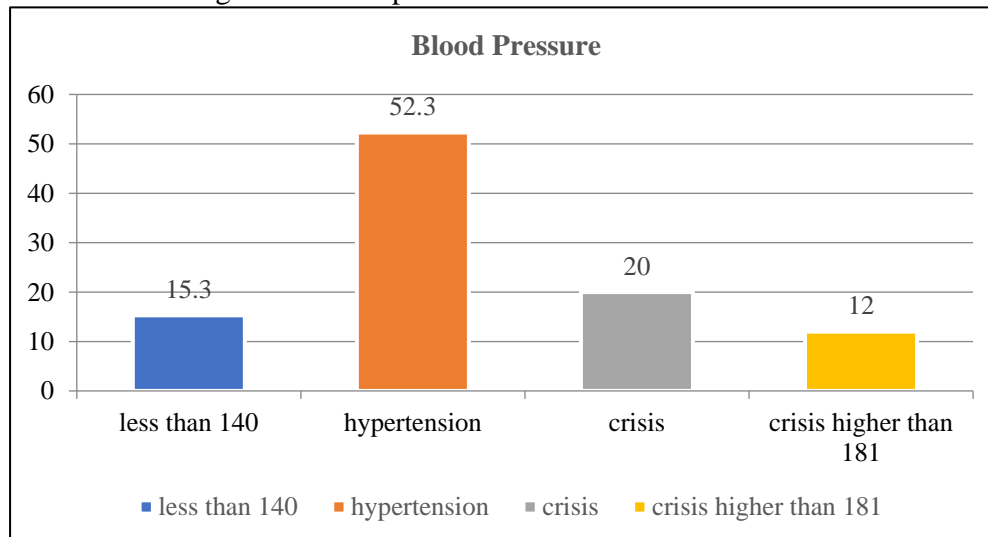Figure 3: Blood pressure level via diabetic mellitus

Table-4 shows the hypertension wise diabetic and non-diabetic population of Swabi. In total 150 population n= 125 (83%) were hypertension population out of which n= 95 (63.3%) were diabetic, while n= 30 (20%) were non-diabetic population. Out of total n= 25 (16.7%) were normal, in which n= 14 (9.3%) were diabetic and n=11 (7.3%) was normal population. Mean±SD of the data was 1.17±0.374 and variance was 0.140 while the P-value was 0.041. Therefore, there was a strong association between the hypertension and diabetes mellitus in the population of Swabi, Khyber Pakhtunkhwa.

Table-4: Hypertension wise frequency distribution of diabetic and non-diabetic population

Variable	Hypertension		Total	Mean±SD	Variance	P-value
	Positive	Negative				
Diabetic	95 (63.3%)	14 (9.3%)	109 (72.7%)			
Non-diabetic	30 (20%)	11 (7.3%)	41 (27.3%)	1.17±0.374	0.14	0.041
Total	125 (83%)	25 (16.7%)	150 (100%)			

Figure 4: Hypertension wise diabetic and non-diabetic population of Swabi
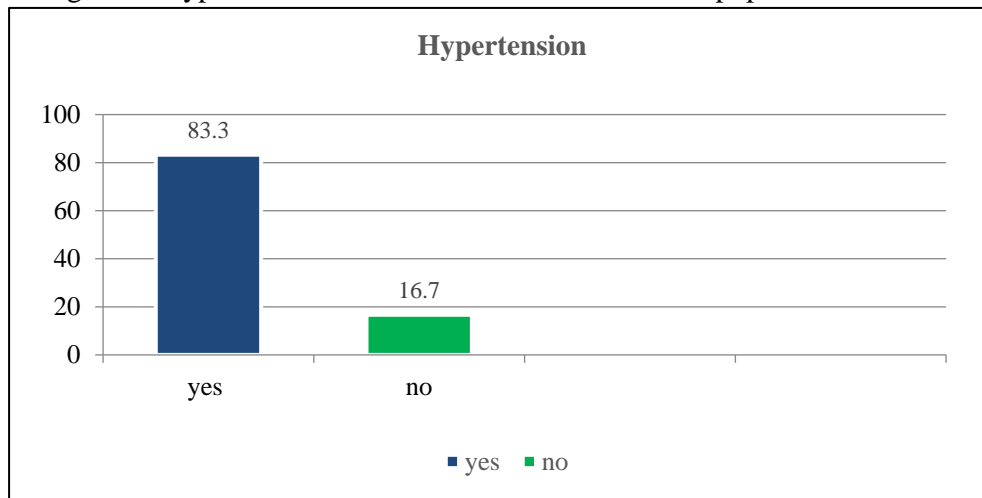
5.   Discussion

Diabetes mellitus has gained lots of concentration due to its speedy prevalence. National Diabetes Survey of Pakistan (1994-1998) stated that the frequency of diabetes is 8.7% which raised to 26.3% in 2017 and is increasing day by day. Therefore, the current study was conducted to examine the occurrence of diabetes mellitus as well as the risk factors in region Swabi, Khyber Pakhtunkhwa, Pakistan. Total of 150 samples were collected randomly out of which 107 (71.3%) were diabetic patients while other 43 (28.7%) were normal. The significant risk factors of diabetes mellitus were hypertension (n= 95, 63%, CI 95% and P-value was 0.041 < 0.05), Moreover, factors like gender, education, smoking, age (P-value > 0.05) were non-significant for diabetes among the population of district Swabi.

The study found that the frequency distribution of diabetes mellitus was 71.3% in the population of district Swabi while Basit *et al.* (2018) reported that the prevalence of diabetes was 26.3% in Pakistan. In support of this Aamir *et al.* (2019) reported that in Pakistan prevalence of diabetes mellitus was 28%. Furthermore, according to Zuhaid *et al.* (2012) in Peshawar the prevalence of diabetes was 47.1%. In addition to this Akhtar *et al.* (2011) stated that the occurrence of diabetes mellitus was 9.52% in district Swat. Similarly, Fatima *et al.* (2022) reported that in district Mardan the prevalence of diabetes mellitus was 50.4%. The growth in diabetes mellitus may be due to changes in daily life which lead to unhealthy foods and inactivity. It may vary from place to place depending on population size, environmental changes and sample size.

In the current examination, there was a significant association of diabetes mellitus with hypertension 63% (P = 0.042 < 0.05) compared to the study conducted in China by Qiu *et al.* (2021) the association of diabetes mellitus with hypertension was 59%. Similarly Said *et al.* (2019) reported that there was a significant association of diabetes with hypertension 29.9%. Furthermore, Zuhaid *et al.* (2012) reported that hypertension was 31.8%, which means there was a strong association with diabetes mellitus. In support of this study, Basit *et al.* (2018) and Aamir *et al.* (2019) also reported that Hypertension has a significant association with diabetes mellitus. Likewise, the present study was upheld by Akhtar *et al.* (2021), the researchers reported hypertension (P = 0.022) was strongly significant to diabetes mellitus. In addition to this study Smith *et al.* (2012) said that hypertension has a significant association with diabetes mellitus. Similarly, Rahati *et al.* (2014) also supported that hypertension was a strong risk factor for diabetes mellitus.

The present examination reported that socioeconomic status was a non-significant risk factor for diabetes mellitus. In support of this study Robbins *et al.* (2005) also reported that socioeconomic status was not a crucial factor of diabetes mellitus. Similarly, Brancati et al., 1996) reported that factors like smoking, profession, marital status, monitoring health and lifestyle were non-significant risk factor of diabetes mellitus. Due to the reason that these factors vary from man to man, place to place, therefore these factors contributed differently at different conditions. Due to heterogeneous nature of diabetes mellitus, it was difficult to investigate the risk factors. Genetic history, environmental effects, feeding habits, physical movements, and psychological changes vary from parson to parson.

6.   Conclusion

The findings of the present study showed that there was a significant association of diabetes mellitus with hypertension, hyper glyceridemia and anxiety/depression. Moreover, other risk factors like gender, age, education and smoking were not systematically significant in association with diabetes mellitus. The exact cause of diabetes is unknown; however, there are some factors like hypertension, overweight, inactive lifestyle, food habits, and environmental and genetic history that can affects which build sugar in bloodstream. Therefore, pancreas does not produce enough insulin. Consequently, there is an abnormally high blood glucose level in the body. This leads to diabetes mellitus as well as other microvascular and macro vascular complications. Gradually, long-term complications of diabetes are developing. The longer the diabetes and the less controlled blood sugar, the higher are the risk of complications. Eventually, diabetes complications may be disabling or even life-threatening.

It was of enormous significance to estimate diabetes, hypertension and investigate risk factors to prevent continual diseases in the population of district Swabi, Khyber Pakhtunkhwa, Pakistan. Diabetes mellitus Type II has become a major fitness problem in the area of Swabi. Consequently, proper as well as higher policies are mandatory to triumph over the current problem. Medical check-ups should be regulated. Instructional level change is needed into the first-rate predictive thing of diabetes mellitus for public attention and prevention of disease. The population need to eat fruit and vegetables and get the vitamins, minerals, and fibres. Consuming 0-calorie or low sweeteners are also called synthetic sweeteners it may assist to control blood glucose levels and helping weight down. It is better to get important nutrients by ingesting an aggregate of different foods. Physical activities are must, which help to manage the diabetes mellitus along with decrease of the risk of heart disease.

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