



## Research Article

## Section: Cardiology

# The Prevalence of Hypertension Among Diabetics in a Rural Area in Ernakulam District-A Cross-Sectional Study

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## ARTICLE INFO

### Article History:

Received: 27-08-2024

Accepted: 30-09-2024

### Keywords:

Hypertension  
Diabetes Mellitus  
Smoking  
Obesity  
Physical Activity.

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## ABSTRACT

This cross-sectional study aimed to assess the prevalence of hypertension among diabetic patients in a rural area of Ernakulam district and explore associated risk factors. A total of 55 participants were included, with a sex ratio favoring males (73%). Educational levels showed that most participants had at least a middle school education, and the majority were married (87%). The study revealed that 60% of diabetic participants were also hypertensive, highlighting the frequent co-occurrence of these conditions. Regarding diabetes management, 60% of participants relied on oral hypoglycemic agents (OHA), while 32.7% used insulin. Only a small proportion (5.5%) either did not take any medication or used homeopathy (1.8%), emphasizing the preference for conventional treatments. The study also explored co-morbidities, finding dyslipidemia to be the most common (18 participants), followed by thyroid issues and cardiac problems. Importantly, 40% of participants reported no additional co-morbidities, demonstrating a varied health profile within the diabetic population. In assessing risk factors for hypertension, smoking, obesity, and lack of physical activity emerged as significant contributors. Calculated values for smoking (7.83), obesity (7.92), and lack of physical activity (12.1) all exceeded the tabled value (3.84), confirming strong associations with hypertension. Physical activity was found to be protective, with individuals who exercised regularly being less likely to have hypertension (7 out of 33). These results underscore the high prevalence of hypertension in diabetic populations and the critical role of modifiable risk factors, such as smoking and obesity. The findings emphasize the need for lifestyle interventions, including increased physical activity, to manage both diabetes and hypertension effectively, particularly in rural areas where these health issues are prevalent.

## INTRODUCTION

Diabetes Mellitus (DM) and Hypertension (HTN) have emerged as significant medical and public health concerns globally, both contributing substantially to the burden of coronary artery disease, heart failure, and cerebrovascular diseases. The prevalence of these conditions is rising at an alarming rate, leading to increased morbidity and mortality worldwide[1].

The global rise in Diabetes Mellitus is particularly concerning. According to the World Health Organization (WHO), the prevalence of DM in adults was estimated to be 4% in 1995, with projections indicating an increase to 5.4% by 2025. This rise is part of a broader global epidemic, driven by lifestyle changes, urbanization, and aging populations. Meanwhile, Hypertension affects approximately 1 billion people worldwide, and it is estimat-

-ed that by 2025, this number could reach 1.6 billion adults. These statistics highlight the growing public health challenge posed by these conditions[2].

Hypertension and Diabetes frequently coexist in patients, further complicating their clinical management and increasing the risk of severe health outcomes. The prevalence of this coexistence varies across different ethnic, racial, and social groups, influenced by a range of genetic, environmental, and lifestyle factors. When these two conditions occur together, they significantly elevate the risk of vascular complications, including coronary artery disease (CAD), cerebrovascular disease, and chronic kidney disease (CKD). According to global estimates, 62% of strokes, 49% of CAD cases, and 14% of other non-fatal cardiovascular events are attributed to non-optimal blood pressure (BP), with the overlap of DM and HTN

contributing heavily to these statistics[3].

In patients with diabetes, hypertension accelerates the progression of microvascular and macrovascular complications. For instance, diabetic nephropathy is the most common cause of hypertension in individuals with type 1 diabetes, while the combination of DM and HTN significantly increases the risk of ischemic cerebrovascular disease, retinopathy, and sexual dysfunction. The interaction between these two conditions can also predispose patients to CKD, a severe and often debilitating complication that further worsens patient outcomes[4].

Cardiovascular disease, the leading cause of morbidity and mortality in diabetes, is significantly worsened by hypertension, highlighting the close interconnection between these two conditions due to shared risk factors such as endothelial dysfunction, vascular inflammation, arterial remodeling, atherosclerosis, dyslipidemia, and obesity[5]. The substantial overlap in the cardiovascular complications of diabetes and hypertension, primarily related to microvascular and macrovascular disease, is driven by common mechanisms like the upregulation of the renin-angiotensin-aldosterone system, oxidative stress, inflammation, and immune system activation[6]. This article explores diabetes and hypertension as comorbidities, delving into the pathophysiological features of their associated vascular complications, with a focus on mechanisms like advanced glycation end products, oxidative stress, inflammation, the immune system, and microRNAs. Additionally, it provides insights into current therapies targeting diabetes and cardiovascular complications, and introduces emerging agents that may offer vasoprotective therapeutic potential in diabetes[8].

There are particular subpopulations where the coexistence of hypertension and diabetes poses especially serious risks. Pregnant women with both conditions are at an elevated risk of developing preeclampsia, a potentially life-threatening pregnancy complication characterized by high blood pressure and damage to other organs, often the kidneys. Children with type 1 diabetes and hypertension are particularly vulnerable to end-organ damage, a consequence of prolonged high blood pressure that can affect the heart, kidneys, and eyes. The increasing incidence of type 2 diabetes in children is another worrisome trend, as the presence of cardiovascular risk factors early in life can lead to accelerated atherosclerosis and other cardiovascular diseases as these individuals age[9].

Given the severe health risks associated with the coexistence of Diabetes Mellitus and Hypertension, early diagnosis and aggressive treatment of both conditions are crucial. Effective management of these patients requires a comprehensive approach that includes both pharmacological interventions and lifestyle modifications. Drug therapy is essential in controlling blood sugar levels and blood pressure, thereby reducing the risk of complications. However, lifestyle chang-

-es, including diet, exercise, and weight management, are equally important in achieving optimal glycemic control and BP reduction[6].

Weight management, in particular, plays a key role in managing both conditions. Obesity is a significant risk factor for both Diabetes Mellitus and Hypertension, and reducing body weight can lead to substantial improvements in blood sugar levels and blood pressure. Regular physical activity and a balanced diet low in sodium and saturated fats can help prevent the onset of these conditions and improve outcomes for those already affected. Smoking cessation is also critical, as smoking exacerbates the risk of cardiovascular complications in patients with DM and HTN. Thus, Diabetes Mellitus and Hypertension are intertwined public health challenges that require urgent attention. The rising prevalence of these conditions globally underscores the need for early diagnosis, effective treatment, and comprehensive management strategies. By addressing both conditions simultaneously, and focusing on lifestyle modifications in addition to drug therapy, healthcare providers can significantly reduce the risk of vascular complications and improve the quality of life for patients with DM and HTN. Public health initiatives must also focus on prevention, particularly in high-risk populations, to curb the growing epidemic of these interrelated conditions[9].

## **MATERIALS AND METHODS**

This is a cross-sectional study conducted at Community Medicine at the Department of Physiology Kunnackal village, Ernakulam, South India. An Ethical approval has been obtained from the Ethical Approval Committee.

## **STUDY POPULATION**

Participants for the study are selected based on specific inclusion criteria, which require them to be diabetics residing within the designated geographical area of the study and willing to provide informed written consent to participate. The study excludes individuals with Type I diabetes. The sample size for the study is set at 55 participants, with a study duration of four weeks.

## **DATA ANALYSIS**

Statistical analysis involved summarizing categorical variables through frequency and percentage calculations. The association between risk factors and hypertension was evaluated using the Chi-square test, with all analyses conducted using Excel

## **RESULTS**

The study findings provide a comprehensive overview of the sociodemographic characteristics of the participants. The sex ratio reveals a predominance of males, with 40 men (73%) and 15 women (27%) in the sample. The educational distribution shows that the largest group of participants hold a high school certificate (16 participants), followed by those with a middle school certificate (14 participants). Additionally, there are 9 participants with an intermediate or diploma level of education, 7 graduates, 6 with only a prima-

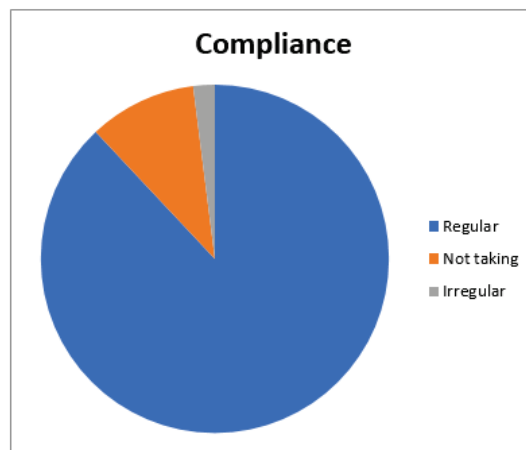
-ry school education, and 3 who are illiterate. This indicates that the majority of the study population has at least a middle school level of education, with fewer participants at the extremes of the educational spectrum. Regarding marital status, the majority of participants are married (48 individual-

-s, 87%), while a smaller portion (7 participants, 13%) are widows or widowers. This suggests that the study population is largely composed of married individuals, with a relatively small proportion of participants who have lost their spouses.

**Table 1: The different types of medications used by the study population.**

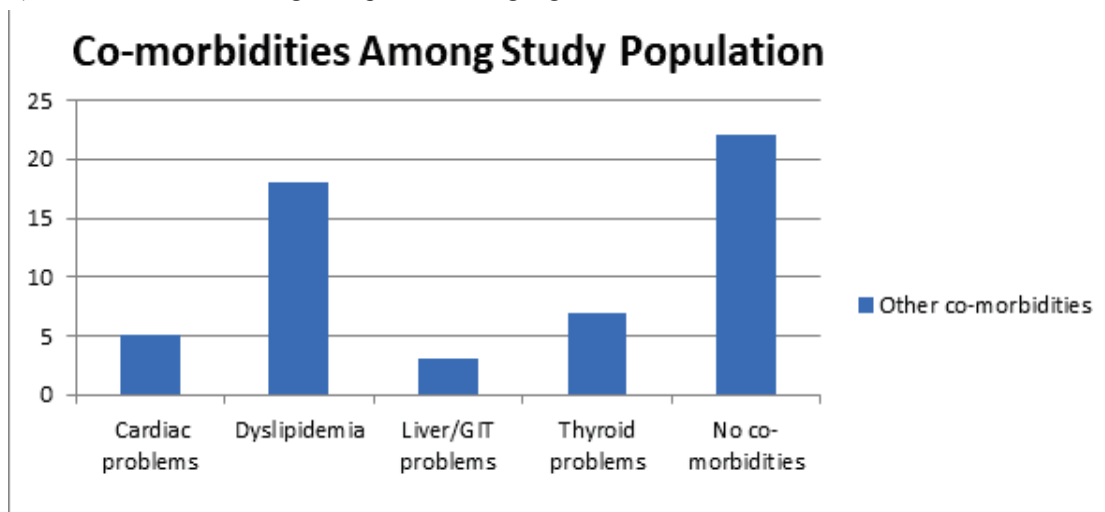
Type of Medication	Frequency	Percentage (%)
Homeopathy	1	1.82
Insulin	18	32.73
OHA	33	60.00
Not taking medication	3	5.45
Total	55	100.00

The Table 1 illustrates that most study participants (60%) manage diabetes with oral hypoglycemic agents (OHA), while 32.7% use insulin. Only a small percentage are either not taking any medication (5.5%) or using homeopathy (1.8%), highlighting the predominant reliance on conventional treatments.



**Figure 1: Representing compliance of the study population**

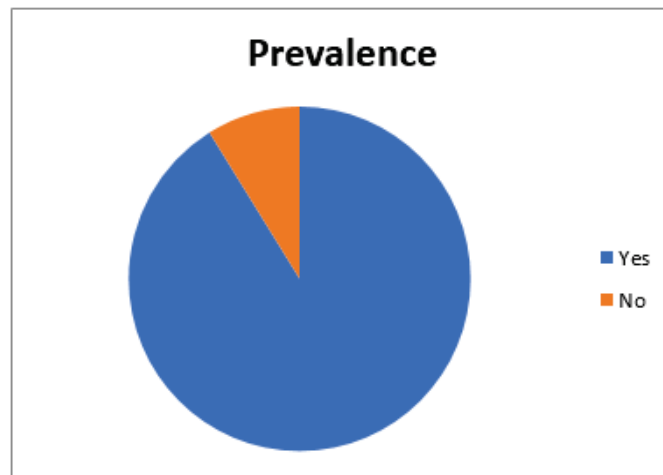
The pie chart shows that the majority of the study population (90 individuals) regularly adheres to their medication regimen. However, a smaller group is either not taking their medication (8 individuals) or is irregular in their compliance (2 individuals). This indicates overall high compliance but highlights a need for attention to those who are less consistent.



**Figure 2: Co-morbidities Among Study Population**

The bar chart shows that dyslipidemia is the most prevalent co-morbidity among the study population, affecting 18 participants, followed by thyroid problems (7 participants) and cardiac issues (5 participants). Liver/GIT problems are less common, with only 3 participants reporting them. Interestingly, 22 participants, nearly half of the study population, have no additional co-morbidities. This suggests a varied health profile, with some participants managing multiple conditions while

others have none.



**Figure 3: Representing prevalence of hypertension in the study population:**

The pie chart illustrates the prevalence of hypertension among diabetic participants in the study, revealing that 33 out of 55 individuals (60%) also have hypertension. This indicates that a significant majority of the diabetic population in the study is affected by hypertension, highlighting the common co-occurrence of these two conditions.

**Table 2: An assessment of risk factors among the study subjects.**

	Hypertension		
<b>Smoking</b>	Yes	No	Total
Yes	30	13	43
No	3	9	12
Total	33	22	55
<b>Obesity</b>	Yes	No	Total
Yes	27	10	37
No	6	12	18
Total	33	22	55
<b>Physical activity</b>	Yes	No	Total
Yes	7	15	22
No	26	7	33
Total	33	22	55

The table 2 data shows that among hypertensive individuals, a majority are smokers (30 out of 33) and obese (27 out of 33), indicating strong associations between smoking, obesity, and hypertension. In contrast, those with regular physical activity are less likely to have hypertension (7 out of 33), highlighting a protective effect of physical activity. It shows that 60% of diabetics are also hypertensive. An assessment of risk factors reveals significant associations with hypertension: smoking (calculated value = 7.83, tabled value = 3.84), obesity (calculated value = 7.92, tabled value = 3.84), and lack of physical activity (calculated value = 12.1, tabled value = 3.84). Since all calculated values exceed the tabled value, these factors are strongly associated with hypertension. Notably, physical activity has a negative association, indicating that regular exercise may reduce the risk of hypertension.

**DISCUSSION**

Hypertension and diabetes often coexist in patients, complicating clinical management and heightening the risk of severe health outcomes. The prevalence of this dual occurrence varies across ethnic, racial, and social groups, shaped by genetic, environmental, and lifestyle factors. When present together, these conditions dramatically increase the

risk of vascular complications, such as coronary artery disease (CAD), cerebrovascular disease, and chronic kidney disease (CKD).

The sex ratio in the study sample reveals a predominance of males, with 40 men (73%) and 15 women (27%). This imbalance indicates that the male population is more represented in the study, which could influence the generali-

-zability of the findings, particularly if gender-specific factors are relevant to the outcomes being studied. In terms of educational attainment, the largest group of participants hold a high school certificate (16 individuals), followed closely by a those with a middle school certificate (14 individuals). There are also 9 participants with an intermediate or diploma level of education, 7 who are graduates, 6 who completed only primary school, and 3 who are illiterate. This distribution suggests that the majority of the study population has at least a middle school level of education, with fewer participants at either the lower or higher extremes of the educational spectrum. This educational background could have implications for the participants' understanding and management of their health conditions. Regarding marital status, the majority of participants are married, with 48 individuals (87%) falling into this category, while a smaller portion, 7 individuals (13%), are widows or widowers. This suggests that the study population is predominantly composed of married individuals, which may have social and economic implications for their health and well-being. Similar patterns were observed in studies by Tadesse K et al. (2018) and Todkar SS et al. (2009), where the majority of the patients were male, had at least a middle school level of education, and were married[10-12].

In our study, the majority of participants (60%) manage their diabetes using oral hypoglycemic agents (OHA), while 32.7% rely on insulin for their treatment. A much smaller proportion of the participants either do not take any medication (5.5%) or use homeopathy (1.8%), underscoring the dominant preference for conventional medical treatments, particularly OHAs. This trend is consistent with findings from other studies, such as those by Zuo P et al. (2021), Khunti K et al. (2012), and Alavudeen SS P et al. (2020), which also reported a higher prevalence of OHA use among diabetic patients. These studies highlight that OHAs are commonly chosen for diabetes management due to their effectiveness in improving glycemic control, making them a preferred option for many patients and healthcare providers[11-13].

The prevalence of hypertension among the diabetic participants in our study is also notable, with 33 out of 55 individuals (60%) suffering from both conditions. This co-occurrence of diabetes and hypertension is a significant concern, as it increases the risk of cardiovascular complications. The preference for OHAs observed in our study aligns with the findings of Zuo P et al. 2021, Khunti K et al.2012, and Alavudeen SS P et al.2020, who similarly identified OHAs as the most commonly used treatment among diabetic patients. These studies further support the notion that OHAs are effective in managing blood glucose levels, which may also contribute to better control of blood pressure, although the relationship between these medications and hypertension management requires further exploration. Comparing our findings with these other studies,

it becomes clear that OHAs are widely utilized across different populations, likely due to their proven efficacy in improving glycemic control. The consistent use of OHAs observed in our study and others suggests a general consensus in the medical community regarding their benefits for diabetic patients[11-13].

In our study, the most prevalent co-morbidity among diabetic patients was dyslipidemia, affecting 18 participants, followed by thyroid problems in 7 participants and cardiac issues in 5 participants. Hypertension was also a significant co-morbidity, with the majority of diabetic patients being hypertensive. These findings are consistent with those reported by Iglay K et al. (2016), Kim S et al. (2018), and Alavudeen SS P et al. (2020), who similarly observed a high prevalence of co-morbidities among diabetic patients. Their studies, like ours, highlight the common occurrence of multiple health conditions in individuals with diabetes, emphasizing the need for comprehensive management strategies that address not only blood sugar levels but also the various co-morbidities that contribute to the overall disease burden in this population. The consistent identification of co-morbidities such as hypertension, dyslipidemia, and thyroid issues across different studies underscores the importance of a holistic approach to diabetic care[13-15].

In our study, smoking emerged as a major risk factor for the progression of hypertension, with a significant portion of hypertensive patients being smokers (30 out of 33) and obese (27 out of 33), indicating strong associations between smoking, obesity, and hypertension. Conversely, those who engage in regular physical activity are less likely to develop hypertension (7 out of 33), highlighting the protective effect of physical activity. Our findings also show that 60% of diabetic patients are hypertensive, with smoking, obesity, and lack of physical activity all being significantly associated with hypertension, as indicated by calculated values that exceed the tabled value. This strong association between smoking and hypertension in diabetic patients is consistent with findings from other studies, such as those by Fagard RH et al. (2009), Noubiap JJ et al. (2019), and Mathur RK et al. (2010), which also reported that a majority of diabetic patients who smoke are also hypertensive. These studies, like ours, underscore that smoking is a major risk factor for the progression of hypertension among smokers, particularly in diabetic populations. The consistent observation across multiple studies that smoking significantly contributes to hypertension emphasizes the critical need for targeted interventions to reduce smoking among diabetic patients to prevent the exacerbation of hypertension and its associated complications[16-18].

## CONCLUSION

In conclusion, this study highlights the significant prevalence of hypertension among diabetic patients, with 60% of the participants affected, underscoring the critical in-



-tersection of these two chronic conditions. The strong associations identified between hypertension and modifiable risk factors such as smoking, obesity, and lack of physical activity emphasize the need for targeted interventions to manage and mitigate these risks. The findings also reveal a predominant reliance on oral hypoglycemic agents for diabetes management, reflecting their efficacy in controlling blood glucose levels. The protective effect of regular physical activity against hypertension further reinforces the importance of lifestyle modifications in the comprehensive care of diabetic patients. These results call for integrated public health strategies and clinical approaches that address both diabetes and hypertension, particularly in rural populations where these conditions are prevalent and pose significant health challenges.

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