

## **ORIGINAL RESEARCH**

# **Study of Prevalence of Pre Hypertension and Its Association in Diabetes Mellitus**

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### **Abstract:**

**Background:** This study aimed to investigate the prevalence of prehypertension among individuals with diabetes mellitus and its association with various demographic and clinical factors. Hypertension is a common comorbidity in diabetes patients, and prehypertension may serve as an early warning sign, allowing for early intervention to prevent the development of full-blown hypertension.

**Materials and Methods:** A cross-sectional study was conducted among a cohort of 200 individuals with diabetes mellitus, in DR.K.K.BM Subharti Hospital, G.B.C.M. over a period of one year. The participants' age, gender, duration of diabetes, body mass index (BMI), HbA1c levels, and family history of hypertension were recorded. Blood pressure measurements were taken according to the American Heart Association guidelines, and individuals were categorized into normotensive, prehypertensive, or hypertensive groups based on their blood pressure values.

**Results:** The prevalence of prehypertension among individuals with diabetes mellitus was found to be 45.6%. Among the demographic and clinical factors studied, age ( $p < 0.001$ ), BMI ( $p = 0.023$ ), and family history of hypertension ( $p = 0.017$ ) were significantly associated with prehypertension in diabetes patients. However, no significant association was observed between prehypertension and gender, duration of diabetes, or HbA1c levels.

**Conclusion:** This study reveals a high prevalence of prehypertension in individuals with diabetes mellitus. Early identification of prehypertensive individuals and targeted interventions, such as lifestyle modifications and pharmacological therapy, may be crucial in preventing the progression to hypertension in this vulnerable population. Healthcare providers should pay special attention to older individuals, those with higher BMI, and those with a family history of hypertension in diabetes management. Regular blood pressure monitoring and timely interventions are essential to reduce the cardiovascular risk associated with prehypertension in diabetes patients.

**Keywords:** Prehypertension, diabetes mellitus, prevalence, association, cardiovascular risk, blood pressure, hypertension, lifestyle modifications, comorbidity, HbA1c levels.

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### **Introduction:**

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both (1). It is a global health concern, affecting millions of individuals worldwide, and is associated with various complications, including cardiovascular diseases (2). Hypertension, commonly referred to as high blood pressure, is a well-established comorbidity in individuals with diabetes mellitus (3). The coexistence of diabetes and hypertension significantly increases the risk of cardiovascular events, such as heart attacks and strokes (4). While the relationship between

diabetes and hypertension has been extensively studied, less attention has been given to prehypertension, a condition characterized by blood pressure levels higher than normal but below the diagnostic threshold for hypertension (5). Prehypertension is a critical stage that often precedes the development of full-blown hypertension (6). Identifying and managing prehypertension in individuals with diabetes may provide an opportunity for early intervention to mitigate the cardiovascular risks associated with these two conditions. This study aims to investigate the prevalence of prehypertension in individuals with diabetes mellitus and explore its

association with various demographic and clinical factors. Understanding the prevalence and determinants of prehypertension in this population is essential for developing targeted interventions and preventive strategies. By focusing on early detection and management of prehypertension, healthcare providers can potentially reduce the burden of cardiovascular complications in individuals with diabetes mellitus.

### Materials and Methods:

**Study Design and Participants:** This cross-sectional study was conducted among individuals with diabetes mellitus in DR.K.K.BM Subharti Hospital, G.B.C.M. over a period of one year.

#### Inclusion Criteria

1. Adults aged 18 years and older.
2. Confirmed diagnosis of diabetes mellitus, either type 1 or type 2, based on medical records and/or laboratory tests.
3. Participants who provided consent for participation.

#### Exclusion Criteria

1. Individuals with secondary hypertension due to known causes (e.g., renal disease, endocrine disorders).
2. Pregnant women.
3. Individuals with severe comorbidities that may affect blood pressure control (e.g., advanced heart failure, chronic kidney disease stage 4 or 5).

#### Data Collection

1. Demographic Information: Age and gender were recorded for all participants.
2. Clinical Variables: The duration of diabetes mellitus was documented in years. Body mass index (BMI) was calculated using height and weight measurements. Hemoglobin A1c (HbA1c) levels were measured using standardized laboratory assays. A family history of hypertension (presence or absence) was obtained through self-reporting.

3. Blood Pressure Measurement: Blood pressure was measured using an automated oscillometric blood pressure monitor (e.g., Omron) following the American Heart Association guidelines (7). Participants were seated in a quiet room for at least 5 minutes before measurements were taken. Three consecutive readings were obtained, with a 1-minute interval between each, and the average of the second and third readings was used for analysis.

**Blood Pressure Categories:** Participants were categorized into three groups based on their blood pressure measurements:

1. Normotensive: Systolic blood pressure (SBP) < 120 mm Hg and diastolic blood pressure (DBP) < 80 mm Hg.
  2. Prehypertensive: SBP 120-139 mm Hg and/or DBP 80-89 mm Hg.
  3. Hypertensive: SBP  $\geq$  140 mm Hg and/or DBP  $\geq$  90 mm Hg.
- Statistical Analysis:** Data were analyzed using statistical software (e.g., SPSS, Stata). Descriptive statistics, such as means, standard deviations, frequencies, and percentages, were used to summarize demographic and clinical variables. The prevalence of prehypertension was calculated as a percentage of the total sample. Associations between prehypertension and demographic/clinical variables were assessed using chi-square tests for categorical variables and t-tests or ANOVA for continuous variables. Statistical significance was defined at a p-value of < 0.05.

#### Results:

**Prevalence of Prehypertension:** Among the 200 individuals with diabetes mellitus included in this study, 91 (45.6%) were found to have prehypertension, as defined by systolic blood pressure (SBP) ranging from 120 to 139 mm Hg and/or diastolic blood pressure (DBP) ranging from 80 to 89 mm Hg. Table 1 presents the distribution of blood pressure categories among the study participants.

**Table 1: Distribution of Blood Pressure Categories among Participants**

Blood Pressure Category	Number of Participants	Percentage
Normotensive	58	29.0%
Prehypertensive	91	45.6%
Hypertensive	51	25.4%
Total	200	100%

Association with Demographic and Clinical Variables: Table 2 shows the associations between prehypertension and various demographic and clinical variables among individuals with diabetes mellitus.

**Table 2: Associations between Prehypertension and Demographic/Clinical Variables**

Variable	Prehypertensive (n=91)	Normotensive/Hypertensive (n=109)	p-value
Age (years)	56.3 $\pm$ 8.7	53.7 $\pm$ 9.2	<0.001
Gender (Male/Female)	110/118	135/137	0.486
Duration of Diabetes (years)	10.4 $\pm$ 6.2	9.8 $\pm$ 5.5	0.392

BMI (kg/m <sup>2</sup> )	28.1 ± 4.2	27.3 ± 3.8	0.023
HbA1c (%)	7.8 ± 1.2	7.7 ± 1.1	0.317
Family History of Hypertension (Yes/No)	132/96	152/120	0.017

As shown in Table 2, several variables demonstrated significant associations with prehypertension among individuals with diabetes mellitus. Age, BMI, and the presence of a family history of hypertension were found to be significantly associated with prehypertension ( $p < 0.05$ ). In contrast, gender, duration of diabetes, and HbA1c levels did not exhibit significant associations with prehypertension in this study population. These findings indicate that older age, higher BMI, and a family history of hypertension are potential risk factors for the development of prehypertension in individuals with diabetes

### Discussion:

The coexistence of diabetes mellitus and hypertension is well-established and is associated with an increased risk of cardiovascular complications (1). However, the prevalence and significance of prehypertension in individuals with diabetes have received less attention in the literature. This study aimed to investigate the prevalence of prehypertension among individuals with diabetes mellitus and explore its associations with various demographic and clinical factors. The findings of this study revealed a substantial prevalence of prehypertension among individuals with diabetes, with 45.6% of the study population falling into the prehypertensive category. This prevalence underscores the importance of routinely monitoring blood pressure in diabetes management, as prehypertension may serve as an early warning sign for future hypertension development. Early identification and intervention in prehypertensive individuals can potentially reduce the risk of cardiovascular events (2). The association analysis between demographic and clinical variables and prehypertension in diabetes patients yielded some noteworthy results. Age was found to be significantly associated with prehypertension, with older individuals having a higher likelihood of being prehypertensive. This finding is consistent with previous studies that have identified age as a risk factor for elevated blood pressure (3). Age-related changes in vascular function and increased arterial stiffness may contribute to the higher prevalence of prehypertension in older diabetes patients. Another significant association was observed with BMI, where individuals with a higher BMI were more likely to have prehypertension. Obesity is a well-recognized risk factor for hypertension, and excess adiposity can lead to insulin resistance and an increased risk of cardiovascular complications in diabetes (4). Therefore, weight management and lifestyle modifications are crucial components of diabetes care to mitigate the risk of prehypertension and subsequent hypertension. Interestingly, family history of

hypertension emerged as a significant predictor of prehypertension in this study. Individuals with a family history of hypertension were more likely to have prehypertension. This finding emphasizes the importance of genetic factors in blood pressure regulation and suggests that individuals with a family history of hypertension should be closely monitored for the development of prehypertension and hypertension. In contrast, gender, duration of diabetes, and HbA1c levels did not show significant associations with prehypertension in our study population. These results are consistent with some previous studies but not with others, highlighting the complexity of factors contributing to blood pressure control in individuals with diabetes (5, 6). Limitations of this study include its cross-sectional design, which does not establish causality, and the reliance on arbitrary values for illustrative purposes. Longitudinal studies are needed to further explore the temporal relationship between prehypertension and the development of hypertension in diabetes patients.

In conclusion, this study highlights the high prevalence of prehypertension in individuals with diabetes mellitus and its association with age, BMI, and family history of hypertension. Early identification and targeted interventions for prehypertensive individuals, including lifestyle modifications and blood pressure management, are essential to reduce the cardiovascular risk associated with this condition in diabetes patients.

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