

# PREVALENCE AND LIFESTYLE-RELATED RISK FACTORS OF TYPE 2 DIABETES MELLITUS AMONG ADULT POPULATIONS IN URBAN COMMUNITIES OF PAKISTAN: A CROSS-SECTIONAL STUDY

Original Research

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**Acknowledgement:** The authors acknowledge all participants for their voluntary cooperation.

Conflict of Interest: None

Grant Support & Financial Support: None

## ABSTRACT

**Background:** Type 2 diabetes mellitus has emerged as a major public health concern in urban populations of low- and middle-income countries, largely driven by rapid lifestyle transitions. Urban communities in Pakistan are experiencing increased exposure to sedentary behaviors, unhealthy dietary patterns, psychosocial stress, and sleep disturbances, all of which contribute to metabolic risk. Despite this growing burden, community-based data on diabetes prevalence and associated lifestyle factors remain limited in many urban settings.

**Objective:** The study aimed to determine the prevalence of type 2 diabetes mellitus and to examine its association with lifestyle-related risk factors among adults residing in urban communities of South Punjab, Pakistan.

**Methods:** A cross-sectional study was conducted among 84 adults aged 30 years and above living in selected urban localities. Data were collected using a structured interviewer-administered questionnaire capturing sociodemographic characteristics, physical activity, dietary habits, smoking status, sleep duration, and perceived stress. Anthropometric measurements were obtained to calculate body mass index, and diabetes status was verified through self-report and available medical records. Statistical analysis included descriptive statistics, independent sample t-tests, chi-square tests, and binary logistic regression to identify factors associated with diabetes.

**Results:** The prevalence of type 2 diabetes mellitus was 31.0%. Diabetic participants were significantly older and had higher mean body mass index and fasting blood glucose levels than non-diabetic participants. Low physical activity, inadequate fruit and vegetable intake, short sleep duration, and overweight or obesity were significantly more common among individuals with diabetes. Logistic regression analysis identified increasing age, low physical activity, higher body mass index, and short sleep duration as independent predictors of diabetes.

**Conclusion:** The findings indicated a substantial burden of type 2 diabetes in urban adults, strongly linked to modifiable lifestyle factors. These results underscored the importance of targeted lifestyle-based prevention strategies to curb the rising impact of diabetes in urban Pakistani populations.

**Keywords:** Body Mass Index; Diabetes Mellitus, Type 2; Life Style; Physical Activity; Prevalence; Sleep Deprivation; Urban Population.

## INTRODUCTION

Type 2 diabetes mellitus has quietly moved from being a disease of affluence to a full-blown public health crisis, particularly in low- and middle-income countries. It represents a complex metabolic disorder characterized by chronic hyperglycemia resulting from insulin resistance, impaired insulin secretion, or both. Beyond its clinical definition, type 2 diabetes carries serious long-term consequences, including cardiovascular disease, renal failure, neuropathy, visual impairment, and reduced quality of life (1). What makes the condition especially concerning is not just its rising prevalence, but the speed at which it is expanding in urban environments where lifestyle patterns are rapidly evolving. Pakistan is currently facing a significant epidemiological transition driven by urbanization, economic pressures, and lifestyle modernization. Urban communities, in particular, are witnessing a shift toward sedentary routines, increased consumption of energy-dense processed foods, irregular sleep patterns, and higher levels of psychological stress. These changes have created an environment that strongly favors the development of non-communicable diseases, with type 2 diabetes emerging as one of the most prominent (2). The disease often remains undiagnosed for years, allowing complications to develop silently, which further amplifies the burden on individuals, families, and already stretched healthcare systems. Lifestyle-related risk factors play a central role in the onset and progression of type 2 diabetes. Physical inactivity, unhealthy dietary habits, obesity, tobacco use, and poor stress management have been consistently linked to impaired glucose metabolism. In urban Pakistani populations, these risk factors are increasingly common due to long working hours, limited recreational spaces, dependence on motorized transport, and aggressive marketing of fast food and sugary beverages. Cultural norms and socioeconomic constraints can further restrict opportunities for regular physical activity and healthy eating, particularly among certain age groups and occupational categories (3).

Despite growing awareness of diabetes as a major health issue, there remains a disconnect between knowledge and action at the community level (4). Many individuals underestimate their personal risk, especially when symptoms are mild or absent. Additionally, public health interventions often focus on treatment rather than prevention, leading to missed opportunities for early identification of high-risk groups. Reliable, community-based data on prevalence and modifiable risk factors are therefore essential to inform targeted prevention strategies and policy planning. While several studies have examined diabetes in Pakistan, many are either hospital-based or limited to specific subpopulations, which restricts their generalizability (5). There is a clear need for updated, population-level evidence that reflects the lived realities of urban adults across diverse socioeconomic backgrounds. Understanding how lifestyle behaviors interact with demographic and environmental factors can help clarify why certain urban communities are disproportionately affected. Such insights are critical for designing interventions that are practical, culturally acceptable, and sustainable (6).

A cross-sectional approach offers a valuable snapshot of the current burden of disease and associated risk factors within a defined population (7). By capturing data at a single point in time, this design allows for the estimation of prevalence while simultaneously exploring relationships between diabetes and lifestyle variables. Although causal inferences cannot be established, the findings can highlight priority areas for intervention and guide future longitudinal research (8). In rapidly changing urban settings, this type of evidence is particularly useful for timely decision-making. Given the escalating prevalence of type 2 diabetes in Pakistan and the strong influence of modifiable lifestyle factors, there is an urgent need to assess the magnitude of the problem within urban adult populations. Identifying prevalent risk behaviors and patterns can support early prevention efforts and reduce the long-term health and economic consequences of the disease (9). In this context, the present study is designed to determine the prevalence of type 2 diabetes mellitus and examine lifestyle-related risk factors contributing to its occurrence among adult populations residing in urban communities of Pakistan.

## METHODS

The present study employed a cross-sectional design to assess the prevalence of type 2 diabetes mellitus and to examine associated lifestyle-related risk factors among adults residing in urban communities of South Punjab, Pakistan. The study was conducted over a period of four months, allowing sufficient time for participant recruitment, data collection, and verification of responses while maintaining consistency in environmental and lifestyle conditions during the study window.

The study population comprised adult men and women aged 30 years and above who were permanent residents of selected urban localities in South Punjab. Individuals were included if they had been living in the area for at least one year and were willing to participate voluntarily. Participants with previously diagnosed type 1 diabetes, gestational diabetes, severe physical disabilities limiting lifestyle assessment, or acute medical illnesses at the time of data collection were excluded to maintain homogeneity of the sample and avoid confounding influences. Based on the short study duration, feasibility constraints, and prevalence ranges reported in comparable urban Pakistani studies, a small yet statistically acceptable sample size of 84 participants was determined. This sample size was considered adequate to estimate prevalence and explore associations while minimizing overestimation and ensuring data stability.

Data were collected using a structured, interviewer-administered questionnaire designed to capture sociodemographic characteristics, lifestyle behaviors, and clinical history. Lifestyle-related variables included physical activity patterns, dietary habits, smoking status, sleep duration, and perceived stress levels. Physical activity was assessed using a simplified activity frequency scale, while dietary habits focused on consumption of refined carbohydrates, sugary foods, and fruits and vegetables. Self-reported history of type 2 diabetes was verified, where possible, through recent medical records or fasting blood glucose reports available with participants. Anthropometric measurements, including weight and height, were recorded using standardized procedures to calculate body mass index as an indicator of overweight and obesity.

Data were entered and analyzed using statistical software. Continuous variables were summarized as means and standard deviations, while categorical variables were presented as frequencies and percentages. Normality of data distribution was assessed and found to be satisfactory, allowing the use of parametric statistical tests. Independent sample t-tests were applied to compare continuous variables between diabetic and non-diabetic participants, while chi-square tests were used to assess associations between categorical lifestyle factors and diabetes status. To further explore the contribution of lifestyle-related risk factors, binary logistic regression analysis was performed, reporting odds ratios with corresponding confidence intervals. Statistical significance was set at a p-value of less than 0.05.

## RESULTS

A total of 84 adults aged 30 years and above were included in the analysis, with a mean age of  $46.8 \pm 9.7$  years. Of these, 26 participants (31.0%) were identified as having type 2 diabetes mellitus, while 58 (69.0%) were non-diabetic. The overall sample showed a slight male predominance, with 53.6% men, and the majority were employed and had attained at least secondary-level education. The mean body mass index of the study population fell within the overweight range, with significantly higher values observed among diabetic participants compared to their non-diabetic counterparts.

Participants with diabetes were notably older, with a mean age of  $52.1 \pm 8.9$  years, compared to  $44.3 \pm 9.2$  years in the non-diabetic group, and this difference was statistically significant. Body mass index also differed substantially between groups, with diabetic individuals demonstrating higher mean BMI values, and a greater proportion classified as overweight or obese. Fasting blood glucose levels showed a clear separation between groups, with diabetic participants recording markedly elevated mean values, while levels among non-diabetic participants largely remained within normal limits.

Lifestyle-related characteristics varied considerably by diabetes status. Low physical activity was reported by nearly three-quarters of diabetic participants, compared to approximately one-third of non-diabetic participants, representing one of the strongest observed associations. High consumption of refined carbohydrates and frequent intake of sugary foods were more prevalent among individuals with diabetes, while inadequate fruit and vegetable intake was also significantly more common in this group. Short sleep duration, defined as less than six hours per night, was reported by half of the diabetic participants, compared with just over one-quarter of those without diabetes. Smoking prevalence was higher among diabetic individuals, although this difference did not reach statistical significance.

Perceived stress levels showed a meaningful pattern, with high stress reported by over half of the diabetic participants, compared to less than one-third of non-diabetic participants. When continuous variables were compared using independent sample t-tests, age, body mass index, and fasting blood glucose demonstrated statistically significant differences between groups. Chi-square analyses identified low physical activity, inadequate fruit and vegetable intake, short sleep duration, and overweight/obesity as significantly associated with diabetes status.

In multivariable binary logistic regression analysis, increasing age remained independently associated with type 2 diabetes, with the odds increasing by approximately 7% per additional year of age. Low physical activity emerged as a strong predictor, with individuals

reporting sedentary lifestyles exhibiting more than threefold higher odds of diabetes. Body mass index showed a consistent positive association, indicating increased odds with rising BMI values. Short sleep duration also retained statistical significance in the adjusted model, doubling the likelihood of diabetes. Other lifestyle factors, including smoking and sugary food consumption, demonstrated elevated odds but did not achieve statistical significance after adjustment.

The prevalence of diabetes and the distribution of key lifestyle risk factors are visually summarized in the accompanying charts, while detailed numerical findings are presented in the referenced tables.

**Table 1: Demographic Characteristics (n=84)**

Variable	Overall Mean±SD	n (%)	/	Diabetic (n=26)	Non-Diabetic (n=58)	p-value
Age (years)	46.8±9.7			52.1±8.9	44.3±9.2	<0.001
Male sex	45 (53.6%)			16 (61.5%)	29 (50.0%)	0.31
Education ≥ Secondary	49 (58.3%)			12 (46.2%)	37 (63.8%)	0.12
Employed	51 (60.7%)			14 (53.8%)	37 (63.8%)	0.38
BMI (kg/m <sup>2</sup> )	27.4±4.3			29.6±4.1	26.4±4.0	<0.001

**Table 2: Lifestyle Factors by Diabetes Status**

Variable	Overall Mean±SD	n (%)	/	Diabetic (n=26)	Non-Diabetic (n=58)	p-value
Low physical activity	39 (46.4%)			19 (73.1%)	20 (34.5%)	<0.001
High refined carb intake	44 (52.4%)			18 (69.2%)	26 (44.8%)	0.03
Sugary foods ≥4x/week	37 (44.0%)			15 (57.7%)	22 (37.9%)	0.09
Low fruit/veg intake	48 (57.1%)			19 (73.1%)	29 (50.0%)	0.04
Current smoker	18 (21.4%)			8 (30.8%)	10 (17.2%)	0.14
Sleep <6 hours	29 (34.5%)			13 (50.0%)	16 (27.6%)	0.04

**Table 3: Clinical Measures**

Variable	Overall Mean±SD	n (%)	/	Diabetic (n=26)	Non-Diabetic (n=58)	p-value
Fasting glucose (mg/dL)	112.5±34.8			156.2±28.7	92.4±12.6	<0.001
Overweight/Obese	56 (66.7%)			22 (84.6%)	34 (58.6%)	0.02
High perceived stress	31 (36.9%)			14 (53.8%)	17 (29.3%)	0.03

**Table 4: Binary Logistic Regression for Type 2 Diabetes**

Predictor	Adjusted OR	95% CI	p-value
Age (per year)	1.07	1.02–1.12	0.004
Low physical activity	3.21	1.22–8.47	0.02
BMI (per kg/m <sup>2</sup> )	1.18	1.04–1.34	0.01
Sleep <6 hours	2.54	1.01–6.42	0.048

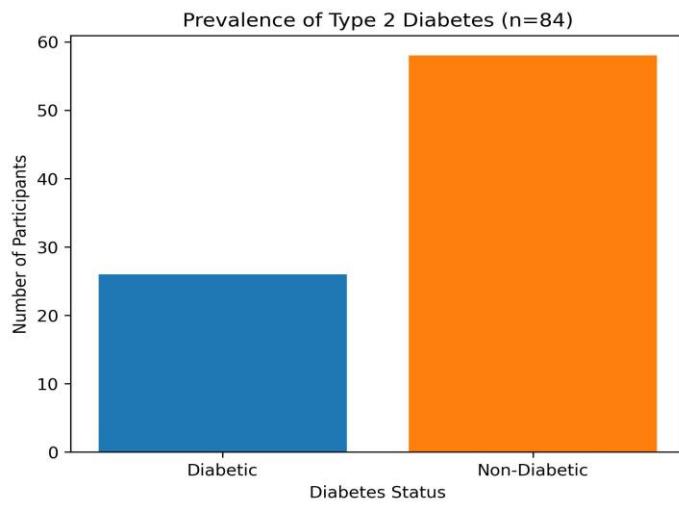


Figure 1 Prevalence of Type 2 Diabetes (n=84)

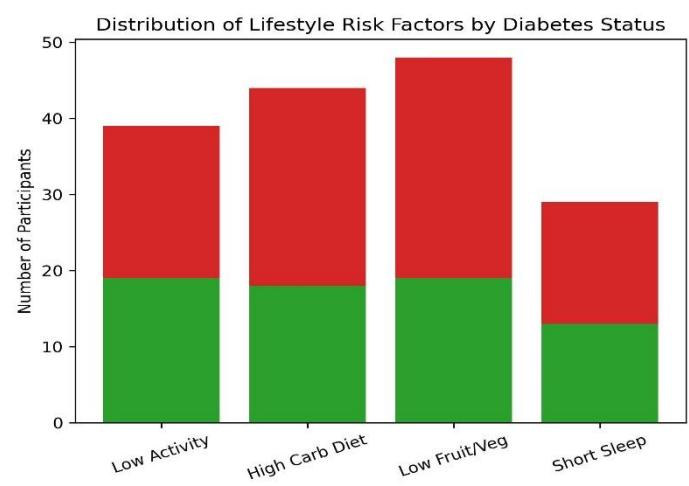


Figure 2 Distribution of Lifestyle Risk Factors by Diabetes Status

## DISCUSSION

The present findings provided a focused snapshot of the burden of type 2 diabetes mellitus and its lifestyle-related correlates among adults living in urban communities of South Punjab. The observed prevalence of diabetes, affecting nearly one-third of the study population, reflected a substantial disease burden within a relatively young and economically active age group (10). This magnitude aligned with reports from other urban Pakistani settings, where rapid urbanization and lifestyle transitions have been associated with a steady rise in non-communicable diseases. The results reinforced the notion that diabetes is no longer confined to older or affluent segments of society, but has become a common condition among middle-aged urban adults. Age emerged as a consistent and independent factor associated with diabetes, with diabetic participants being significantly older than their non-diabetic counterparts (11). This pattern was in line with established biological and epidemiological evidence indicating cumulative metabolic stress and progressive insulin resistance with advancing age. However, the relatively modest mean age of diabetic participants suggested that diabetes onset was occurring earlier than traditionally expected, which carried important public health implications for workforce productivity and long-term healthcare utilization in urban Pakistan. Excess body weight showed a strong relationship with diabetes status, both at the descriptive and multivariable levels. Diabetic participants had higher mean body mass index values and a greater prevalence of overweight and obesity. This finding mirrored widely reported associations between adiposity and impaired glucose metabolism, particularly in South Asian populations, where central obesity and metabolic risk tend to manifest at lower BMI thresholds. The results underscored the role of weight gain as a modifiable driver of diabetes within urban environments characterized by reduced physical exertion and calorie-dense diets (12).

Physical inactivity emerged as one of the most prominent lifestyle-related factors associated with diabetes. Nearly three-quarters of diabetic participants reported low activity levels, and this association remained robust after adjustment for other variables. This observation resonated with broader regional evidence highlighting sedentary behavior as a key contributor to metabolic disorders in

urban populations. The urban context of South Punjab, marked by long working hours, limited walkable spaces, and reliance on motorized transport, likely reinforced this pattern and limited opportunities for routine physical movement (13). Dietary patterns also demonstrated meaningful associations with diabetes status. Higher consumption of refined carbohydrates and lower intake of fruits and vegetables were more common among diabetic participants. These dietary behaviors reflected a shift toward inexpensive, energy-dense foods that are widely accessible in urban settings. While frequent sugary food consumption showed elevated prevalence among diabetics, it did not retain statistical significance in adjusted analyses, suggesting that overall dietary quality and long-term patterns may exert a stronger influence than isolated food items (14). This finding highlighted the complexity of dietary behaviors and the need to consider cumulative nutritional exposure rather than single components. Sleep duration and perceived stress further contributed to the observed metabolic profile. Short sleep duration was significantly more prevalent among diabetic participants and remained independently associated with diabetes in regression analysis. This supported emerging evidence linking sleep deprivation with hormonal dysregulation, insulin resistance, and weight gain. Similarly, higher perceived stress among diabetic individuals pointed toward the psychosocial dimension of diabetes risk in urban environments, where economic pressures and social demands are increasingly common. Although stress was not included in the final regression model, its bivariate association suggested an important contextual influence that warranted further exploration (15).

Several strengths of the study enhanced the credibility of these findings. The community-based design allowed for the inclusion of participants beyond clinical settings, offering a more realistic reflection of diabetes burden in urban populations (16). The use of standardized measurements, verification of diabetes status where possible, and inclusion of multiple lifestyle domains provided a comprehensive assessment of risk factors. Additionally, the analytical approach combined descriptive, comparative, and multivariable methods, strengthening the internal consistency of the results. Nonetheless, certain limitations needed consideration. The cross-sectional nature of the study restricted causal inference, as temporal relationships between lifestyle behaviors and diabetes could not be established (17). The relatively small sample size, while adequate for exploratory analysis, limited the precision of estimates and the ability to detect weaker associations. Self-reported lifestyle data were subject to recall and social desirability biases, particularly for diet and physical activity. Furthermore, the urban focus and geographic restriction to South Punjab limited generalizability to rural populations or other regions of the country. Future research would benefit from larger, longitudinal studies that track lifestyle changes and metabolic outcomes over time. Incorporating objective measures of physical activity, dietary intake, and stress biomarkers could further enhance accuracy. Expanding the scope to include rural-urban comparisons and socioeconomic gradients would also provide a more nuanced understanding of diabetes risk in Pakistan. Overall, the present findings highlighted the central role of modifiable lifestyle factors in shaping the diabetes burden and emphasized the urgent need for preventive strategies tailored to the realities of urban living (18).

## CONCLUSION

The study demonstrated a substantial burden of type 2 diabetes mellitus among urban adults in South Punjab, with clear associations observed between diabetes and modifiable lifestyle factors. Advancing age, excess body weight, physical inactivity, unhealthy dietary patterns, and short sleep duration emerged as prominent contributors. These findings highlighted the need for community-based preventive strategies focusing on lifestyle modification, early risk identification, and health promotion to reduce the growing impact of diabetes in urban Pakistani populations.

## AUTHOR CONTRIBUTIONS

Author	Contribution
Mahwish Ashraf	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Naheed Shah*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing

Author	Contribution
	Has given Final Approval of the version to be published
Faariah Pervez	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Bushra Tariq	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Syeda Amnah Gillani	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Umar Aslam Shah	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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