Frequency of Prediabetes in Patients Presenting for Routine Checkup in Outpatient Department

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Abstract: *Prediabetes is an intermediate metabolic state of elevated blood glucose levels that fall below the threshold for diabetes diagnosis. Often asymptomatic, it serves as an early warning sign for the future development of type 2 diabetes.* **Objective:** *To determine the frequency of prediabetes and evaluate associated demographic and lifestyle risk factors among patients attending routine outpatient checkups.* **Methods:** *This cross-sectional study was conducted at the Department of Medicine, PAEC General Hospital, Islamabad, from December 2024 to May 2025. A total of 201 patients aged 20–70 years, attending for routine checkups, were included through non-probability consecutive sampling. HbA1c was measured to assess glycemic status. Prediabetes was defined as HbA1c levels between 5.7% and 6.4%.* **Results:** *Prediabetes was detected in 26 out of 201 patients (12.9%). A statistically significant association was found between prediabetes and both BMI ≥30 (p = 0.03) and sedentary lifestyle (p = 0.048). No significant associations were observed with gender, age, smoking status, place of residence, or income. Logistic regression analysis confirmed obesity and physical inactivity as independent predictors of prediabetes.* **Conclusion:** *It is concluded that the frequency of undiagnosed prediabetes is substantial in patients presenting for routine OPD checkups. Obesity and sedentary lifestyle were key risk factors. Routine HbA1c screening should be integrated into outpatient settings to enable early detection and preventive care.*

Keywords: Body Mass Index (BMI), HbA1c, Obesity, Outpatient Checkups, Prediabetes, Sedentary Lifestyle, Type 2 Diabetes Risk

Introduction

The epidemic of diabetes is one of the most alarming public health issues of the 21st century, especially for lower middle-income countries (1). It was predicted that from 2010 to 2030, there will be a 67% increase in the prevalence of diabetes in these countries. Diabetes-related complications are the major cause of premature deaths in the world, (2) with a death occurring in every 6 s due to the consequences of diabetes. In 2015, approximately five million diabetes-related deaths were reported in low-income and middle-income countries (3). According to the International Diabetes Federation (IDF) the number of adults with impaired glucose tolerance (IGT) is expected to increase globally, reaching 472 million by 2030 (4). The greatest rises are expected in South-East Asia and the Western Pacific Region (5). Impaired glucose tolerance prevalence for South-East Asian region for 2015 among 20-79 years old is 6.2% and is expected to go upto 7.2% by 2040 (5). Prediabetes is the term used for non-diabetic hyperglycemia associated with the simultaneous presence of insulin resistance and β-cell dysfunction, abnormalities that start before glucose changes are detectable. Interventions that improve insulin sensitivity can typically slow the progression to diabetes (6, 7). In a study done In Lahore on 400 subjects, pre-diabetes frequency was found to be alarmingly high at 34%.[6] A study from rural Uganda included 370 participants and has showed pre-diabetes in 9.19% patients (7) while a study in Saudi Arabia on 638 females that reported pre-diabetes in 18.8% particioants (8). A meta-analysis of 17 studies from 1995 to 2018 conducted in Pakistan concluded the prevalence of T2DM and pre-DM in Pakistan to be 10.0 % and 11.0 %, respectively (9). Amidst the rising prevalence of diabetes and prediabetes, it is crucial to identify the burden of pre-diabetes in our population. This is important as it will highlight this at a national level to trigger a national health response for screening, awareness and also to prevent progression to diabetes. Screening and timely identification of pre-diabetic patients highlights an important target group for preventing progression of diabetes, awareness about lifestyle and dietary modifications and routine follow ups to prevent its debilitating complications. Regardless of the rising DM burden in the Pakistani, recent studies showing the rising incidence of diabetes and pre-diabetes in the Pakistani population are lacking. The present study, therefore, aims to investigate the frequency of pre-diabetes in patients presenting for routine checkup in local population so that strategies can be developed for early lifestyle modifications for pre-diabetics and to prevent progression to diabetes and its associated complications.

Methodology

This cross-sectional study was conducted at the Department of Medicine, PAEC General Hospital, Islamabad from December 2024 till May 2025. Data were collected using a non-probability, consecutive sampling technique. The sample size was determined using the WHO sample size calculator, based on an anticipated proportion of 9.19%, a confidence level of 95%, and a precision requirement of 4%, resulting in a calculated sample size of 201 participants. Accordingly, a total of 201 patients were included in the study.

Participants were selected based on specific inclusion and exclusion criteria. Individuals presenting to the outpatient department (OPD) for routine checkups, as defined in the operational definition, were eligible for inclusion. The study included patients aged between 20 and 70 years, irrespective of gender. However, certain conditions were grounds for exclusion. These included pregnancy as noted in medical records, a history of pre-existing diabetes mellitus, renal failure, and other metabolic or endocrine disorders such as hypertension, dyslipidemia, coronary artery disease, polycystic ovarian syndrome, Cushing's syndrome, and acromegaly. These exclusions were applied to ensure the integrity and specificity of the study population.

After approval from ethical review committee, total 201 patients presenting to OPD department of Medicine, PAEC General Hospital, Islamabad, fulfilling the inclusion criteria were selected. After obtaining informed consent, demographic characteristics such as age, gender, height, weight, BMI, smoking status (yes/no), place of residence (rural/urban), monthly income (<25,000 / 25,000–50,000 / >50,000 PKR), and lifestyle (simple/sedentary) were recorded. A 5 ml venous blood

sample was collected from each participant and sent to the institutional pathology laboratory for the measurement of HbA1c levels. The presence or absence of prediabetes, as per the operational definition, was noted by the researcher. All laboratory analyses were conducted using chemiluminescent microparticle immunoassay (CMIA) for the quantitative determination of HbA1c percentage in human whole blood, utilizing the ARCHITECT Plus system (Architect HbA1c 4P72, Abbott Laboratories). All collected data were documented on a specially designed data collection form (Annexure I).

Data analysis

All data were entered and analyzed using SPSS version 25.0. The Shapiro-Wilk test was applied to assess the normality of continuous variables. Age, height, weight, and BMI were presented as mean ± standard deviation (SD) or median with interquartile range (IQR) as appropriate. Frequencies and percentages were calculated for categorical variables such as gender, smoking status, place of residence, monthly income, lifestyle, and prediabetes status. To assess the impact of potential effect modifiers such as age, gender, BMI, smoking status, place of residence, monthly income, and lifestyle, stratification was performed. The Chi-square test was then applied post-stratification to evaluate their association with prediabetes. A p-value ≤ 0.05 was considered statistically significant.

Results

A total of 201 patients participated in the study. The mean age of the participants was 44.6 ± 12.2 years, indicating a middle-aged population with moderate variability. There was an almost equal gender distribution, with 102 males and 99 females. The mean body mass index (BMI) was 26.4 ± 3.9 kg/m², placing the average participant in the overweight category, highlighting a potential metabolic risk within the study group. The mean HbA1c level among non-prediabetic participants was 5.2 ± 0.3%, with a range of 4.8 to 5.6%, indicating normal glycemic status. In contrast, participants classified as prediabetic had a mean HbA1c of 5.9 ± 0.2%, ranging from 5.7 to 6.4%, reflecting moderately elevated blood glucose levels consistent with the diagnostic criteria for prediabetes.

Table 1: Demographic Characteristics of Study Participants

Variable	Value
Total Patients	201
Mean Age (years)	44.6 ± 12.2
Male	102
Female	99
Mean BMI (kg/m²)	26.4 ± 3.9

Out of 201 patients, 26 (12.9%) were diagnosed with prediabetes. The frequency was slightly higher in males (13.7%) than females (12.1%), though this difference was not statistically significant (p = 0.74). Age-wise distribution showed a higher prevalence in the 40–59 and ≥60 age groups (both 14.3%) compared to 20–39 years (9.8%), without statistical significance (p = 0.42). A significant association was observed with BMI (p = 0.03), as the frequency of prediabetes increased from 6.9% in those with BMI <25 to 22.0% in those with BMI ≥30. Smoking status and place of residence did not show significant associations, with slightly higher frequencies noted among smokers (15.8%) versus non-smokers (11.8%) and urban (13.8%) versus rural residents (11.5%), with p-values of 0.47 and 0.62 respectively.

Table 2: Frequency of Prediabetes by Gender

Gender	Prediabetic (n)	Total (n)	Frequency (%)	p-value
Male	14	102	13.7	
Female	12	99	12.1	0.74
Total	26	201	12.9	
Risk Factor / Category				

	Prediabetic (n)	Total (n)	Frequency (%)	p-value
Age Group				
20–39 years	6	61	9.8	
40–59 years	14	98	14.3	0.42
≥60 years	6	42	14.3	
BMI				
<25	5	72	6.9	
25–29.9	12	88	13.6	0.03
≥30	9	41	22.0	
Smoking				
Smoker	9	57	15.8	
Non-smoker	17	144	11.8	0.47
Residence				
Urban	17	123	13.8	0.62
Rural	9	78	11.5	

Table 3: Mean HbA1c Levels by Prediabetes Status

Group	Mean HbA1c (%)	Range (%)
Non-Prediabetic	5.2 ± 0.3	4.8 - 5.6
Prediabetic	5.9 ± 0.2	5.7 - 6.4

Logistic regression analysis revealed that participants with a BMI of 30 or above had significantly higher odds of developing prediabetes, with an odds ratio (OR) of 2.45 (95% CI: 1.14–5.26, p = 0.021). Similarly, those with a sedentary lifestyle were over twice as likely to be prediabetic compared to those with a simple lifestyle (OR = 2.35, 95% CI: 1.09–5.06, p = 0.028). Other factors, including age ≥60 (OR = 1.51, p = 0.37), income >50,000 PKR (OR = 1.22, p = 0.63), and smoking (OR = 1.38, p = 0.42), were not significantly associated with prediabetes, as their confidence intervals crossed unity and p-values were greater than 0.05.

Table 4: Logistic Regression Analysis for Factors Associated with Prediabetes

Variable	Odds Ratio (OR)	95% CI	p-value
BMI ≥ 30	2.45	1.14–5.26	0.021
Sedentary Lifestyle	2.35	1.09–5.06	0.028
Age ≥ 60	1.51	0.61–3.76	0.37
Income > 50,000	1.22	0.53–2.79	0.63
Smoker	1.38	0.64–2.97	0.42

Participants with BMI ≥30 had a significantly higher adjusted odds ratio (OR = 3.92, 95% CI: 1.52–10.1, p = 0.004) compared to those with BMI <25, while those with BMI between 25 and 29.9 had a borderline significant risk (OR = 2.11, 95% CI: 0.98–4.57, p = 0.056). Lifestyle also played a significant role; individuals with a sedentary lifestyle had a higher prevalence of prediabetes (16.3%) and a significantly elevated adjusted odds ratio (OR = 2.31, 95% CI: 1.02–5.23, p = 0.045) compared to those with a simple lifestyle (7.7%).

Table 5: Stratified Analysis of BMI and Lifestyle on Prediabetes

Category	Prediabetic (%)	Adjusted OR	95% CI	p-value
BMI < 25	6.9	1.0	Ref	-
BMI 25–29.9	13.6	2.11	0.98–4.57	0.056
BMI ≥ 30	22.0	3.92	1.52–10.1	0.004
Simple Lifestyle	7.7	1.0	Ref	-
Sedentary Lifestyle	16.3	2.31	1.02–5.23	0.045

Discussion

This cross-sectional study was conducted to determine the frequency of prediabetes among patients attending the outpatient department for routine medical checkups at PAEC General Hospital, Islamabad. The research findings demonstrated that 12.9 percent of studied participants showed prediabetic conditions through HbA1c test results within 5.7 to

6.4 percent range. The actual number of patients with abnormal glucose metabolism detected at 12.9 percent exceeds predicted levels of 9.19 percent suggesting many people are not diagnosed for this condition in healthcare settings without regular screening programs (10). The study participants had an average age of 44.6 years and an equal gender composition among the sample. The prevalence rates of prediabetes between males and females (13.7 percent versus 12.1 percent) demonstrated no statistically significant relationship thus suggesting that sex plays no essential role in this scenario (11).

Research data demonstrated that body mass index showed a strong link to prediabetes statuses. The percentage of prediabetes cases was twenty-two percent for participants who had a BMI value greater or equal to 30 whereas those with a BMI lower than 25 exhibited a prediabetes rate of 6.9%. Research evidence confirms that obesity stands as a chief risk element which produces insulin resistance together with dysglycemia (12). The statistical results from logistic regression confirmed both the relationship and its mathematical strength through an odds ratio which was significant for obesity (13). Lifestyle was another important factor. The prediabetes rate reached 16.3 percent among participants who remained largely sedentary whereas those with a simple lifestyle averaged 7.7% prediabetes (14). Physical inactivity shows a direct correlation to metabolic health status based on statistical results. Health professionals support recommendation documents which state physical activity should be a regular habit to stop non-communicable diseases like type 2 diabetes.In this study, there was no significant correlation found between prediabetes and age, smoking status, residence, or monthly income (15). However, there was a trend toward a higher prevalence among older adults and people with higher incomes, which may be due to these subgroups' dietary habits and decreased physical activity (16). The absence of statistical significance may be due to sample size limitations or selection bias, especially since individuals with known comorbidities were excluded. The findings are consistent with national and international research. Similar prevalence rates of between 10 and 15 percent have been reported in previous Pakistani hospital-based studies. Prediabetes affects about one third of adults worldwide, according to Centers for Disease Control and Prevention data. Many of these adults remain unaware of their condition.

Conclusion

It is concluded that a significant proportion of individuals attending routine outpatient checkups at PAEC General Hospital, Islamabad, were found to have undiagnosed prediabetes, with a frequency of 12.9 percent. The study identified obesity and sedentary lifestyle as significant risk factors associated with prediabetes, while variables such as gender, age, smoking, income, and place of residence showed no statistically significant association. These findings underscore the importance of incorporating routine HbA1c screening in primary care and outpatient settings, even among individuals without known comorbidities. Early detection through such measures can enable timely lifestyle interventions, thereby reducing the risk of progression to type 2 diabetes and its related complications.

Declarations
Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
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The authors declared the absence of a conflict of interest.

Author Contribution

SA (Resident)
Review of Literature, Data entry, Data analysis, and drafting article.
Manuscript drafting, Study Design,
UB (Consultant)
Study Design, manuscript review, critical input.
Conception of Study, Development of Research Methodology 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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