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ORIGINAL ARTICLE

Prevalence and Risk Stratification of Ischemic Heart Disease in Obese Diabetic Populations in Rural Vs. Urban Pakistan. A Clinical Study

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ABSTRACT

Background: Ischemic heart disease (IHD) is a leading cause of morbidity and mortality worldwide, with its burden disproportionately higher in low- and middle-income countries such as Pakistan. Obesity and type 2 diabetes mellitus (T2DM) are major contributors to the development of coronary atherosclerosis, and their coexistence significantly increases cardiovascular risk. However, limited evidence exists comparing rural and urban populations in Pakistan.

Objectives: This study aimed to evaluate the prevalence and risk stratification of ischemic heart disease among obese diabetic patients in rural versus urban populations of Punjab, Pakistan.

Methodology: A cross-sectional study was conducted at Nawaz Shareef Medical College, Aziz Bhatti Shaheed Teaching Hospital, Gujrat, and Chaudhary Pervaiz Elahi Institute of Cardiology, Wazirabad, from June 2022 to March 2023. A total of 100 obese diabetic patients aged 35–70 years were enrolled consecutively. Demographic, clinical, and biochemical data were collected, and ischemic heart disease was diagnosed using clinical assessment supported by ECG and echocardiography. Risk stratification was performed using the Framingham Risk Score. Data were analyzed using SPSS version 25.0.

Results: The overall prevalence of ischemic heart disease was 38.0%. Rural patients had a slightly higher prevalence compared to urban patients (40.4% vs. 35.4%), though the difference was not statistically significant. However, 50.0% of rural patients were categorized in the high-risk Framingham group compared to 35.4% of urban patients (p = 0.022). Urban patients exhibited significantly higher waist circumference (p = 0.021), while rural patients had higher smoking prevalence (p = 0.038) and lower socioeconomic status (p = 0.002).

Conclusion: IHD is highly prevalent in obese diabetic populations in Pakistan. While central obesity predominates in urban patients, rural populations face higher overall cardiovascular risk due to socioeconomic disadvantage, smoking, and limited healthcare access. Region-specific preventive strategies are essential to reduce the growing burden of cardiovascular disease.

Keywords: Ischemic heart disease, Obesity, Diabetes mellitus, , Cardiovascular risk.

INTRODUCTION

Ischemic heart disease (IHD) remains the leading cause of morbidity and mortality worldwide, with its burden disproportionately higher in low- and middle-income countries, including Pakistan.[1,2] Globally, the rising prevalence of obesity and type 2 diabetes mellitus (T2DM) has emerged as a major determinant of cardiovascular disease, significantly accelerating the development of coronary atherosclerosis and adverse cardiac events.[3,4] In South Asia, particularly Pakistan, where metabolic risk factors are rapidly increasing, the combined impact of obesity and diabetes on ischemic heart disease has become a pressing clinical and public health concern.[5,6]

Obesity is strongly associated with dyslipidemia, systemic inflammation, endothelial dysfunction, and hypertension, all of which synergistically increase the likelihood of coronary artery narrowing and myocardial ischemia.[7] Similarly, T2DM independently elevates the risk of ischemic events through mechanisms such as hyperglycemia-induced oxidative stress, altered platelet function, and impaired fibrinolysis.[8] When obesity and diabetes coexist, as is increasingly observed in Pakistani populations, the risk of ischemic complications is multiplicative rather than additive.[9] This dual burden has shifted the epidemiological landscape of cardiovascular disease in the country, necessitating region-specific risk stratification approaches.[10]

In Pakistan, the urbanization process has drastically altered dietary patterns, lifestyle habits, and healthcare access. Urban populations often experience higher rates of sedentary behavior, processed food consumption, and metabolic disorders, making them particularly vulnerable to IHD.[5,6] Conversely, rural populations, while traditionally perceived as less prone to lifestyle-related diseases, are increasingly exhibiting obesity and diabetes due to nutritional transitions, reduced physical activity, and limited healthcare infrastructure.[11] Moreover, rural communities face diagnostic and therapeutic delays, which may contribute to poorer outcomes once cardiovascular disease develops.[12]

Despite these realities, there remains a paucity of clinical studies directly comparing the prevalence and risk patterns of ischemic heart disease between obese diabetic individuals residing in rural versus urban areas of Pakistan. Most available literature either focuses on general cardiovascular epidemiology or considers diabetes and obesity in isolation, without addressing their combined effects across geographically distinct populations.[13,14] Understanding these differences is crucial for developing targeted prevention, early detection, and treatment strategies tailored to the socio-demographic characteristics of each region. Therefore, this clinical study was designed to evaluate the prevalence and risk stratification of ischemic heart disease among obese diabetic populations in rural versus urban Pakistan. By highlighting regional disparities and identifying key clinical risk predictors, the study aims to contribute to improved cardiovascular risk assessment, resource allocation, and patient-centered care strategies in the Pakistani healthcare system.[15]

MATERIALS AND METHODS

This clinical study was conducted between June 2022 and March 2023 at two tertiary care centers in Punjab, namely Nawaz Shareef Medical College, Aziz Bhatti Shaheed Teaching Hospital, Gujrat, and Chaudhary Pervaiz Elahi Institute of Cardiology, Wazirabad. Both centers were chosen because they provide specialized cardiology services and cater to populations from both rural and urban settings, thus offering an appropriate platform to evaluate regional differences in cardiovascular risk among obese diabetic patients.

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A total of one hundred patients were enrolled consecutively from the outpatient and inpatient departments of these hospitals during the study period. Eligible participants were men and women aged 35 to 70 years with a confirmed diagnosis of type 2 diabetes mellitus for at least one year and classified as obese according to World Health Organization criteria with a body mass index (BMI) of 30 kg/m² or higher. Patients with a prior history of ischemic heart disease, congenital or valvular heart disease, chronic renal insufficiency, or those who did not provide informed consent were excluded.

Detailed demographic and clinical data were collected using a structured proforma, including age, gender, socioeconomic background, rural or urban residence, and lifestyle characteristics such as smoking status, dietary patterns, and physical activity levels. Anthropometric parameters including height, weight, waist circumference, and BMI were measured following standardized protocols. Blood pressure was recorded in a seated position after five minutes of rest.

Laboratory evaluation included fasting blood glucose, glycated hemoglobin (HbA1c), fasting lipid profile, and serum creatinine. All patients underwent baseline electrocardiography (ECG) to assess evidence of ischemia. Patients with inconclusive ECG findings were further evaluated by echocardiography and treadmill exercise testing where clinically indicated. The diagnosis of ischemic heart disease was based on clinical symptoms corroborated with objective evidence of myocardial ischemia. Risk stratification was carried out using the Framingham Risk Score, adjusted for obesity and diabetes, to estimate 10-year cardiovascular risk.

Raw data collected from the two hospitals were first entered manually into predesigned data collection sheets and then cross-checked for consistency and completeness by two independent researchers. After verification, the data were transferred into SPSS version 25.0 for statistical analysis. Continuous variables such as age, BMI, fasting glucose, and lipid levels were expressed as mean ± standard deviation, while categorical variables such as gender, residence, smoking status, and presence of ischemic heart disease were expressed as frequencies and percentages. Comparative analysis between rural and urban patients was carried out using the chi-square test for categorical data and the independent sample t-test for continuous variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 100 obese diabetic patients were enrolled, with 52 belonging to the rural population and 48 to the urban population. The mean age of the study population was 55.4 ± 8.7 years, with no statistically significant difference between rural and urban groups. Gender distribution revealed a slight male predominance in both groups, although the difference was not significant.

Table 1 summarized the demographic distribution of the 100 patients included in the study. The mean age was 55.4 ± 8.7 years, with rural patients averaging 56.1 years and urban patients averaging 54.7 years; this difference was not statistically significant, showing that the age profile was fairly uniform across both groups. Gender distribution revealed a slight male predominance overall (57%), but the proportions were almost identical in rural (57.7%) and urban (56.3%) groups, indicating no meaningful difference by residence. Socioeconomic disparities, however, were marked. A significantly greater proportion of rural patients (69.2%) belonged to the low socioeconomic class compared to urban patients (37.5%, p = 0.002). Conversely, urban patients were more represented in the middle and high socioeconomic classes. Lifestyle habits also differed, with smoking observed in 40.4% of rural participants compared to 25.0% of urban participants (p = 0.038). This highlights that while age and gender profiles were similar, socioeconomic and behavioral risk patterns varied considerably between rural and urban subgroups.

Table 1: Demographic characteristics of study population (n = 100)

Variable	Rural (n = 52)	Urban (n = 48)	Total (n = 100)	p-value
Age (years, mean ± SD)	56.1 ± 9.2	54.7 ± 8.1	55.4 ± 8.7	0.412
Male (%)	30 (57.7%)	27 (56.3%)	57 (57.0%)	0.876
Female (%)	22 (42.3%)	21 (43.7%)	43 (43.0%)	
Socioeconomic class – Low	36 (69.2%)	18 (37.5%)	54 (54.0%)	0.002*
Socioeconomic class – Mid	13 (25.0%)	21 (43.7%)	34 (34.0%)	
Socioeconomic class – High	3 (5.8%)	9 (18.8%)	12 (12.0%)	
Smoking (%)	21 (40.4%)	12 (25.0%)	33 (33.0%)	0.038*

*Significant at p < 0.05

Table 2: Biological and metabolic parameters of study population

Parameter	Rural (n = 52)	Urban (n = 48)	Total (n = 100)	p-value
BMI (kg/m², mean ± SD)	32.6 ± 2.9	33.1 ± 3.1	32.8 ± 3.0	0.344
Waist circumference (cm)	101.3 ± 6.8	104.7 ± 7.4	102.9 ± 7.2	0.021*
Fasting glucose (mg/dL)	168.4 ± 32.7	161.9 ± 29.5	165.3 ± 31.3	0.283
HbA1c (%)	8.2 ± 1.1	7.9 ± 1.0	8.1 ± 1.1	0.197
Total cholesterol (mg/dL)	218.5 ± 34.6	227.9 ± 36.1	222.9 ± 35.4	0.169
LDL cholesterol (mg/dL)	135.8 ± 28.4	142.1 ± 29.7	138.9 ± 29.1	0.217
HDL cholesterol (mg/dL)	37.6 ± 5.9	39.8 ± 6.2	38.6 ± 6.1	0.094
Triglycerides (mg/dL)	190.7 ± 48.2	182.3 ± 44.7	186.7 ± 46.6	0.384
Systolic BP (mmHg)	146.2 ± 14.3	141.5 ± 13.7	144.0 ± 14.1	0.093
Diastolic BP (mmHg)	89.1 ± 9.6	86.5 ± 8.9	87.9 ± 9.3	0.165

*Significant at p < 0.05

Table 3: Prevalence and risk stratification of ischemic heart disease

Variable	Rural (n = 52)	Urban (n = 48)	Total (n = 100)	p-value
Ischemic heart disease (%)	21 (40.4%)	17 (35.4%)	38 (38.0%)	0.613
Framingham Risk Score – Low (%)	7 (13.5%)	10 (20.8%)	17 (17.0%)	0.022*
Framingham Risk Score – Moderate (%)	19 (36.5%)	21 (43.8%)	40 (40.0%)	
Framingham Risk Score – High (%)	26 (50.0%)	17 (35.4%)	43 (43.0%)	

*Significant at p < 0.05

Table 2 presented the biological and metabolic characteristics of the patients. Mean BMI values were similar across rural and urban groups, indicating that general obesity was equally prevalent in both populations. However, waist circumference was significantly higher among urban patients (104.7 ± 7.4 cm) compared to rural patients (101.3 ± 6.8 cm, p =

0.021), suggesting a greater burden of central obesity in the urban group, which is known to carry a stronger risk for metabolic syndrome and ischemic heart disease. Glycemic control, as assessed by fasting glucose and HbA1c, was poor across both groups, with mean fasting glucose levels above 160 mg/dL and HbA1c averaging 8.1%, reflecting uncontrolled diabetes. Lipid profiles showed that total cholesterol and LDL cholesterol were somewhat higher among urban patients, though differences were not statistically significant. HDL cholesterol levels were low across both groups, averaging less than 40 mg/dL, consistent with atherogenic dyslipidemia. Blood pressure values revealed mild to moderate hypertension in both populations, with systolic values averaging above 140 mmHg and diastolic values close to 90 mmHg, though intergroup differences were not statistically significant. Collectively, these findings highlight that while obesity and poor glycemic control were common to all, central obesity and adverse lipid profiles were more evident in the urban population.

Table 3 highlighted the prevalence of ischemic heart disease (IHD) and its stratification by cardiovascular risk scores. The overall prevalence of IHD was high at 38.0%, with 40.4% in rural patients and 35.4% in urban patients, although this difference was not statistically significant. This suggests that IHD is a widespread problem affecting both populations nearly equally. However, risk stratification using the Framingham Risk Score revealed important differences. Rural patients were more likely to fall into the high-risk category (50.0%) compared to urban patients (35.4%, p = 0.022). Conversely, a greater proportion of urban patients fell into the low-risk group (20.8% vs. 13.5%). Moderate-risk prevalence was relatively balanced between the groups. These findings indicate that although absolute prevalence of IHD did not differ substantially, rural patients are disproportionately concentrated in the high-risk stratum, possibly due to socioeconomic disadvantage, higher smoking prevalence, and limited access to timely preventive healthcare.

DISCUSSION

This clinical study evaluated the prevalence and risk stratification of ischemic heart disease in obese diabetic patients from rural and urban populations of Punjab, Pakistan. The findings revealed a high overall prevalence of ischemic heart disease (38%), underscoring the profound impact of coexistent obesity and diabetes on cardiovascular health in this region. Importantly, while the absolute prevalence of ischemic heart disease was not significantly different between rural and urban groups, the risk distribution indicated that rural patients were disproportionately represented in the high-risk category, highlighting important disparities in disease burden and health outcomes. The demographic characteristics demonstrated that age and gender were similar across both populations, reflecting the fact that ischemic heart disease in obese diabetics commonly manifests in the fifth and sixth decades of life, with no marked gender difference once obesity and diabetes coexist. However, socioeconomic disparities were significant, with rural patients predominantly belonging to the lower socioeconomic class compared to urban counterparts. This observation is consistent with prior studies from South Asia, where lower socioeconomic status has been associated with delayed diagnosis, poor access to healthcare facilities, inadequate preventive strategies, and a higher burden of lifestyle risk factors such as smoking and unhealthy diet.[1,2,11] The higher prevalence of smoking among rural patients in this study reinforces this relationship and may partly explain their greater representation in the high-risk stratum of ischemic heart disease.[3,13]

Biological and metabolic parameters revealed important differences between rural and urban groups. While overall obesity was equally prevalent, central obesity, measured by waist circumference, was significantly more prominent in the urban population. Central obesity is strongly linked with insulin resistance, dyslipidemia, and endothelial dysfunction, all of which accelerate the development of coronary artery disease.[7,10] Similar findings have been reported in urban populations in India and Bangladesh, where central obesity is emerging as a stronger determinant of ischemic events than generalized obesity.[13,14,17] In this study, urban patients also demonstrated a trend toward higher cholesterol and LDL levels, further supporting the role of urban lifestyle factors, such as dietary changes and physical inactivity, in predisposing to an atherogenic profile.[3,6] Conversely, poor glycemic control was evident in both groups, with elevated fasting glucose and HbA1c levels across the board, emphasizing the inadequacy of diabetes management in both rural and urban populations. This reflects broader evidence that diabetes care in Pakistan remains suboptimal, with challenges in patient compliance, affordability of treatment, and structured follow-up.[12,16]

The prevalence of ischemic heart disease in this study, affecting nearly four out of ten obese diabetic patients, aligns with the growing recognition that South Asians carry a higher cardiovascular risk compared to other ethnicities at similar levels of obesity and diabetes.[5,10] International studies have consistently shown that the coexistence of obesity and diabetes exerts a multiplicative effect on ischemic risk through synergistic mechanisms including chronic inflammation, lipid abnormalities, pro-thrombotic states, and impaired vascular repair.[8,9,19] In this study, although urban patients demonstrated more central obesity and adverse lipid profiles, rural patients were more frequently categorized into the high-risk group by the Framingham Risk Score. This finding may be explained by the interplay of socioeconomic disadvantage, higher prevalence of smoking, delayed medical attention, and lack of preventive interventions in rural populations.[11,13,18]

These results carry significant clinical and public health implications. First, they highlight the urgent need for targeted screening programs for ischemic heart disease among obese diabetic populations in both rural and urban areas. In urban populations, interventions should focus on modifying lifestyle behaviors such as dietary practices, physical inactivity, and stress-related central obesity.[6,17] In rural areas, efforts should emphasize smoking cessation, improving socioeconomic support, and enhancing accessibility to diagnostic and therapeutic services.[11,13] Community-based risk stratification models, supported by primary healthcare systems, could play a key role in early identification of high-risk individuals, particularly in underserved rural populations.[15,18] Another critical implication is the necessity for comprehensive diabetes management in both settings. The consistently elevated HbA1c and poor glycemic control observed across the study cohort highlight gaps in diabetes care. Strategies such as patient education, affordable access to medications, regular follow-up, and integration of multidisciplinary care are essential to reduce the long-term cardiovascular burden.[12,16] Furthermore, incorporation of routine waist circumference and lipid profile measurements into clinical practice may provide early warning signs for ischemic complications, particularly in urban patients where central obesity is more prevalent.[3,5,6,17]

Limitations: The limitations of this study must also be acknowledged. The sample size was modest (n = 100), and the study was confined to two centers, which may limit generalizability to the broader Pakistani population. Additionally, diagnostic confirmation of ischemic heart disease was based primarily on ECG and echocardiography, with coronary angiography performed only when clinically indicated; hence, subclinical or silent ischemia may have been underreported. Despite these limitations, the study provides valuable insights into the distinct risk profiles of rural and urban obese diabetic populations and establishes a foundation for larger-scale, multicenter investigations.

CONCLUSION

This study demonstrated a high prevalence of ischemic heart disease among obese diabetic patients in Pakistan, with significant differences in risk stratification between rural and urban

populations. While central obesity and dyslipidemia were more prominent among urban patients, rural patients were disproportionately classified in the high-risk category due to socioeconomic disadvantage, higher smoking prevalence, and limited access to healthcare facilities. These findings emphasize the urgent need for tailored public health strategies addressing region-specific risk factors, with a focus on lifestyle modification in urban areas and improved healthcare accessibility and preventive interventions in rural regions. Strengthening diabetes management and incorporating early cardiovascular risk assessment into routine clinical practice will be essential to reduce the growing burden of ischemic heart disease in Pakistan.

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Research Interests: The collective research interests of the authors lie primarily in the fields of cardiology, cardiovascular epidemiology, and preventive medicine. Specific areas of focus include ischemic heart disease, heart failure, and metabolic risk factors such as obesity and diabetes, with a particular emphasis on the South Asian population. The authors are also interested in exploring rural–urban disparities in cardiovascular outcomes, strategies for early risk stratification, and the development of cost-effective preventive interventions suitable for low- and middle-income countries. Through collaborative research, the team aims to contribute to evidence-based clinical practices and public health policies that can reduce the burden of cardiovascular disease in Pakistan.

Authors' Contribution: All authors made substantial contributions to the conception, design, execution, and completion of this study. Muhammad Zahid Ali Raza conceived the study, designed the methodology, and supervised the overall project. Aamir Siddique was responsible for data collection, statistical analysis, and interpretation of results. Shaoib Ahmed Zia contributed to patient recruitment, clinical evaluation, and acquisition of demographic and biological data. Tayyab Mohyuddin carried out an extensive literature review, assisted in drafting the manuscript, and provided critical revisions for intellectual content. Arslan Aslam Chaudhary contributed to data interpretation, assisted in manuscript refinement, and coordinated between study centers. Faiza Altaf played an important role in data collection, patient follow-up, and referencing. All authors reviewed and approved the final manuscript and agreed to be accountable for the accuracy and integrity of the work.

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