



Prevalence, factors and complication of Diabetes in an underdeveloped Region of Khyber Pukhtun Khawa: A cross-sectional study

Fazal Shan^{*1}, Sajid Ali², Imad Ud Din³, Majid Ullah², Hamza Ali², Hammad Rashid², Hassan Khan², Rafi Ullah², Arbaz Khan², Muhammad Khalid Khan², Imad Khan⁴

¹*Department of Molecular Biology and Genetics, Khyber Medical University, Peshawar, Pakistan*

²*Department of Medical Lab-Technology Institute of Health Sciences, Khyber Medical University, Dir lower, Pakistan*

³*Department of Health, Institute of Health Sciences, Khyber Medical University, Dir lower, Pakistan*

⁴*Department of Microbiology, Khyber Medical University, Peshawar, Pakistan*

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Abstract

This cross-sectional study aimed to investigate the prevalence and associated factors of diabetes in an underdeveloped region. The study was conducted over a four-month period, involving 409 participants from a specific region in Pakistan. Data on demographic characteristics, clinical variables, and risk factors were collected using questionnaires and laboratory tests. Statistical analysis was performed to determine prevalence rates and assess associations between variables. The study revealed a high prevalence of diabetes, with 22.49% of the participants diagnosed as hyperglycemic. The prevalence of diabetes was found to be higher in males compared to females. Risk factors such as obesity, hypertension, and positive family history were significantly associated with diabetes. Various diabetes-related complications, including retinopathy, gestational diabetes mellitus, periodontal disease, diabetic nephropathy, and heart disease, were identified among the participants. This study highlights the alarming burden of diabetes in the studied underdeveloped region. The higher prevalence of diabetes in males, the association with risk factors, and the presence of diabetes-related complications underscore the need for urgent public health awareness campaigns. Early diagnosis, treatment, and preventive measures are crucial to mitigate the increasing prevalence of diabetes. Further research and interventions are required to effectively manage and reduce the burden of diabetes in underdeveloped regions.

*Corresponding Author: Fazal Shan ✉ fazalshan.ibms@kmu.edu.pk

Introduction

Diabetes is a metabolic disorder characterized by elevated blood glucose levels, known as hyperglycemia. It arises from abnormalities in insulin secretion, action, or both, leading to disruptions in carbohydrate, fat, and protein metabolism. The condition is progressive and heterogeneous, displaying diverse manifestations and complex pathogenesis (Association, 2010). The signs and symptoms of diabetes include polydipsia (excessive thirst), unintended weight loss, polyphagia (increased appetite), and hyperglycemia (elevated blood glucose levels) (Ramachandran, 2014). Diabetes classifies into four categories, type I diabetes, type II diabetes, gestational diabetes, and diabetes that has a specific etiology which may be genetic or secondary to drugs, pancreatic factors, or other illnesses (Forouhi and Wareham, 2019). It is a widespread global problem, currently impacting around 415 million individuals, with projections suggesting it may affect up to 642 million more people worldwide by the year 2040 (Herman, 2017). A cross-sectional study of 3.47 million young individuals found that the prevalence of type 1 diabetes among those aged 19 or younger increased significantly from 1.48 to 2.15 cases per 1000 youths. Additionally, the prevalence of type 2 diabetes among individuals increased from 0.34 to 0.67 cases per 1000 individuals. Around 90 to 95% of individuals are diagnosed with type 2 diabetes (Divers *et al.*, 2020, Badawi *et al.*, 2010, Whiting *et al.*, 2011). In 2019, it is estimated that approximately 9.3% of the global population, which amounts to around 463 million people, had diabetes (Saeedi *et al.*, 2019).

In the last ten years, diabetes prevalence has risen more rapidly in both developed and developing countries (WHO, 2016). Diabetes is associated with changes in alteration in small vessels, larger vessels, and metabolic functions (Abbott *et al.*, 2002). It can lead to various health complications, such as vision impairment (Diabetic Retinopathy), gestational diabetes mellitus, gum diseases (Periodontal Disease), kidney failure (Diabetic Nephropathy), stroke, nerve disorders (Diabetic Neuropathy), and heart diseases (Kaul *et al.*, 2013). The primary aim of this study was to determine the occurrence of

diabetes among residents living in underdeveloped regions and to promote increased awareness of this condition within the local communities.

Materials and methods

Study design, duration and setting

A cross-sectional study was carried out over duration of four months, from Jan to May 2023. The study was conducted at THQ Hospital Samarbagha, located in the Dir-lower region of the Khyber Pakhtunkhwa province in Pakistan.

Sample size, Sample selection criteria

The sample size for the study, determined by using the world health organization (WHO) calculator, was (n= 409). In present study included all individuals aged 24 and above who had been diagnosed with diabetes, as well as volunteers who willingly participated. Females with pregnancies and individuals who were not residents of Tehsil Samarbagha were excluded from the study.

Data collection process

Demographic information was obtained from patients using a questionnaire as part of the data collection process. Diabetic patients were screened for random plasma glucose levels (measured in mg/dl) using a erba spectrophotometer Chem 7 bio chemistry analyzer within one hour of blood collection, blood samples were drawn into sterilized disposable vacuonier tubes containing sodium fluoride tube.

After collecting the blood samples, they were centrifuged and transported for further analysis. The blood glucose levels were measured using the glucose oxidase peroxidase method. Individuals were categorized as having type II diabetes mellitus if their random blood glucose levels were equal to or higher than 200mg/dl. Those with blood glucose levels between 140-199mg/dl (7.8-11.0mmol/L) were classified as having pre-diabetes mellitus. Similarly, hypertension was diagnosed in individuals whose blood pressure (BP) readings were 140/90 or higher. Obesity was confirmed in persons with a Body Mass Index (BMI) greater than 30kg/mm².

Data analysis

The data obtained from the study were analyzed using appropriate statistical methods. Descriptive statistics such as means, standard deviations, frequencies, and percentages were calculated to summarize the demographic characteristics and clinical variables of the participants. Statistical Package for the Social Sciences (SPSSv21) software was used to perform the data analysis.

Results

A total of 409 samples were collected for the study. Among these samples, 92 individuals (22.49%) were identified as hyperglycemic, indicating higher-than-normal blood glucose levels. The remaining 317 samples (77.50%) were categorized as normal, representing individuals with blood glucose levels within the expected range as shown in table no 1.

Table 1. Prevalence of hyperglycemic patients.

Factors	Number of Samples	Percentage
Hyperglycemic	92	22.49%
Normal	317	77.50%
Total	409	100%

Out of the total 409 samples collected, 279 samples (68.21%) were from male participants, while 130 samples (31.78%) were from female participants as shown in table no 2.

Table 2. Distribution of samples based on gender.

Parameters	Number of Samples	Percentage
Male	279	68.21%
Female	130	31.78%
Total	409	100%

The highest numbers of samples (113 samples, 27.62%) were collected from individuals aged 41 to 50 years. The second-highest numbers of samples (86 samples, 21.02%) were from individuals aged 31 to 40 years. The distribution of samples across other age groups is as follows: 70 samples (17.11%) from individuals aged 51 to 60 years, 68 samples (16.62%) from those aged 61 to 70 years, 42 samples (10.26%) from participants aged 71 years and above, and 30 samples (7.3%) from individuals aged 24 to 30 years.

Table 3. The distribution of samples based on age groups.

Age	Number of Samples	Percentage
24-30 years	30	7.33%
31-40 years	86	21.02%
41-50 years	113	27.62%
51-60 years	70	17.11%
61-70 years	68	16.62%
71 years above	42	10.26%

Out of the 92 hyperglycemic samples, 53 samples (57.60%) were from male participants and exhibited hyperglycemia. On the other hand, 39 samples (42.40%) were from female participants with hyperglycemia. This indicates a higher prevalence of hyperglycemia in males compared to females.

Table 4. Gender based prevalence of hyperglycemia.

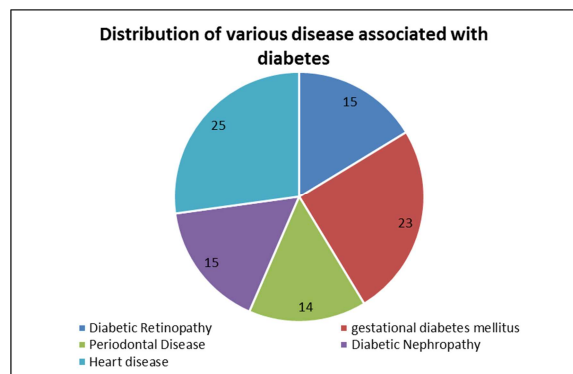
Gender	Number of Samples	Percentage
Male	53	57.60%
Female	39	42.40%
Total	92	100%

The study examined the risk factors associated with hyperglycemia among a total of 409 participants. The findings revealed that 52 individuals (12%) who had hyperglycemia were also affected by Hypertension, obesity and Familial history. Moreover, 123 participants (30.10%) were diagnosed with hypertension without any reported obesity. Additionally, a significant number of 153 individuals (37.4%) had a positive familial history of hyperglycemia. Furthermore, 81 participants (20%) were identified as obese. These results highlight the association between hyperglycemia and risk factors such as hypertension, obesity and familial history of the disease within the studied population.

Among the total of 92 diabetic individuals, various diseases associated with diabetes were identified. Specifically, 15 individuals (16.3%) had diabetic retinopathy, 23 individuals (25%) had gestational diabetes mellitus, 14 individuals (15.2%) had periodontal disease, 15 individuals (16.3%) had diabetic nephropathy, and 25 individuals (27.2%) had heart disease. These findings highlight the presence of multiple coexisting health conditions that are commonly associated with diabetes as shown Fig. 1.

Table 5. Risk Factor associated with hyperglycemia.

Hypertension /obesity/ Familial history		Hypertension		Familial history		Obesity	
No. of samples	%	No. of samples	%	No. of samples	%	No. of samples	%
52	12	123	30.10	153	37.4	81	20.00

**Fig. 1.** Distribution of various diseases associated with diabetes.

Discussion

Based on our study findings, it was observed that 22.49% of the participants had hyperglycemia. This prevalence rate is comparable to the reported rate of 21.7% in the United States (US) (Stanifer *et al.*, 2016). In a study conducted by Chiwanga *et al.* in Uganda, it was found that the prevalence of diabetes was reported to be 10.1% (Chiwanga *et al.*, 2016). According to the diabetes survey conducted in Pakistan by Basit *et al.* in 2018, the prevalence of diabetes in the entire country was reported to be 26.3%. The study found that individuals above the age of 43, those with hypertension, and obese individuals were at a higher risk of developing diabetes compared to those who were considered healthy (Basit *et al.*, 2018). In the samarbagh region, the study revealed that a significant number of patients were unaware of their clinical diabetes condition. The variation in prevalence rates can be attributed to the level of knowledge and awareness about diabetes within the community. Factors such as dietary patterns, lack of adherence to treatment, and inadequate preventive measures may contribute to the high prevalence observed. It is crucial to prioritize public health awareness campaigns in order to address the burden of diabetes in our regions effectively. Additionally,

early detection and treatment of communicable diseases are of utmost importance, particularly in underprivileged regions of Pakistan.

The present study investigated the prevalence of diabetes and associated factors among individuals residing in underdeveloped regions. The present study found that hyperglycemic individuals were predominantly in the 41-50 age group (27.62%). In contrast, a US study reported a higher prevalence (41.4%) in the 26-39 age group (Stanifer *et al.*, 2016), while a study from Uganda showed a high prevalence (53.6%) in the 18-39 age group (Chiwanga *et al.*, 2016). These variations highlight differences in the age distribution of hyperglycemic patients across studies, emphasizing the importance of considering age demographics when comparing findings. The gender distribution showed a higher proportion of male participants (57.60%) compared to females (42.40%). Higher prevalence of diabetes was observed among males. This finding contrasts with several studies conducted in different countries worldwide, where the prevalence of diabetes was reported to be higher among females than males (Basit *et al.*, 2018). In Punjab, Sindh, and Balochistan provinces of Pakistan, a higher number of female patients were observed compared to male individuals with diabetes. However, in the Khyber Pakhtunkhwa province of Pakistan, the prevalence of diabetes was higher among male patients (54.1%) compared to female patients (45.9%), which aligns with the findings of the present study (Basit *et al.*, 2018).

The prevalence of hypertension among diabetic patients was found to be 30.10% in our study. This aligns closely with the reported prevalence of 31% in a study conducted in the United States by Stanifer *et al.* (Stanifer *et al.*, 2016). Similarly, another study reported a similar prevalence of hypertension among diabetic individuals in Uganda, with a rate of 29.5% (Chiwanga *et al.*, 2016). These findings are consistent with the present study, indicating a higher occurrence of hypertension in individuals with diabetes (Basit *et al.*, 2018). Obesity among diabetic patients was observed 20.0% in current study. This percentage differs significantly from the reported rate

of 58.0% in the study conducted by US study conducted in 2016 (Stanifer *et al.*, 2016). Similarly, 43.2% a prevalence of for obesity found among diabetic patients in Uganda (Chiwanga *et al.*, 2016). These results highlight variations in obesity prevalence among diabetic individuals across different studies. In our study, 37.4% of the patients had a positive family history of diabetes. This percentage differs from the reported rate of 19.5% in the study. These findings suggest variations in the prevalence of a positive family history of diabetes among the studied populations. The present study found a higher prevalence of a positive family history of diabetes compared to the study conducted in Uganda (Chiwanga *et al.*, 2016). According to the diabetes survey conducted in Pakistan, it was discovered that 30.2% of individuals with diabetes had a positive family history of the disease (Basit *et al.*, 2018). Consistent with expectations, the prevalence of diabetes was found to be higher among individuals with a positive family history of the disease compared to those without such a history. This observation suggests that the incidence of diabetes is likely to rise in future (Danquah *et al.*, 2012). Several studies have reported a significant association between diabetes and a positive family history, with the risk of developing diabetes being two to six times higher in individuals with a family history of the disease compared to those without (Harrison *et al.*, 2003). Moreover, various diseases associated with diabetes were observed within the study population. Diabetic retinopathy, a complication affecting the eyes, was found in 16.3% of diabetic individuals. Gestational diabetes mellitus, a type of diabetes that occurs during pregnancy, was identified in 25% of cases. Other complications such as periodontal disease (15.2%), diabetic nephropathy (16.3%), and heart disease (27.2%) were also prevalent among the diabetic participants.

Conclusion

The current study provides important insights into the prevalence and associated factors of diabetes in the studied population. The findings reveal a concerning burden of diabetes, with a significant proportion of individuals being affected. The study highlights the higher prevalence of diabetes among

males, the association of diabetes with risk factors such as obesity, hypertension, and positive family history, and the presence of diabetes-related complications. These results emphasize the urgent need for public health awareness campaigns to address diabetes in the region and promote early diagnosis, treatment, and preventive measures. Further research is warranted to explore interventions and strategies to effectively manage and reduce the burden of diabetes in underdeveloped regions.

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