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PREVALENCE OF DIABETES IN DIFFERENT AGE GROUPS AND GENDERS MEASURED BY HBA1C

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ABSTRACT

Objective: To determine the prevalence of diabetes in different age groups and genders measured by HbA1c. Study Design: cross-sectional, retrospective research. Place and Duration of Study: This retrospective, cross-sectional study was carried out at Department of Pathology in Buch International Hospital, Multan from 1st January 2023 to 31st Dec 2023, after the approval of ethical committee. Methodology: A total of 2331 patients, were selected by non-probability and consecutive sampling technique, with no specific age limit of both genders, after taking informed consent. Almost 2 ml venous blood was taken from the cubital vein following standard operating procedure. Sample was taken in EDTA vial, clot was checked physically and mixed in roller mixer for 3-5 minutes. Quality controls were performed before running the samples. Samples were run in Cobas C311 analyzer and results appeared on screen. Results are entered into Fotis/HMIS by duty technician or technologist. Initial authentication is done by lab manager and finally the reports were approved by duty Pathologist. During sampling age and gender were recorded. The reference value for a "normal" HBA1c level in a normal healthy adult is less than 5.7% and for prediabetes between 5.7 to 6.4%, and > 6.4% is considered as diabetes. Results: In our study, total 1189 patients among 2324 patients were diabetic with 51.2%. Pre-diabetic patients were 704/2324 with total percentage of 30.3. Total 593 males (out of 1035) with percentage of 49.9 % and 596 females (out of 1289) with percentage of 50.1% were affected with diabetes showing higher prevalence in females. Percentage of diabetes in various age groups was also calculated which exhibit the highest rates of illness(51.8 in females aged 41 to 60 years, while men are more effected in first two decades of life with overall percentage of 64.3% with second peak in 81- 100 years of age with 63 %. There were 288 males and 416 females (out of 2324) who showed normal HBA1c values within reference ranges. Prediabetes patients are mostly females 416 with overall 50.1%. Conclusion: According to the current study, diabetes mellitus is quite prevalent among Multan City's population. Overall, 51.1% of Multan's population has diabetes. Type 2 diabetes is more common in young people and is brought on by an unhealthy and sedentary lifestyle. . Diabetes can be avoided early on by treating risk factors such as insulin resistance and obesity. National programs that promote healthy habits from an early age should be given priority in the health care agenda.

INTRODUCTION

The condition known as diabetes mellitus (DM) is caused by insufficient insulin production, a hormone necessary for the body to metabolise carbohydrates. Nowadays, diabetes mellitus (DM) is the leading cause of disease and death (1). High rates of hospitalisation, renal failure, blindness, and organ amputations are associated with diabetes worldwide (2). One chronic hyperglycaemic condition is diabetes mellitus. The reasons of hyperglycemia or decreased insulin secretions might result in increased glucose synthesis and decreased glucose utilisation, depending on the aetiology of diabetes (3).

Diabetes mellitus type 2, commonly referred to as non-insulin dependent diabetes, is a metabolic disease characterised by elevated blood glucose levels brought on by insulin resistance and insufficiency (4). Globally, the number of people with diabetes is rising, according to. According to the World Health Organisation, a globally renowned organisation, the number of cases of diabetes would undoubtedly rise from 246 million in 2007 to almost 380 million by 2025. Diabetes is becoming more common worldwide as a result of sedentary lifestyles, ageing, obesity, urbanisation, physical inactivity, and poor eating habits. According to estimates, 49.7% of individuals with type-II diabetes go undiagnosed (2). The average life expectancy is reduced by approximately ten years in persons with type-II diabetes. The bulk of diabetic patients in emerging nations are younger than 64. Between 2010 and 2030, the prevalence of diabetes in the adult population is predicted to rise by 69% in emerging nations compared to 20% in industrialised nations. The prevalence of diabetes is rapidly increasing in Pakistan, a developing nation. Although estimates of the incidence of diabetes differ from study to study, numerous research studies have been conducted to examine the prevalence of diabetes and related risk factors (3).

Recent research show that the prevalence of this disease has increased by more than 12.1% in India, followed by Pakistan (11.1%) and China (6.1%). According to research, Asians are 3.8 times more likely than white Caucasians to get diabetes. About 8 million people in Pakistan have diabetes, making it the fourth-largest country on the list. The WHO predicts that number will double by 2025. The primary causes of type 2 diabetes are biological, followed by hereditary factors. A positive history of DM, the use of antidiabetic medication, or a HbA1c of ≥6.5% (48 mmol/mol) were the criteria used to identify DM. The American Diabetes Association (ADA) classified prediabetes, or pre-DM, as having a HbA1c of 5.7% to 6.49% (39–47 mmol/mol). Diabetes testing will aid in future planning and service delivery because the rising prevalence of type II diabetes is one of Pakistan's fastest-growing public health issues and significantly strains the country's already meagre health care budget (4).

METHODOLOGY

From January 1, 2023, to December 31, 2023, this retrospective, cross-sectional investigation was carried out at the Department of Pathology at Buch International Hospital in Multan.

, after the approval of ethical committee. After obtaining informed consent, a total of 2331 patients were chosen using a non-probability, consecutive sampling procedure, with no age restrictions for either gender. Using standard operating technique for blood sample, approximately 2 millilitres of venous blood were extracted from the cubital vein.Sample was taken in EDTA vial and clot was checked physically and mixed in roller mixer for 3-5 minutes. Quality controls were performed before running the samples. Samples were run in Cobas C311 analyzer and results appeared on screen. Results are entered into Fotis/HMIS by duty technician or technologist. Initial authentication is done by lab manager and finally the reports were approved by duty Pathologist. During sampling age and gender were recorded. The results were compared with reference values of HBA1c as discussed above

Data analysis was done with SPSS version 21. Frequencies and percentages were used to summarise the categorical factors (normal, prediabetes, and diabetic state) and the quantitative variables (age and gender). The stratification process was used to control for effect modifiers such as age and gender. Following stratification, the correlation between categorical variables was ascertained using the Pearson Chi-Square test. A significance level of $p < 0.05$ was considered.

RESULTS

This study included a total of 2324 patients undergoing HBA1c testing from 1st January 2023 to December 2023.

Of the 2324 patients in total, 1035 were men and 1289 were women.The mean age for male is calculated about 53.1 with standard deviation of 15.1and mean age for female was found 49.8 with SD of 15.01 with 95% confidential interval as shown in table 1.

TABLE. 1

	Gender	N	Mean	Std. Deviation
Age	Female	1289	49.80	15.016
	Male	1035	53.01	15.185
	Total	2324		

In our study, total 1189 patients among 2324 patients were diabetic with 51.2%. Prediabetic patients were 704/2324 with total percentage of 30.3 as shown in Table 2.

TABLE 2.

Status Frequency		Percentage (%)	Cumulative Percent
Pre-Diabetic	704	30.3	30.3
Normal	431	18.5	48.8
Diabetic	1189	51.2	100
Total	2324	100	

Total 593 males (out of 1035) with percentage of 49.9 % and 596 females (out of 1289) with percentage of 50.1% were affected with diabetes showing higher prevalence in females as shown in Table 3.

TABLE 3

Status	Count		%Result	
	Male	Female	Male	Female
Diabetic	593	596	49.9	50.1
Pre-Diabetic	288	416	40.9	59.1
Normal	154	277	35.7	64.3

Prevalence of diabetes in different age groups was also calculated which show highest incidence of diseases (51.8%) among the 41-60 years old people in females while men are more effected in first two decades of life with overall percentage of 64.3% with second peak in 81100 years of age with 63 % as shown in table 4.

TABLE 4

Age Group	Status	Gender	
		Female	Male
1-20	Pre-Diabetic (%)	50	50
	Diabetic	35.7	64.3

	Normal	66.7	33.3
	Pre-Diabetic (%)	61.9	38.1
21-40	Diabetic	46.7	53.3
	Normal	73.1	26.9
	Pre-Diabetic (%)	60.1	39.9
41-60	Diabetic	51.8	48.2
	Normal	55.1	44.9
	Pre-Diabetic (%)	55.6	44.4
61-80	Diabetic	50.2	49.8
	Normal	49	51
	Pre-Diabetic (%)	44.4	55.6
81-100	Diabetic	37	63
	Normal	33.3	66.7

There were 288 males and 416 females (out of 2324) who showed normal HBA1c values within reference ranges. Prediabetes patients are mostly females 416 with overall 50.1% as shown in Figure 1.

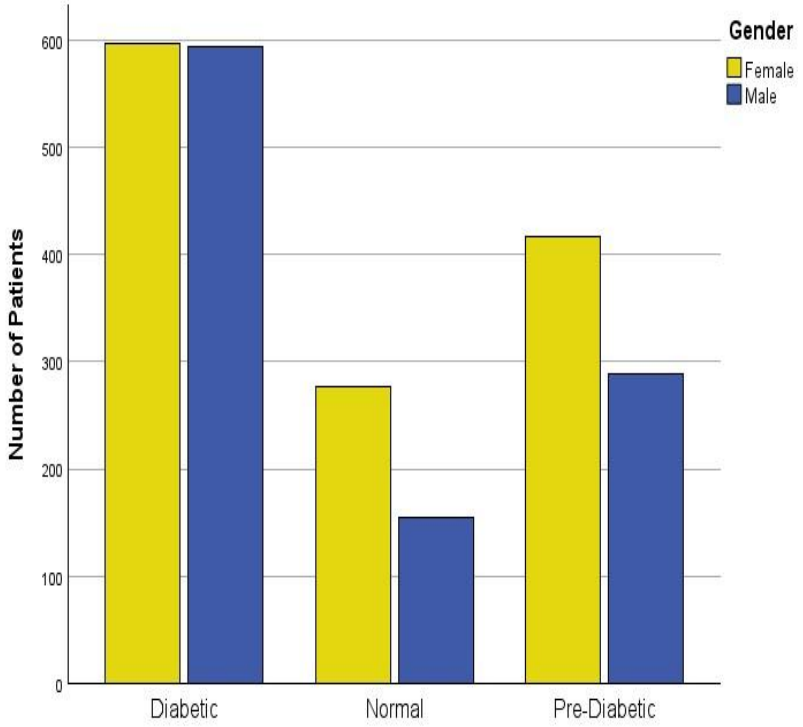

FIGURE 1 DISTRIBUTION OF DIABETIC, NORMAL AND PRE-DIABETIC PATIENTS

DISCUSSION

In poor nations, diabetes mellitus (DM), an incurable metabolic condition, has been a financial burden. It has been determined that 240 million people worldwide suffer with diabetes. According to one estimate, this number will rise alarmingly in the upcoming years, reaching 380 million by 2025, severely burdening low-income nations. Pakistan is currently ranked sixth among nations with a higher risk of diabetes. The prevalence rate of diabetes was

found to be 3.5% for women and 6% for men in urban communities, but 6.9% for men and 2.5% for women in rural settings (1,2)

The percentage of circulating haemoglobin that is glycated is shown by HbA1c. Glycation is a non-enzymatic process that measures the average plasma glucose during the preceding 8–12 weeks and serves as a biomarker for glucose levels over time (5). These days, it is regarded as the gold standard for evaluating the consequences of diabetes and is utilised for both diabetes diagnosis and quantification. However, Rahi and associates initially reported an elevated HbA1c level in diabetic patients in 1968, and throughout the ensuing decades, it emerged as the most significant marker of blood glucose management. It is frequently used to evaluate how well diabetes medication is working (6).

The test is affordable, simple to administer, and efficient. Furthermore, the association between microvascular problems and HbA1c is curvilinear. Lower HbA1c levels are linked to a delayed onset of certain microvascular problems, according to three seminal trials conducted in patients with type 2 diabetes (ACCORD, ADVANCE, and VADT). On the other hand, high HbA1c is also regarded as a risk factor for stroke and coronary heart disease on its own (6,7). However, it is not useful for quantifying glycaemic fluctuations within and between days.which are an unreliable measure in patients with anaemia, certain hemoglobinopathies, iron insufficiency, and liver disease, and which have been connected to both microvascular and macrovascular problems. Moreover, it doesn't offer comprehensive guidance on how to modify the treatment plan (8,9). Compared to Caucasians, African Americans and Hispanics in the US have higher HbA1c concentrations (by 0.2–0.4%). According to the research, there are racial and ethnic variations in glycation levels that impact the precision of HbA1c assays (10).

There are different studies done in Pakistan. In one study by Khalid M et al,among the 139 patients who met the inclusion criteria and women made up 72.7% of the total. 346 female and 370 male subjects made up the total of 716 subjects. Male prevalence of diabetes was estimated to be 42.43% (157 out of 370), while female prevalence was determined to be 43.64% (151 out of 346). Diabetes incidence was also calculated for different age groups, with the lowest incidence (28.26%) occurring in the 11–30 age group and the highest incidence (60.62%) occurring in the 51–70 age group. Conversely, 38.77% of those between the ages of 31 and 50 were noted. Age was related to the prevalence of diabetes mellitus, which rose in both sexes as people aged (1).

Amir et al. conducted a community-based investigation on the prevalence of type 2 diabetes in Pakistan using glycated haemoglobin (HbA1c) as the screening test. Of the 18,856 eligible patients, 16.98% (95% CI 16.44 to 17.51, n = 3201) had type 2 diabetes, and 10.91% (95% CI 10.46 to 11.36, n = 2057) had prediabetes. The largest occurrence was among females (17.80%, p=0.009) and those aged 51–60 (26.03%, p<0.001) (2).

Huang S et al conducted study in Tawainese adults which showed variation of HBA1c with different ages and gender. It showed that for the two age groups of 30-39 and 40-49 years, males' HbA1c readings were considerably greater than those of females and it indicated that, for the 50–59 age range, there was no discernible variation in HbA1c values between the sexes. Male Chinese aged 70 years or older and Japanese aged 54 years or older likewise showed similar outcomes. It is unclear, therefore, why older guys' HbA1c levels did not rise with age (5)

The National Health Insurance Research Database was utilised by Sheen et al., 2019 to find out the frequency of diabetes in Taiwan. Men had a higher prevalence of DM overall, but women over 65 had a higher prevalence. In people over 80, the prevalence of DM was over 50%. The prevalence of diabetes mellitus is steadily rising, however the incidence barely increased between 2005 and 2014 (6).

The study was conducted in Kanungu Health Centre IV in Kanungu District, which has a total population of 252,144.. Among the 139 patients in study who met the inclusion criteria, women made up 72.7% of the total. It was discovered that 7.9% and 22.8% of the men and women, respectively had diabetes. The age range of 51–55 had the highest rate of diabetes, at 30.4%, followed by the group of 61–65, at 65%. All participants in the 66–70 and 76–80 age groups were non diabetic. This bivalent

analysis revealed significant relationships between being diabetic and the following factors: body mass index (BMI) (overweight and obese), age groups 61–65, smoking, alcoholism, and family history (10).

According to the 2016 WHO national profile, 14.4% of Saudi citizens are diabetics, with a 14.7% incidence in men In Jeddah, the prevalence of prediabetes was 9.0% in 2015, with 9.4% of men affected; for diabetes, the prevalence was 12.1%, with 12.9% of adult males suffering from the disease. The greatest risk variables were high age (> 45), hypertension and high triglyceride levels, a study carried by Khaled Ket al (11).

In another study by Mirzaei M et al.Women had a substantially higher prevalence than men (15.6 vs. 12.4%). Significant correlations were identified between age, education, marital status, unemployment, insurance status, and a good family history with the prevalence of DM ($P < 0.0001$). There were 25.8% of those with pre-diabetes. 58.3% of diabetic patients did not have their condition under control, which is not statistically significant when considering socioeconomic position (12).

Similar study carried by S.Akhter et al, in 26 population-based studies, 80775 people in all, drawn from 996 potentially pertinent studies, were included in the meta-analysis. The combined prevalence of diabetes in the general population was 7.8% (95% CI: 6.4–9.3). In a sample of 56,452 individuals, the cumulative prevalence of pre-diabetes was 10.1% (95% CI: 6.7–14.0; 17 studies). The results of the invariable meta-regression analysis demonstrated a relationship between the age of patients, the year of the study, and the existence of hypertension and the prevalence of diabetes. The prevalence of diabetes was significantly higher in urban than in rural areas, with no clear gender difference (13).

1189 of the 2324 people who came in for a diabetes mellitus diagnosis were found to be afflicted, according to our study's random selection process. The study showed that diabetes was very common (51.2%) among the population of Multan City that is higher than previous study done by Khalid M et al carried in 2021.

According to the current study, age-wise occurrence of Diabetes was highest in the age group 1-20 in males affected with overall 64.3 % with second high peak at age 81-100 years in males with overall percentage of 63 % and in that age group females are less affected. Females are affected in age group in age group 41-60 with overall 51.8%. That was different from study carried by Khalid M et al in people of Bahawalpur. The possible cause for increase in frequency of diabetes in young age group is found to be lack of exercise and unhealthy life style. So, age is independent factor in prevalence of diabetes in population of Multan.

In line with Khalid M's study, which also indicated that the prevalence of diabetes was higher in women (43.64%) than in men (42.43%),(1). This is also comparable to a research by Aamir et al. in Multan that found that women are more likely than men to have diabetes, with a prevalence of 55% versus 45% (2)et al in Multan that females have high prevalence of diabetes 55% as compared to males 45% (2) This study is also comparable to carried by Akhtar et al those females have high percentage of diabetes 15% as compared to males 14% (3). Explanation for the higher predominance of this disease in comparison to men was that women tend to be housewives, engage in fewer outside activities, and are hence more likely to be obese. Age, changes in lifestyle, and dietary and eating habits were the main causes of the rise in the prevalence of diabetes among females.

CONCLUSION

According to the results of our study, 51.1% of Multan City's population has diabetes mellitus. Young people especially males in first two decades of life are more effected by type 2 diabetes which is due to unhealthy and sedentary life style. Although gestational diabetes is also contributing factor for high prevalence of diabetes in females. By addressing risk factors like obesity and insulin resistance, diabetes can be prevented in its early stages. Priority should be given in the health care agenda to national initiatives that encourage people to lead healthy lifestyles beginning at an early age.

DECLARATION

The authors declare that there is no conflict of interest.

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