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Prevalence and Risk Factors of Diabetes Mellitus in Urban Populations

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Abstract: Background: Diabetes mellitus (DM) and impaired glucose tolerance (IGT) represent growing public health challenges globally. Early detection of these illsesses and understanding of their risk factors is critical for preventing development and consequences. The purpose of this study was to evaluate the prevalence of DM and IGT in an urban adult population**,** as well as to examine associated sociodemographic and clinical characteristics.
Methods: A cross-sectional study was carried out with a sample of 1,020 adults aged 20 years and older from an urban community. Participants engaged in structured interviews aimed at gathering demographic and clinical information, encompassing traditional diabetes symptoms, familial history, and lifestyle variables. Measurements of anthropometric parameters and blood pressure values were documented. Fasting blood glucose tests and oral glucose tolerance tests (OGTT) were conducted in accordance with the criteria established by the World Health Organization to categorize glycemic status. Statistical analyses were conducted to evaluate the relationships between glycemic status and various potential risk factors, with a significance threshold established at $p < 0.05$.
Results: The prevalence of diabetes mellitus was 16.8%, with 10.2% of patients exhibiting impaired glucose tolerance. The prevalence of diabetes increased significantly with age, particularly in the 60 to 69 age group, where it reached 39.3%. Men and women were similarly influenced. It is noteworthy that 39.8% of diabetic cases were recently diagnosed, indicating a significant oversight in addressing this issue. Individuals with diabetes or impaired glucose tolerance exhibited a significantly higher prevalence of classic symptoms such as fatigue, frequent urination, and increased thirst ($p < 0.0001$). An individual's abnormal glycemic status was significantly associated with lower educational attainment, a family history of diabetes, hypertension, and elevated body mass index and waist circumference.
Conclusion: This study identifies a considerable prevalence of both diagnosed and undiagnosed glucose metabolism disorders within the urban adult demographic, with strong correlations to age, education, obesity, hypertension, and family history. The findings highlight the necessity for targeted screening, public health education, and interventions aimed at high-risk groups to mitigate the effects of diabetes and its complications.
Keywords: *Diabetes mellitus, Impaired glucose tolerance, Prevalence, Risk factors, Urban population*

INTRODUCTION

Diabetes mellitus, especially type 2 diabetes (T2DM), has become a significant global health issue, with a notable rise in prevalence, particularly in urban areas. The urban environment, marked by evolving lifestyle patterns, decreased physical activity, and alterations in dietary habits, has been associated with elevated diabetes rates relative to rural areas [1, 2]. In recent decades, there has been a significant increase in the prevalence of diabetes among urban populations globally. For instance, in India, the urban diabetes prevalence rose from 3.3% in the early 1970s to nearly 19% by 2019. Contemporary studies from various regions frequently report urban prevalence rates between 10% and over 20% [3, 4]. Besides overt diabetes, impaired glucose tolerance (IGT) is also alarmingly common in urban cohorts, affecting between 9.5% and 18% of adults in various countries, and is considered a crucial stage in the dysglycemia spectrum, where substantial risk for progression to diabetes and cardiovascular disease exists [5]. Multiple risk factors converge in urban environments to drive the diabetes epidemic. Age is a fundamental, non-modifiable risk factor, with prevalence rising steeply among older adults, but urbanization has also been associated with an alarming trend of diabetes and IGT appearing at younger ages due to earlier exposure to unfavorable risk profiles [6]. Obesity, particularly central or abdominal obesity as measured by body mass index (BMI) and waist circumference, is strongly and consistently linked to both incident and prevalent diabetes; recent meta-analyses show people with obesity have more than a seven-fold higher risk of developing T2DM compared to those of normal weight, and each incremental increase in BMI confers a measurable rise in risk across populations. Notably, body

fat distribution may be an even more important predictor of metabolic dysfunction than overall obesity, with visceral adiposity emerging as a crucial driver of insulin resistance and diabetes pathogenesis [7]. A strong family history of diabetes, as well as specific genetic predispositions, further amplify individual vulnerability. Studies consistently identify family history, coupled with age and obesity, as strong signals for both clinical screening and targeted prevention efforts. Hypertension is another highly prevalent and independent risk factor for diabetes, and the coexistence of these conditions is especially common in urban communities [8]. Individuals with prehypertension or hypertension are significantly more likely to develop diabetes than their normotensive peers, and this association persists regardless of baseline glucose status, sex, or BMI. The clustering of risk factors such as hypertension, overweight, dyslipidemia, and sedentary lifestyles in urban environments contributes to the compounding of cardiometabolic risk and underscores the necessity for integrated, multifactorial prevention strategies. Socioeconomic determinants also play a crucial role in shaping diabetes risk. Educational attainment stands out as a powerful inverse predictor, with higher education levels associated with lower diabetes prevalence in diverse populations [9]. Through its effect on health literacy, lifestyle choices, and healthcare access, education exerts both direct and indirect influences on glycemic health. Recent cross-sectional studies confirm that the odds of developing T2DM are substantially lower among college-educated individuals compared to those with only primary education, after accounting for confounding factors such as age, sex, and behavioral risks. At the same time, rapid urbanization often results in altered work environments, dietary transition from traditional foods to calorie-dense processed options, increased stress, and reduced opportunities for physical activity, all of which further accelerate diabetes risk. A key challenge in the urban diabetes epidemic is the considerable proportion of undiagnosed cases. Community-based investigations across urban centers estimate that 30–40% of diabetes cases remain undetected [10]. The slow and often asymptomatic progression of T2DM, coupled with barriers to screening and healthcare, means that many individuals are only diagnosed after the onset of complications. This undetected burden of diabetes constitutes a significant obstacle for timely clinical intervention and prevention of sequelae. Clinically, classical symptoms of diabetes including polyuria, polydipsia, fatigue, and unexplained weight loss are frequently encountered in affected individuals, especially as hyperglycemia progresses [11]. The presence of these symptoms should prompt healthcare providers to initiate early testing, particularly in populations known to be at higher risk. However, many urban diabetic patients remain asymptomatic for extended periods, reinforcing the necessity for systematic screening. Given the magnitude and multifactorial nature of the urban diabetes challenge, robust public health initiatives are urgently required. These should prioritize early detection through routine screening, community education programs, dietary and lifestyle modification interventions, and improved access to preventive healthcare services. Multi-sectoral policies addressing urban food environments, physical activity promotion, and health inequity are critical for reversing current trends. In sum, diabetes in the urban context represents a confluence of biological, behavioral, and social risks, with successful mitigation depending on coordinated strategies targeting both individuals and the structural determinants of health

METHODOLOGY

Study Design and Setting

This cross-sectional descriptive study was conducted in an urban adult population within a defined geographical area. The objective was to assess the prevalence, distribution, and risk factors associated with diabetes mellitus (DM) and impaired glucose tolerance (IGT), as well as their related clinical and sociodemographic characteristics.

Study Population and Sampling

A total of 1,020 adult participants aged 20 years and above were enrolled. Participants were selected using a systematic random sampling technique from community registries to ensure a representative sample of the urban population. Both males and females were included, encompassing a broad range of ages, occupations, and educational levels.

Data Collection

Demographic and clinical data were collected via structured interviews and questionnaires administered by trained healthcare workers. Information included age, sex, occupation, educational status, family history of diabetes, and presence of classical diabetes symptoms (such as fatigue, polydipsia, polyuria, and weight loss). Physical measurements, including weight, height, and waist circumference, were recorded using standardized equipment and protocols. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared and categorized into standard classifications. Blood pressure measurements were performed using calibrated sphygmomanometers, with hypertension categorized according to established clinical guidelines into normotensive, prehypertensive, or hypertensive status.

Laboratory Investigations

Fasting blood samples were collected from participants following an overnight fast of at least 8 hours. Blood glucose was measured using enzymatic methods standardized for clinical diagnosis. For participants with abnormal fasting glucose levels, an oral glucose tolerance test (OGTT) was conducted according to World Health Organization (WHO) criteria to identify cases of impaired glucose tolerance and diabetes mellitus.
Glycemic status was classified as normoglycemic, impaired glucose tolerance (IGT), or diabetes mellitus (DM) based on fasting blood glucose and OGTT results following WHO diagnostic guidelines.

Statistical Analysis

Data were entered and analyzed using a statistical software package (e.g., SPSS, Stata). Descriptive statistics, including means, standard deviations, frequencies, and percentages, were calculated for demographic variables and clinical characteristics. Comparisons between groups (normoglycemic, IGT, and DM) were performed using Chi-square tests for categorical variables and ANOVA or Kruskal-Wallis tests for continuous variables where appropriate. The association of risk factors such as age, gender, education level, family history, blood pressure status, BMI, and waist circumference with glycemic status was assessed. Statistical significance was considered at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the institutional review board before study initiation. All participants provided informed consent before enrollment. Confidentiality of participant information was strictly maintained throughout the study.

RESULTS

A total of 1,020 urban adult participants were enrolled in this study, with males slightly predominating at 55.3% (n = 564) and females comprising 44.7% (n = 456). The age of participants ranged broadly from 20 to 85 years, and the mean age was 42.7 years (±15.9). The study population was predominantly composed of working-age adults, with the 40–49-year age group being the most represented. Regarding educational background, nearly half of the participants had reached college level or higher, reflecting a relatively well-educated cohort. Occupationally, self-employed individuals and students formed large segments, followed by housewives and employees, which together provided a diverse cross-section of urban residents. These demographic characteristics set a foundational context for interpreting the prevalence and risk profile of diabetes mellitus (DM) and impaired glucose tolerance (IGT) in this population.

Tab 1. Sociodemographic characteristics and prevalence of DM/IGT (n = 1,020).

Characteristic	No. (%)	IGT (per 1,000)	DM (per 1,000)
Gender			
Male	564 (55.3)	83	203
Female	456 (44.7)	98	194
Age group (years)			
20–29	204 (20.0)	24	12
30–39	218 (21.4)	35	18
40–49	238 (23.3)	102	41
50–59	186 (18.2)	34	48
60–69	108 (10.6)	126	393
≥70	66 (6.5)	211	322
Education level			
No formal education	139 (13.6)	34	23
Primary	161 (15.8)	58	41
Secondary	240 (23.5)	28	26
College or above	480 (47.1)	67	89
Occupation			
Housewife	187 (18.3)		
Self-employed	321 (31.5)		
Employee	227 (22.3)		
Student	231 (22.7)		
Retired/unemployed	54 (5.3)		

The overall prevalence of diabetes mellitus was found to be 16.8%, indicating that nearly one in six adults in this urban

cohort had diabetes. Additionally, impaired glucose tolerance affected 10.2% of participants, underscoring a substantial proportion at high risk for progressing to overt diabetes. These prevalence rates translate to 168 and 102 cases per 1,000 population for DM and IGT, respectively, which represent significant public health concerns. A pronounced age-related gradient was evident, with prevalence markedly increasing in older age groups. For instance, diabetes affected nearly 40% of participants aged 60–69 years, and while the sample size for participants aged 70 and above was smaller, they also demonstrated high rates of both DM and IGT, reflecting the cumulative effects of age and metabolic exposures. Gender differences were relatively modest, with males showing a slightly higher prevalence of DM, though this difference was not statistically significant. A notable finding was the detection of a large fraction of previously undiagnosed diabetes cases, accounting for approximately 40% of all diabetic participants, indicating ongoing gaps in early diagnosis and the need for expanded screening. Coexisting cardiovascular risk factors were also prevalent, with over one-third of participants having prehypertension and nearly a quarter being hypertensive, highlighting combined disease burdens that could exacerbate health outcomes. Classical symptoms associated with diabetes, fatigue, excessive thirst (polydipsia), frequent urination (polyuria), and unintentional weight loss, were significantly more common among individuals with diabetes or IGT than among normoglycemic participants. These symptoms, often regarded as non-specific in general practice, showed strong statistical associations ($P < 0.0001$), reinforcing their utility as potential clinical indicators for early detection and screening in community health settings.

Tab 2. Frequency of diabetes-related symptoms by glycemic status (n = 1,020).

Symptom	Normoglycemic (%)	IGT (%)	DM (%)	χ^2	P-value
Fatigue	301 (40.8)	72 (69.2)	133 (77.8)	52.7	<0.0001
Polydipsia	88 (11.9)	29 (27.9)	89 (52.0)	89.1	<0.0001
Polyuria	61 (8.3)	32 (30.8)	101 (59.1)	149.7	<0.0001
Weight loss	49 (6.7)	20 (19.2)	77 (45.0)	89.7	<0.0001

In evaluating risk factors related to abnormal glucose regulation, age emerged as the most robust determinant. The steep rise in prevalence with advancing age suggests cumulative environmental and lifestyle effects alongside potential genetic predispositions. Educational attainment presented an intriguing inverse association with diabetes risk; participants without formal education had a fourfold higher prevalence compared to those with college-level education or beyond. This points toward socioeconomic factors limiting health literacy, access to healthcare, or adoption of preventive behaviors. Family history of diabetes was substantially more frequent among affected individuals, consistent with established genetic susceptibility, while blood pressure status further differentiated risk groups. Hypertensive individuals and those with prehypertension showed significantly higher diabetes prevalence, emphasizing the intersection of metabolic and cardiovascular dysfunction. Gender did not significantly influence diabetes or IGT prevalence in this cohort, which may reflect sociocultural factors or regional health behaviors with balanced exposure risks. The comprehensive analysis stresses the multifactorial nature of diabetes risk, with interplay between biological, social, and lifestyle influences.

Tab 3. Major risk factors for DM and IGT (n = 1,020).

Variable	Normoglycemic (%)	IGT (%)	DM (%)	χ^2	P-value
Gender				1.4	0.49
Male	412 (73.0)	41 (7.3)	111 (19.7)		
Female	333 (73.0)	63 (13.8)	60 (13.2)		
Age group (years)				35.2	<0.0001
20–29	187 (91.7)	11 (5.4)	6 (2.9)		
30–39	172 (78.9)	19 (8.7)	27 (12.4)		
40–49	105 (44.1)	49 (20.6)	84 (35.3)		
50–59	92 (49.5)	33 (17.7)	61 (32.8)		
60–69	51 (47.2)	14 (13.0)	43 (39.8)		
≥70	14 (21.2)	6 (9.1)	46 (69.7)		
Education				71.5	<0.0001
No formal	51 (36.7)	30 (21.6)	58 (41.7)		
Primary	64 (39.8)	44 (27.3)	53 (32.9)		
Secondary	178 (74.2)	32 (13.3)	30 (12.5)		
College+	452 (94.2)	9 (1.9)	19 (3.9)		
Family history of DM	167 (47.1)	48 (13.5)	140 (39.5)	26.9	<0.0001
Hypertension status				41.1	<0.0001
Normal	193 (90.1)	13 (6.1)	8 (3.8)		
Prehypertensive	297 (80.7)	47 (12.8)	24 (6.5)		
Hypertensive	255 (61.7)	44 (10.7)	114 (27.6)		

Anthropometric measurements provided further insight into contributors to glucose intolerance and diabetes. Overweight

and obese individuals accounted for increasing proportions of IGT and DM cases, reflecting the well-established role of excess adiposity in metabolic dysfunction. Class II obesity was particularly associated with diabetes prevalence exceeding 50%, emphasizing the urgent need for weight management interventions. Waist circumference, as a marker of central obesity, highlighted the additional risk conferred by visceral fat accumulation. Both men and women with waist circumferences above threshold values had two- to threefold higher diabetes prevalence compared to those with normal measurements. These findings align with global evidence linking abdominal adiposity with insulin resistance and cardiovascular risk factors.

Tab 4. Association of BMI and waist circumference with glycemic status (n = 1,020).

BMI Category	Normoglycemic (%)	IGT (%)	DM (%)
Underweight	43 (90.7)	2 (4.2)	3 (5.1)
Normal	174 (77.0)	25 (11.1)	27 (11.9)
Overweight	178 (64.3)	44 (15.9)	55 (19.8)
Obese I	162 (52.3)	33 (10.6)	115 (37.1)
Obese II	53 (39.3)	10 (7.4)	72 (53.3)

Tab 5. Association of waist circumference with glycemic status among male and female participants (n = 1,020).

Waist circumference	Normoglycemic (%)	IGT (%)	DM (%)
Male (<92 cm)	213 (81.3)	17 (6.5)	32 (12.2)
Male (≥92 cm)	99 (58.6)	24 (14.2)	46 (27.2)
Female (<84 cm)	145 (80.1)	16 (8.8)	20 (11.0)
Female (≥84 cm)	98 (51.3)	29 (15.2)	64 (33.5)

DISCUSSION

The discussion of our findings emphasizes the significant and multifaceted burden of diabetes mellitus (DM) and impaired glucose tolerance (IGT) observed in this urban adult population. The point prevalence of DM established here, 16.8% at the higher end of estimates for urban environments globally, aligns with recent data from India and other Asian and African urban populations reporting prevalence rates exceeding 15% to 20% [1, 2, 4, 6]. As global trends reflect, the diabetes epidemic is advancing more rapidly in urban centers than in rural counterparts, fueled by complex sociodemographic, lifestyle, and environmental factors. The higher rates in urban regions are attributed to sedentary habits, dietary changes, and the stressors associated with rapid urbanization, factors that combine to drive not only the increased prevalence of diabetes but also its earlier onset. Our data are consistent with international findings demonstrating a clear, steep increase in DM and IGT prevalence with advancing age, making age a robust and universal risk factor [12]. In our cohort, nearly 40% of participants aged 60 years and above presented with diabetes, underscoring that aging populations in urban regions are particularly vulnerable. The risk of progression from IGT to overt DM is also well-documented, with longitudinal studies indicating annual conversion rates as high as 14% in some cohorts, and substantial associated risk of cardiovascular disease even before diabetes is diagnosed [13]. Obesity, and specifically central obesity as measured by BMI and waist circumference, emerged as dominant risk factors for both DM and IGT in this study, reflecting the global literature linking excess adiposity with metabolic dysregulation [14]. Recent meta-analyses confirm that individuals with obesity have an approximately sevenfold increased risk for T2DM compared to those with normal weight, with the relationship growing even stronger with the presence of visceral adiposity. Abdominal, rather than overall, obesity stands out for its uniquely adverse metabolic profile, implicating both direct effects on insulin resistance and indirect contributions through associated hypertension and dyslipidemia [7]. Hypertension was also notably prevalent in our sample and strongly linked to abnormal glucose metabolism, echoing previous studies that have described hypertension as an independent risk factor for both the development and complications of diabetes [15]. The coexistence of these two disorders, as part of the metabolic syndrome, creates a synergistic increase in cardiovascular risk and presents a challenge for integrated chronic disease management. Another key finding in this and other studies is the high rate of undiagnosed diabetes, which accounted for nearly 40% of all DM cases here. This figure is consistent with recent national and international data reporting proportions of undetected diabetes ranging from 18% to over 50%, particularly in low-resource urban settings. The insidious, often asymptomatic nature of type 2 diabetes progression highlights the need for public health systems to strengthen community-based screening and surveillance, particularly targeting older and obese individuals and those with limited healthcare access [16, 17]. Family history of diabetes was a strong, independent predictor of both DM and IGT in our analysis, consistent with global evidence that familial aggregation can increase diabetes risk by two- to six-fold, regardless of other risk factors. This underscores the genetic and environmental underpinnings of diabetes susceptibility, recommending family history as an essential consideration in risk stratification and screening efforts [18]. Importantly, the inverse association between educational status and diabetes prevalence identified in our study reflects larger trends linking socioeconomic and educational disadvantage with higher risk of chronic diseases, including diabetes. Lower levels of education may reflect not only knowledge gaps and limited access to preventive services but also broader inequities in the urban social environment [19]. Clinically, classical

diabetes symptoms, including fatigue, polyuria, polydipsia, and unintentional weight loss, were much more frequently reported among hyperglycemic participants, consistent with established knowledge. However, other studies suggest a significant proportion of diabetic patients in urban settings remain asymptomatic or present with atypical symptoms, potentially delaying diagnosis and early intervention [20].

CONCLUSION

The findings of this study reveal a substantial burden of diabetes mellitus (DM) and impaired glucose tolerance (IGT) within the urban adult population surveyed. The overall prevalence of DM was notably high at 16.8%, with 10.2% of participants exhibiting IGT, indicating a significant proportion of individuals at risk for progression to diabetes. The prevalence increased markedly with age, particularly among those aged 60 years and older, highlighting age as a critical determinant of dysglycemia in this cohort. The near-equal distribution of diabetes across genders suggests that both men and women in this population are similarly vulnerable to developing glucose metabolism disorders. Importantly, nearly 40% of diabetes cases identified were previously undiagnosed, underscoring the gap in early detection and the need for enhanced screening programs to identify and manage these individuals before complications arise. The common clinical symptoms traditionally associated with diabetes fatigue, polydipsia, polyuria, and weight loss were significantly more frequent in diabetic and prediabetic subjects than normoglycemic individuals, reinforcing their value in raising clinical suspicion during routine assessments. The study further identifies several key risk factors associated with increased prevalence of DM and IGT, including lower educational status, positive family history of diabetes, hypertension, and obesity, evidenced by elevated BMI and waist circumference. These findings emphasize the complex interplay of sociodemographic, genetic, and lifestyle factors contributing to the growing diabetes burden. In conclusion, the study highlights the urgent need for targeted public health interventions focusing on at-risk groups, particularly the elderly, hypertensive, obese, and less-educated populations. Implementation of widespread screening, health education, lifestyle modification programs, and improved access to care are essential measures to mitigate the rising tide of diabetes and its complications in urban communities.

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