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Original Research Article

Frequency of Prediabetes in Patients With High BMI Presenting to a Tertiary Care Hospital

Shehzad[1], Kalimullah[1], Abdul Hanan[2], Yasir[1], Fawadullah[1]

[1]Department of Medicine, QHAMC Nowshera, Pakistan
[2]Department of Medicine, NMC Nowshera, Pakistan
**Corresponding author`s email address:* kalim83@yahoo.com

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Abstract: *Prediabetes is characterized by elevated blood sugar levels but not yet diabetes. Preventive interventions are crucial to prevent the progression to full-blown diabetes.* ***Objective:*** *This study aimed to determine the Frequency of prediabetes in patients with high BMI presenting to a tertiary care hospital.* ***Method:*** *The current cross-sectional study was conducted at the Department of Medicine, Qazi Hussain Medical Complex, Nowshera, over 6 months (July to December 2024) after taking permission from the ethical board of the institute. A total of 126 individuals with high BMI (body mass index 25 ≥ kg/m2) of both genders and different age groups (18-85 years) were included. Demographic data, including BMI, gender, age, education, employment, residence, and socioeconomic position, were collected. A history of hypertension and smoking was also reported. Participants with a high BMI were tested for pre-diabetes using Fasting Plasma Glucose (FPG) or Hemoglobin A1c (HbA1c) evaluations. Data was analyzed through SPSS version 25. The post-stratification chi-square or Fisher's exact test was applied to determine the significance.* ***Results:*** *A total of 126 individuals were screened in this study, out of which 20(15.8%) were found to be pre diabetes. Of the prediabetes individuals, 13 (65%) were males and 7(45%) were females. In this study, 75% of individuals had a family history of diabetes, one of the prediabetes risk factors. Most research participants (50%) come from lower-income families and live in rural regions (75%). A history of hypertension was observed in 85% of the individuals, and smoking in 70% of the participants. The majority (90%) were overweight, while 10% were obese. The Chi-Square test results showed values of 0.03, showing a strong association between prediabetes and body mass index (p-value <0.05).* ***Conclusion:*** *The present study concluded that the Frequency of prediabetes was 15.8% in patients with high BMI 15.8%. A significant association exists between prediabetes and BMI (Chi square = 0.31, p-value < 0.05).*

Keywords: Frequency; Prediabetes; Body mass index

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Introduction

Elevated blood sugar levels characterize Prediabetes but not yet diabetes, which is a warning sign of metabolic dysfunction. Preventive interventions are crucial to prevent the progression to full-blown diabetes. (1)Pre-diabetes, which is generally asymptomatic and insidious in development, presents a significant chance for early intervention to prevent complications. To improve metabolic health, managing disease progression, preventing complications, and making lifestyle adjustments is important. (2)Diabetes may be classified into type 1, type 2, and gestational diabetes. Type I diabetes affects children and young adults and is caused by the immune system attacking beta cells in the pancreas, which create insulin. Lifelong insulin treatment is necessary for survival. (3) Type II diabetes, the most prevalent kind, often affects older individuals and is linked to lifestyle factors. These variables cause insulin resistance and issues with blood sugar regulation. (4) Complications of diabetes significantly reduce both quality of life and life duration. Diabetes has a significant financial burden, depleting healthcare resources and limiting socioeconomic growth, particularly in low- and middle-income countries coping with both infectious and non-communicable diseases. (5, 6)Effective diabetes treatment needs a coordinated strategy that includes lifestyle modifications, medication use, regular blood glucose examinations, and patient education. (7)Obesity is characterized by excess fat or adipose tissue in the body, which can lead to health issues such as diabetes, cardiovascular disease, hypertension, and hyperlipidemia. (8) In Pakistan, adults (42% men and 58% females) had a generalized obesity prevalence of 57.9%, according to research. Obesity requires several treatment methods and may even lead to life-threatening conditions. Losing weight can improve health and well-being and reduce economic costs for individuals and the country. (9)A study found a 20% prevalence of pre-diabetes in high BMI individuals. (10) Managing pre-diabetes in high BMI individuals requires a personalized approach that addresses both metabolic and obesity-related complications. This study aims to identify the prevalence of pre-diabetes in patients with high BMI at our health facility, as there is no existing literature on the issue locally. This study aims to provide healthcare providers with the knowledge and tools to optimize care for at-risk patients, foster interdisciplinary collaboration, and pave the way for personalized, patient-centered management approaches tailored to individual needs and preferences.

Methodology

The current cross-sectional study was conducted at the Department of Medicine, Qazi Hussain Medical Complex, Nowshera, over 6 months from July to December 2024, after taking permission from the ethical board of the institute. The non-probability sampling technique was used. The sample size was determined using the WHO calculator. A total of 126 individuals with high BMI (body mass index 25 ≥ kg/m2) of both genders and different age groups (18-85 years) were included. In contrast, individuals with renal and hepatic diseases, taking vitamin D supplements, and having already had diabetes mellitus were excluded. Demographic data, including BMI, gender, age, education, employment, residence, and socioeconomic position, were collected. A history of hypertension and smoking was also reported. Participants with a high BMI were tested for pre-diabetes using Fasting Plasma Glucose (FPG) or Hemoglobin A1c (HbA1c) evaluations. A sterile needle was used to puncture a vein in the inside of the elbow or back of the hand and collect a small amount (3 mL) of blood in a tube for lab investigations. A post-

fellowship consultant with at least five years of experience monitored the entire process. The patient's information was recorded on a pre-designed structured proforma..Data was analyzed through SPSS version 25. For numerical data like age, height, weight, and BMI, the mean + SD or IQR was represented as c. Categorical data, including gender, pre-diabetes, hypertension, smoking, education, occupation, domicile, and socioeconomic status, were presented in frequency and prevalence. Effect modifiers, including age, gender, BMI, hypertension, smoking, education, employment, domicile, and socioeconomic status, were stratified. The post-stratification chi-square or Fisher's exact test was applied to determine the significance.

Results

A total of 126 individuals were screened in this study, of which 20(15.8%) were pre diabetes. The average age of the research participants was 46.8 ± 8.25 years. Of the prediabetes individuals, 13 (65%) were males and 7(45%) were females. The most prevalent age group was 63-77 years (30%), followed by the age group 48-62 years (25%) and 33-47 years (20%), respectively. 70% of the participants were illiterate. In this study, 75% of individuals had a family history of diabetes, one of the prediabetes risk factors. Most research participants (50%) come from lower-income families and live in rural regions (75%). A history of hypertension was observed in 85% of the individuals, and smoking in 70% of the participants, as presented in Table 1. The majority (90%) were overweight, while 10% were obese, as shown in Table 2. The Chi-Square test results showed values of 0.03, which show a strong association between prediabetes and body mass index (p-value <0.05) as presented in Table 3.

Table 1: Demographic features of the study participants

Variables	Frequency /Percentage	Value of P
Age in years		
18-32	2(10%)	0.7
33-47	4(20%)	
48-62	5(25%)	
63-77	6(30%)	
78-85	3(15%)	
Gender		
Male	13(65%)	0.7
Female	7(45%)	
Education		
Illiterate	14(70%)	0.002
Literate	6(30%)	
Occupation		
Farmer	5(25%)	0.003
Barbar	10(50%)	
Teacher	5(25%)	
Family history of diabetes mellitus		
No	5(25%)	0.001
Yes	15(75%)	
Socio economic class		
Upper	5(25%)	0.6
Middle	5(25%)	
Lower	10(50%)	
Residence		
Urban	5(25%)	0.2
Rural	15(75%)	
History of smoking		
Yes	14(70%)	0.001
No	6(30%)	
History of hypertension		
Yes	17(85%)	0.001
No	3(15%)	

Table 2: Body mass index of the study participants

BMI	Frequency	Percentage
Overweight	18	90%
Obese	2	10%

Total	20	100%

Table 3. Chi-Square test results

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	8.800a	3	.033	0.31
Likelihood Ratio	12.460	3	.009	0.13
Fisher's Exact Test	9.962			0.19
Number of cases	20			

Discussion

Prediabetes is more common than diabetes and poses a significant health risk. A study in India revealed that 14% of the population had prediabetes. However, it is often asymptomatic, making diagnosis challenging. (11) Identifying prediabetes and related risk factors is crucial for achieving a meaningful treatment effect. In this study, 126 individuals with high BMI were screened, of which 20(15.8%) were found to be pre diabetes. The incidence is higher than that found by Muthunarayanan et al. (12), a study of the rural Tamil Nadu population, and Ahmed et al. (11) in a study of Kashmir residents aged 20 and above. In the current study, the majority of the prediabetics were male (65%). Previously, community-based research revealed a male predominance in the diabetic and prediabetic population. (13) In our study, the age group with the highest prevalence of prediabetes was 63-77 years, accounting for 30% of the population. The significant frequency of prediabetes in this age range can be attributed to ageing. Insulin-producing enzymes are disturbed at this stage. Changes in cell permeability and nuclear response to insulin can lead to a rise in blood glucose. Women are more likely to develop prediabetes due to their lower muscle mass, which can lead to moderate to severe insulin resistance. Patients without stable employment were more likely to develop prediabetes due to a lack of routine physical activity. The majority of these individuals sit at home and watch TV, which raises the risk of prediabetes. The biggest number of instances was observed among the barbarians. Individuals with a family history of DM are more likely to develop prediabetes. The study found that 75% of prediabetes patients had a family history of DM. Wagner's multicenter study in Germany found that having a family history of diabetes mellitus was substantially linked with the development of prediabetes ($p < 0.001$). A family history of diabetes mellitus increases the risk of prediabetes by around 40%. (14) In the present study, most (90%) were overweight, while 10% were obese. Obese persons are more likely to have prediabetes than those with a normal body weight. BMIs exceeding normal limits increase the risk of problems, including prediabetes, diabetes, and hypertension. A study found that having a higher BMI than normal affects peripheral resistance to glucose absorption, reducing the sensitivity of pancreatic beta cells. (15) Research indicates that 80% of obese or overweight individuals suffer from hyperglycemia. (16) A study in Iraq found that having a BMI of less than 25 kg/m2 increased the risk of hyperglycemia by 2.7 times. (17) Insulin resistance in prediabetes affects muscle, liver, and fat tissues. The Chi-Square test yielded a score of 0.31, indicating a correlation between prediabetes and BMI. Obese individuals had more instances than those with normal body weight. Excess visceral fat in prediabetic individuals may contribute to insulin resistance in the liver and muscles, resulting in hyperglycemia. Adipose tissue is an endocrine organ that produces both pro- and anti-inflammatory peptides. Inflammation in the pancreas leads to insulin resistance, elevated glucose levels, and poor lipid metabolism. (18) When insulin levels are adequate and sensitive, it binds to receptors on cell surfaces, allowing glucose to enter cells for energy or storage. This results in normal blood glucose levels. (19)Obesity leads to insulin resistance by reducing the number of receptors and preventing post-receptor activation of tyrosine kinase, a subunit B of the insulin receptor. Activating this complex activates beta-phosphorylase and insulin, which regulate blood sugar levels. Hyperinsulinemia occurs when signals for regulating blood sugar levels are not delivered properly. Diabetes risk factors include genetic, physical activity, nutrition, and hormonal metabolism. Increased glucose and fat promote fatty acid transport into adipose tissue and lipogenesis, which is influenced by insulin. Partial oxidation of fatty acids provides ketones, an alternate fuel source for the brain and other organs. Fat tissues have other tasks in addition to storing energy. Excess adipose tissue, a frequent ailment in modern life, has been linked to insulin resistance. (20)

Conclusion

The present study concluded that the Frequency of prediabetes was 15.8% in patients with high BMI 15.8%. A significant association exists between prediabetes and BMI (Chi square = 0.31, p-value < 0.05).

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-*QHAMC*-045-24)
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

S (TMO)
Manuscript drafting, Study Design,
K (Assistant professor/chairman)
Review of Literature, Data entry, Data analysis, and drafting articles.
AB (Professor)
Conception of Study, Development of Research Methodology Design,
Y (TMO)
Study Design, manuscript review, and critical input.
F (TMO),
Manuscript drafting, Study Design,

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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