INSIGHTS-JOURNAL OF
LIFE AND SOCIAL SCIENCES

INSIGHTS-JLSS
Insights-Journal of Life and Social Sciences

PHYSICAL ACTIVITY STATUS AMONG HYPERTENSIVE PATIENTS WITH KNOWN DIABETES MELLITUS IN SINDH, PAKISTAN

Original Article

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Conflict of Interest: None

Grant Support & Financial Support: None

Acknowledgment: The authors express gratitude to all participants and healthcare professionals who contributed to this study.

ABSTRACT

Background: Diabetes mellitus and hypertension are among the most prevalent non-communicable diseases, often coexisting and significantly increasing cardiovascular risk. Physical inactivity is a modifiable risk factor that exacerbates both conditions, yet adherence to physical activity recommendations remains suboptimal in Pakistan. Urbanization and lifestyle shifts have led to increased sedentary behavior, particularly in Sindh, contributing to worsening health outcomes. Understanding the association between physical activity levels and hypertension severity among diabetic patients is essential for developing effective public health strategies.

Objective: This study aims to assess the physical activity status of hypertensive patients with known diabetes mellitus in Sindh, Pakistan, and examine its association with hypertension severity.

Methods: A cross-sectional study was conducted across six cities in Sindh from April to October 2023. A total of 381 participants diagnosed with both diabetes mellitus and hypertension were recruited through convenience sampling from healthcare centers. Data on demographics, physical activity levels, and hypertension severity were collected through structured questionnaires and blood pressure measurements. Physical activity was classified into inactive (no regular activity), moderate (150–300 minutes per week), and high (>300 minutes per week) based on WHO guidelines. Statistical analysis was performed using SPSS version 21, with associations determined at a significance level of $p<0.05$.

Results: Physical inactivity was prevalent among 65.15% of participants, with 53.7% of them having Grade 2 hypertension. In contrast, only 4.2% of highly active individuals exhibited severe hypertension. Moderate activity was associated with a lower prevalence of Grade 2 hypertension (9.4%). Obesity was significantly correlated with hypertension severity, as 68.5% of obese participants had Grade 2 hypertension compared to 8.2% of normal-weight individuals. Urban participants had lower physical activity levels and a higher prevalence of hypertension than rural residents. Poor medication adherence was also linked to increased hypertension severity, with 65.8% of non-adherent participants classified as having Grade 2 hypertension.

Conclusion: Physical inactivity strongly correlates with hypertension severity among diabetic patients. The findings emphasize the urgent need for structured physical activity programs and lifestyle interventions to mitigate cardiovascular risks in this high-risk population. Public health policies should prioritize physical activity promotion, weight management, and patient education to improve long-term health outcomes.

Keywords: Diabetes mellitus, Exercise, Hypertension, Obesity, Physical inactivity, Sedentary behavior, Urban health.

INTRODUCTION

Diabetes mellitus (DM) and hypertension (HTN) are among the most prevalent and interrelated non-communicable diseases, contributing significantly to global morbidity and mortality. The coexistence of these conditions exacerbates disease complications, increasing the risk of cardiovascular diseases (CVDs) and other adverse health outcomes. The global burden of diabetes is rising at an alarming rate, with projections indicating an increase from 171 million in 2000 to 366 million by 2030 (1). Similarly, hypertension is expected to affect approximately 1.56 billion individuals by 2025 (2). In Pakistan, particularly in the Sindh province, these chronic conditions are surging due to rapid urbanization, dietary shifts, and declining physical activity levels (3). Physical inactivity is a well-established, modifiable risk factor for both diabetes and hypertension, contributing to insulin resistance, obesity, and vascular dysfunction. Regular physical activity improves insulin sensitivity, reduces blood pressure, and mitigates cardiovascular risks, yet it remains underutilized as a preventive and therapeutic strategy, particularly in low- and middle-income countries, including Pakistan (4,5). A sedentary lifestyle further exacerbates metabolic and cardiovascular complications, as it is associated with increased arterial stiffness, endothelial dysfunction, and autonomic nervous system dysregulation, all of which accelerate hypertension progression in diabetic individuals (6,7). Evidence suggests that individuals with type 2 diabetes who engage in regular physical activity exhibit significantly lower blood pressure levels compared to those with sedentary lifestyles (7,8).

Despite its well-documented benefits, physical inactivity is widespread in Pakistan due to sociocultural and environmental barriers. A national survey revealed that nearly 40% of adults fail to meet recommended physical activity levels, a concern that is even more pronounced among diabetic and hypertensive individuals (9). Various factors, including lack of awareness, inadequate infrastructure, and safety concerns, contribute to this inactivity, with urban residents demonstrating lower activity levels due to occupational and transportation-related sedentary behaviors (10,11). This sedentary trend amplifies the risk of CVDs, which remain the leading cause of morbidity and mortality among patients with diabetes and hypertension (12). Recognizing this, global health authorities, including the American Diabetes Association (ADA) and the World Health Organization (WHO), recommend at least 150 minutes of moderate-intensity aerobic physical activity per week to reduce the burden of these conditions (13). However, adherence to these guidelines remains suboptimal in Pakistan, necessitating targeted interventions to promote physical activity (14). Given the increasing prevalence of physical inactivity among hypertensive individuals with diabetes, there is an urgent need for evidence-based strategies to address this public health concern. This study aims to assess the physical activity status of hypertensive patients with known diabetes mellitus in Sindh, Pakistan, identifying the key determinants of inactivity within this high-risk population. The findings will provide valuable insights into the behavioral and systemic factors influencing physical activity patterns, aiding in the development of targeted interventions to improve health outcomes.

METHODS

This cross-sectional study was conducted to assess the physical activity status of hypertensive patients diagnosed with diabetes mellitus in Sindh, Pakistan. The study was carried out between April 2023 and October 2023 across six major cities: Naushahro Feroze, Sukkur, Larkana, Hyderabad, Nawabshah, and Kashmore. A total of 381 participants were recruited using convenience sampling from healthcare centers, hospitals, and clinics in both urban and rural areas. Participants were eligible if they had a confirmed diagnosis of both diabetes mellitus and hypertension for at least one year. Individuals with severe mobility impairments, cognitive disorders, or other chronic illnesses that could significantly impact physical activity levels were excluded to maintain the study's focus on modifiable lifestyle behaviors. Data collection was conducted through a structured questionnaire designed to obtain demographic details, medical history, lifestyle behaviors, and physical activity levels (15). The questionnaire gathered information on age, gender, socioeconomic status, duration of diabetes and hypertension, medication adherence, smoking status, and dietary patterns. Physical activity levels were classified according to World Health Organization (WHO) guidelines, categorizing participants as inactive (no regular physical activity), moderately active (150–300 minutes per week), or highly active (>300 minutes per week). Blood pressure measurements were taken using a calibrated sphygmomanometer following standard protocols. Hypertension severity was classified according to the American Heart Association (AHA) criteria: normal (<120/80 mmHg), elevated (120–129/<80 mmHg), Grade 1 hypertension (130–139/80–89 mmHg), and Grade 2 hypertension (≥140/90 mmHg) (16).

Trained healthcare professionals conducted face-to-face interviews and performed blood pressure measurements to ensure data accuracy and reliability. Ethical approval for the study was obtained from the institutional review board, and informed consent was secured from all participants before data collection. Participants were assured of confidentiality, and their responses were anonymized to protect their identities. Data analysis was conducted using SPSS version 21, employing descriptive statistics such as mean, standard deviation, and

frequency distributions to summarize demographic and clinical characteristics. The study adhered to rigorous methodological standards to ensure the validity and reliability of the findings, contributing valuable insights into the relationship between physical activity and hypertension severity among diabetic patients in Sindh, Pakistan.

RESULTS

A total of 381 participants diagnosed with both diabetes mellitus and hypertension were included in the study. The mean age of participants was 52.3 ± 10.2 years. Among them, 40.7% (n=155) were male, and 59.3% (n=226) were female. Urban residents comprised 62.0% (n=236), whereas 38.0% (n=145) were from rural areas. Education levels varied, with 22.8% (n=87) classified as illiterate, 25.1% (n=96) having primary education, and 52.1% (n=198) attaining secondary or higher education. Socioeconomic classification revealed that 37.0% (n=141) belonged to the lower class, 45.0% (n=171) to the middle class, and 18.0% (n=69) to the upper class. Employment status indicated that 74.3% (n=283) were either unemployed or engaged in household work, while 25.7% (n=98) were employed in various occupations. Physical activity analysis showed that 65.15% (n=248) of participants did not engage in any regular physical activity, while 22.31% (n=85) engaged in moderate activity (150–300 minutes per week) and 12.54% (n=48) engaged in high levels of activity (>300 minutes per week). A significant association was observed between physical inactivity and hypertension severity ($p<0.05$). Among participants who did not engage in regular physical activity, 53.7% had Grade 2 hypertension, while only 4.2% of those in the high physical activity category had Grade 2 hypertension. Furthermore, 55.3% of those engaged in moderate activity had normal blood pressure compared to 18.5% of those who were inactive.

The mean BMI of participants was 28.4 ± 4.6 kg/m², with 61% classified as overweight or obese. A strong association was found between BMI and hypertension severity ($p<0.01$). Among participants classified as obese (BMI ≥30 kg/m²), 68.5% had Grade 2 hypertension, while only 8.2% of those with normal weight had Grade 2 hypertension. In the overweight category (BMI 25–29.9 kg/m²), 40.3% had Grade 2 hypertension, with 30.5% classified as having normal blood pressure. Higher BMI was significantly associated with reduced physical activity levels, with a majority of obese individuals belonging to the physically inactive category.

Table 1: BMI Categories and Hypertension Severity

BMI Category (kg/m²)	Normal BP (%)	Elevated BP (%)	Grade 1 HTN (%)	Grade 2 HTN (%)
<25 (Normal weight)	42 (57.5)	10 (13.7)	15 (20.5)	6 (8.2)
25-29.9 (Overweight)	46 (30.5)	9 (6.0)	35 (23.2)	61 (40.3)
≥30 (Obese)	15 (8.6)	4 (2.3)	36 (20.6)	116 (68.5)

Table 2: Demographics of Study Participants

Variable	Frequency (n=381)	Percentage (%)
Gender		
Male	155	40.7
Female	226	59.3
Residence		
Urban	236	62.0
Rural	145	38.0
Variable	**Frequency (n=381)**	**Percentage (%)**
Education Level		
Illiterate	87	22.8

Primary	96	25.1
Secondary or higher	198	52.1
Socioeconomic Status		
Lower Class	141	37.0
Middle Class	171	45.0
Upper Class	69	18.0
Employment Status		
Employed	98	25.7
Unemployed/Household	283	74.3

The analysis of gender-based differences revealed that physical inactivity was more prevalent among females (68.6%) compared to males (60.6%), whereas a higher proportion of males (14.2%) engaged in high levels of physical activity compared to females (10.6%). Correspondingly, Grade 2 hypertension was more frequent among females (56.2%) than males (49.7%), suggesting a possible link between lower physical activity levels and increased hypertension severity among women. Furthermore, medication adherence showed a strong association with hypertension severity. Among participants with poor medication adherence, 65.8% had Grade 2 hypertension, whereas only 18.5% of those with good adherence exhibited severe hypertension. Moderate adherence was observed in 35.2% of participants, with 42.1% of them having Grade 2 hypertension. These findings indicate that inadequate adherence to antihypertensive medications contributes significantly to blood pressure escalation.

Table 3: Association of Physical Activity Levels and Hypertension Severity by Gender

Physical Activity Level	Normal BP (%)	Elevated BP (%)	Grade 1 HTN (%)	Grade 2 HTN (%)	No Regular Activity (%)	Moderate Activity (%)	High Activity (%)	Grade 2 Hypertension (%)
No Regular Activity (n=248)	46 (18.5)	11 (4.4)	58 (23.4)	133 (53.7)	-	-	-	-
Moderate Activity (n=85)	47 (55.3)	8 (9.4)	22 (25.9)	8 (9.4)	-	-	-	-
High Activity (n=48)	35 (72.9)	4 (8.3)	7 (14.6)	2 (4.2)	-	-	-	-
Male	-	-	-	-	60.6	25.2	14.2	49.7
Female	-	-	-	-	68.6	20.8	10.6	56.2

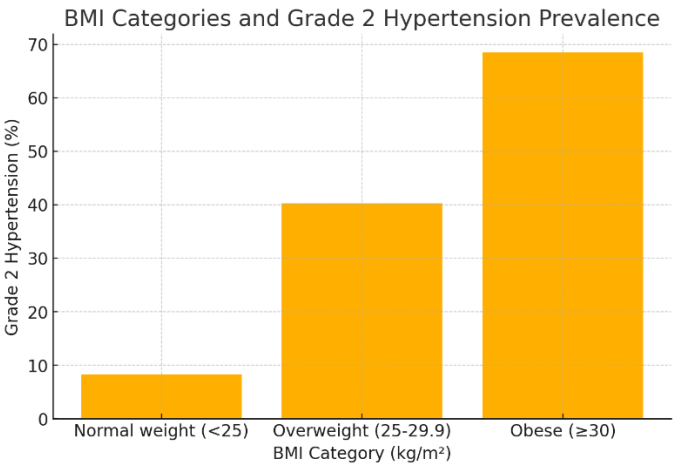

Figure 2 BMI Categories and Grade 2 Hypertension Prevalence

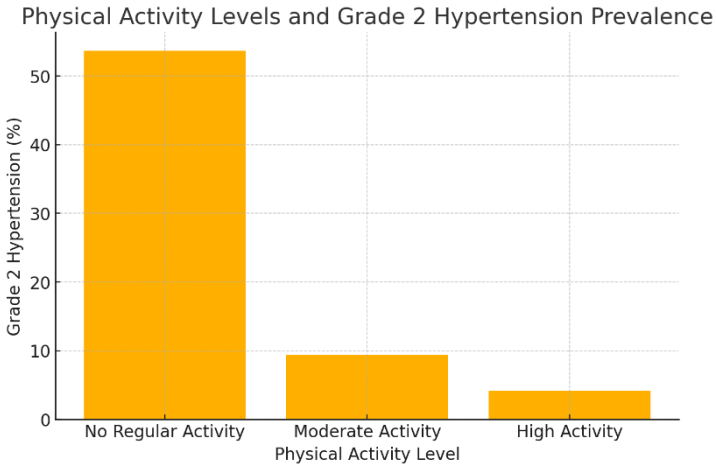

Figure 1 Physical Activity Levels and Grade 2 Hypertension Prevalence

DISCUSSION

The findings of this study underscore the critical role of physical activity in managing hypertension among diabetic patients in Sindh, Pakistan. The results demonstrate a significant association between physical inactivity and increased hypertension severity, reinforcing evidence from existing literature that identifies sedentary behavior as a major contributor to insulin resistance, obesity, and vascular dysfunction. Regular physical activity is widely recognized for its benefits in improving endothelial function, enhancing insulin sensitivity, and reducing arterial stiffness, all of which contribute to blood pressure regulation. The observed reduction in hypertension severity among physically active individuals further supports the established role of exercise in mitigating cardiovascular risk factors associated with diabetes mellitus (15,16). A particularly concerning finding is the high prevalence of Grade 2 hypertension among physically inactive diabetic patients, with more than half of this group classified in the most severe hypertension category. The presence of uncontrolled hypertension in diabetic individuals significantly amplifies the risk of cardiovascular complications, including stroke, myocardial infarction, and chronic kidney disease. These findings highlight the urgent need for structured physical activity interventions as an integral component of diabetes and hypertension management programs. Incorporating aerobic exercise, resistance training, and lifestyle modifications into clinical practice may help reduce hypertension severity and improve long-term health outcomes in this high-risk population (17).

Urban-rural disparities in hypertension prevalence were evident, with urban residents exhibiting a higher prevalence of hypertension compared to rural populations. This disparity may be attributed to differences in lifestyle patterns, dietary habits, and healthcare accessibility. Urban populations often experience higher levels of occupational and transportation-related sedentary behavior, greater consumption of processed foods, and limited access to recreational spaces, all of which contribute to a higher burden of hypertension. In contrast, rural populations may benefit from greater engagement in physically demanding activities due to agricultural and labor-intensive occupations. These findings emphasize the need for region-specific public health strategies that promote physical activity and hypertension management based on demographic and environmental factors (18). The study further identifies a strong association between high BMI and hypertension severity, with obese individuals exhibiting the highest prevalence of Grade 2 hypertension. Excess adiposity contributes to increased vascular resistance, systemic inflammation, and metabolic dysregulation, all of which exacerbate hypertension and diabetes-related complications. The link between obesity and hypertension severity highlights the importance of integrating weight management strategies, including dietary modifications, increased physical activity, and behavioral interventions, into clinical and community-based programs. The incorporation of multidisciplinary approaches, including nutritional counseling and structured exercise programs, may offer a more comprehensive solution to hypertension control in diabetic individuals (19).

Despite the significant associations observed, several limitations must be acknowledged. The cross-sectional study design restricts the ability to establish causal relationships between physical activity and hypertension severity, necessitating longitudinal studies to assess the long-term impact of physical activity interventions on blood pressure control. Future research should incorporate objective assessment tools such as accelerometers or pedometers to obtain precise measurements of physical activity levels. Another limitation is the use of convenience sampling, which may not fully represent the broader hypertensive diabetic population in Sindh. The inclusion of

a larger, randomized sample would improve the generalizability of the findings. These findings have significant implications for both individual patient care and broader public health strategies. Given the increasing burden of hypertension and diabetes in Pakistan, integrating physical activity promotion into healthcare policies and community-based programs is crucial. Healthcare providers should actively counsel diabetic patients on the benefits of regular physical activity and provide tailored exercise recommendations based on individual health status. At a broader level, urban planning and public health initiatives should prioritize the development of environments that facilitate physical activity, such as pedestrian-friendly infrastructure, public parks, and community fitness programs. Addressing the barriers to physical activity, including safety concerns, lack of awareness, and inadequate infrastructure, is essential to improving adherence to exercise recommendations and reducing the burden of hypertension and diabetes in the population (20).

CONCLUSION

This study highlights the critical impact of physical inactivity on hypertension severity among diabetic patients in Sindh, Pakistan, emphasizing the need for targeted lifestyle interventions. The findings reinforce the importance of integrating structured physical activity, weight management strategies, and patient education into healthcare practices to mitigate the complications associated with hypertension and diabetes. Encouraging regular exercise and fostering a supportive environment for physical activity can play a pivotal role in improving cardiovascular health and overall well-being in this high-risk population. Addressing these factors through public health initiatives and tailored clinical interventions is essential for reducing the burden of non-communicable diseases and enhancing long-term health outcomes.

AUTHOR CONTRIBUTIONS

Author	Contribution
Parus Saleem	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Aqsa Kalhoro	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Shagufta	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Aasma Jamali	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Urooj Zahra	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Maria Panhwar	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Aisha Ali Memon	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Zubaida Baloch	Writing - Review & Editing, Assistance with Data Curation
Abdul Razzaque Nohri*	Writing - Review & Editing, Assistance with Data Curation

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