

SOCIO-DEMOGRAPHIC AND LIFESTYLE FACTORS INFLUENCING HYPERTENSION IN RURAL POPULATIONS

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Abstract

Background: Hypertension, a leading risk factor for cardiovascular diseases (CVDs) and other complications such as stroke, heart failure, and renal impairment, is a growing global health challenge. In rural regions of India and other countries, hypertension remains underreported and undertreated despite its high prevalence. The study aims to estimate the prevalence of hypertension among adults in rural Lahore District and understand the socio-demographic, lifestyle, and health-related factors associated with this condition. *Methods:* This community-based, cross-sectional study was conducted from June 2022 to March 2023. A total of 278 adults aged 25 years and above from rural Lahore Sheikhpura, were included using random sampling. Data were collected through house-to-house surveys using a semi-structured questionnaire that assessed socio-demographic factors, lifestyle behaviors, and co-morbidities. Blood pressure was measured twice, and body mass index (BMI) was calculated using standard procedures. Data were analysed using SPSS for statistical analysis, including the Pearson chi-square test for associations. *Results:* The overall prevalence of hypertension was found to be 54%, with 28.78% of participants being previously diagnosed and 25.17% newly diagnosed during the study. Hypertension was significantly associated with age ($p = 0.000$), smoking ($p = 0.003$), diabetes ($p = 0.001$), and family history of hypertension ($p = 0.031$). A majority of the hypertensive participants were on regular medication (85.9%), but 96.25% still had high blood pressure despite treatment. BMI classifications revealed that 23.73% were in Obesity Class I and 18.01% in Obesity Class II, with a strong correlation between obesity and hypertension. *Conclusion:* Hypertension is highly prevalent in rural Lahore, with several risk factors, such as age, smoking, diabetes, and family history, significantly contributing to its development. The study emphasizes the importance of early detection, consistent medication, and lifestyle modifications in managing hypertension. Public health interventions should focus on screening, lifestyle education, and regular monitoring of blood pressure, particularly in rural populations.

INTRODUCTION

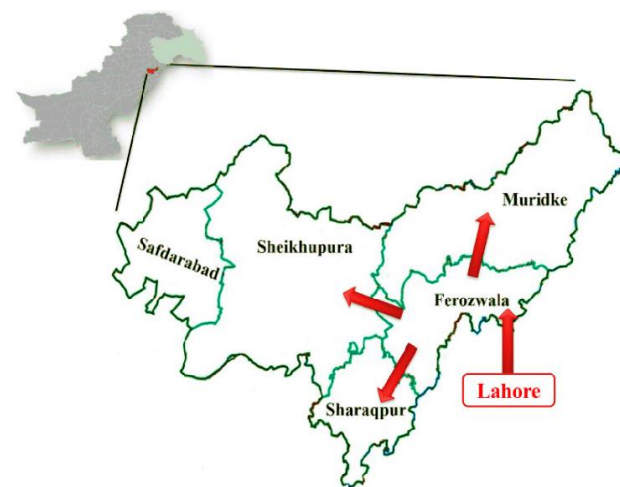
Hypertension, also known as raised blood pressure (BP), is a growing global health concern. According to global statistics, the overall prevalence of raised BP in adults aged 25 and over was around 40% in 2008, a significant increase from earlier decades. The global number of people living with hypertension rose from 600 million in 1980 to nearly 1 billion in 2008, a rise that can be attributed to population growth and ageing populations worldwide [1]. Raised BP is a major contributor to cardiovascular diseases (CVDs), particularly coronary heart disease and stroke, with BP levels positively correlated to the risk of these conditions. Blood pressure increases are known to double the risk of cardiovascular disease with every incremental increase of 20/10 mmHg starting from as low as 115/75 mmHg [2] [3]. Globally, 7.5 million deaths annually are attributed to raised BP, which accounts for 12.8% of all annual deaths and 3.7% of total Disability-Adjusted Life Years (DALYs) [4].

Additionally, hypertension is a known cause of complications such as heart failure, peripheral vascular disease, renal impairment, retinal hemorrhages, and visual impairment [5]. Effective management of systolic and diastolic blood pressure below 140/90 mmHg has been associated with reduced cardiovascular complications [6]. Regionally, the prevalence of hypertension is highest in the African region at 46%, while the WHO Region of the Americas has the lowest prevalence at 35% [7]. Across different income groups, hypertension remains a consistent problem, affecting approximately 40% of both men and women in low-, lower-middle-, and upper-middle-income countries, with a slightly lower prevalence in high-income countries (35%) [8]. Gender differences in hypertension prevalence are evident, with men generally exhibiting a slightly higher prevalence, although this difference is only statistically significant in the European and Americas regions [9]. In India, hypertension is a leading cause of morbidity and mortality, directly responsible for 29% of strokes and 24% of heart attacks [10]. It contributes to 10.8% of all deaths in the country, emphasizing the importance of addressing this silent epidemic. Lifestyle modifications, including physical activity, yoga, and dietary changes, have been identified as effective preventive measures [11].

The Indian government, through initiatives such as the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS), has emphasized the importance of screening individuals above the age of 30 years for hypertension, diabetes, and other cardiovascular diseases [12]. However, a key challenge remains ensuring the correct management of diagnosed hypertensive cases and keeping BP levels under control in the population. The majority of hypertension studies have been conducted in urban areas, but rural areas often experience different health dynamics. In light of this, our study was conducted in a rural setting in order to understand the prevalence and risk factors for hypertension in this population and to explore the treatment-seeking behavior of hypertensive individuals [13]. By focusing on the rural population, the study aims to fill a gap in understanding the unique challenges faced in managing hypertension outside urban centers.

METHODOLOGY

The present study was a community-based cross-sectional study designed to assess the prevalence of hypertension among adults in rural Lahore District, with the aim of examining the socio-demographic, lifestyle, and health-related factors associated with hypertension. The study was conducted from June 2022 to March 2023, with data collection occurring over a period of three months, from June to August 2022 and October to November 2022.



The study targeted adult individuals aged 25 years

and above who were household members in the rural areas of Lahore District. The inclusion criteria for the study required participants to be adults aged 25 years or more, and to be willing to participate. Exclusion criteria involved adults who were below the age of 25 years, chronically ill, or bedridden, as well as individuals who were not willing to participate. The sample size was determined using WHO sample size calculation tables. Given an anticipated prevalence of hypertension of 50%, a 10% relative precision, and a 95% confidence interval, the required sample size was 384. However, due to convenience sampling, a total of 278 participants were included in the study.

Households were selected using a random sampling method for data collection. Data was collected through house-to-house visits with the help of health inspectors and assistant professors from the community medicine department. A pretested, semi-structured questionnaire was used for data collection, which included questions on socio-demographic factors, such as age, gender, marital status, education, and socio-economic status, as well as risk factors for hypertension, including diet, smoking, alcohol consumption, and physical activity. The questionnaire also addressed co-morbidities, such as the presence of diabetes and hypercholesterolemia. Blood pressure measurements were taken using a Blood Pressure Monitor, with two readings taken 5 minutes apart for accuracy. Anthropometric measurements (height and weight) were also taken to calculate the Body Mass Index (BMI).

For the operational definitions, hypertension was classified as participants having either a systolic blood pressure greater than or equal to 140 mmHg, or a diastolic blood pressure greater than or equal to 90 mmHg, or those who were currently on antihypertensive medication. Blood pressure was categorized as normal, prehypertension, or hypertension based on the following criteria: normal if systolic BP was <120 mmHg and diastolic BP were <80 mmHg, prehypertension if systolic BP was between 120-139 mmHg or diastolic BP was between 80-89 mmHg, and hypertension if systolic BP was ≥ 140 mmHg or diastolic BP was ≥ 90 mmHg. BMI classification was done using the Asian standards, with underweight defined as BMI <18.5, normal as BMI 18.5–22.9, overweight as BMI 23–24.9, Obesity Class I as BMI 25–29.9, and Obesity Class II as BMI

≥ 30 . The collected data was entered into Microsoft Excel 2010 and analysed using SPSS (Statistical Package for the Social Sciences) version 16.0. Descriptive statistics were computed for socio-demographic variables, lifestyle factors, and the prevalence of hypertension. The Pearson Chi-Square test was used to assess the associations between hypertension and various socio-demographic and lifestyle factors. Furthermore, univariate analysis was performed to assess the association between BMI classifications and hypertension.

Ethical considerations were paramount in this study. Verbal informed consent was obtained from all participants after clearly explaining the study objectives and procedures. Confidentiality was strictly maintained by ensuring that all data remained anonymous and was used solely for research purposes. For participants diagnosed with hypertension, appropriate referrals were made to the nearest primary health center for proper management. Additionally, participants were educated on the importance of lifestyle modifications, including regular blood pressure check-ups and adherence to prescribed medications.

Results

The study provided a comprehensive analysis of the socio-demographic characteristics, lifestyle factors, co-morbidities, prevalence of hypertension, and BMI classifications among the participants in rural Lahore District. The findings revealed significant variations across different groups. A majority of the participants were aged between 41-60 years, with the largest group (33.45%) being over the age of 61. The sample was predominantly female (68.7%), and a large portion of participants were married (88.84%). Educationally, most participants had at least a high school level of education (39.56%), with 2.15% being illiterate. In terms of socio-economic status, 57.91% of participants were from families categorized as Above Poverty Line (APL), while 42.08% were from Below Poverty Line (BPL). A significant portion, 29.85%, reported a family history of hypertension.

Regarding lifestyle factors and co-morbidities, a majority of participants (83.81%) followed a non-vegetarian diet, and 91.36% were non-smokers. Approximately 88.12% were non-alcoholic, while 22.3% had a history of diabetes, and 16.9% had

hypercholesterolemia. The study also highlighted that 54% of the participants were hypertensive, with 25.17% newly diagnosed during the study. The treatment status revealed that 85.9% of known hypertensives were on regular medication, but only 3.75% had their blood pressure under control. Notably, 77% of hypertensive individuals were still experiencing high blood pressure despite medication. BMI classifications revealed that 34.56% of the participants had normal nutrition (BMI 18.5 - 22.9), while 23.73% were in Obesity Class I (BMI 25 - 29.9). A significant portion of the study population was overweight (18.01%) or obese (18.01%), which aligns with the high prevalence of hypertension in these groups.

The univariate analysis revealed several significant associations between risk factors and hypertension.

Age had a significant correlation with hypertension, with the prevalence of hypertension increasing steadily with age (p-value < 0.000). Participants aged 51-60 years and 61-105 years had the highest prevalence (68.1% and 67.7%, respectively). Dietary habits also showed a significant association, with vegetarians being more likely to have hypertension (p-value = 0.028). The prevalence of hypertension was significantly higher among smokers (p-value = 0.003), and those with diabetes were more likely to develop hypertension (p-value = 0.001). Moreover, those with a family history of hypertension had a higher prevalence of the condition (63.9% vs. 49.7%, p-value = 0.031). In terms of gender, no significant difference in hypertension prevalence was found (p-value = 0.292).

These findings emphasize the

Table: Socio-Demographic Characteristics, Lifestyle Factors, Co-morbidities, Prevalence of Hypertension, and BMI Classifications Among Study Participants

VARIABLES	RESPONSES	FREQUENCY (N)	PERCENTAGE (%)
AGE DISTRIBUTION	<30	19	6.83
	31-40	40	14.38
	41-50	72	25.89
	51-60	54	19.42
	>61	93	33.45
GENDER	Male	87	31.29
	Female	191	68.70
MARITAL STATUS	Married	247	88.84
	Not married	15	5.39
	Separated	5	1.79
	Widow	11	3.95
EDUCATIONAL STATUS	Illiterate	6	2.15
	Primary School	40	14.38
	Middle School	29	10.43
	High School	110	39.56
	Diploma	40	14.38
	Graduate	51	18.34
SOCIO-ECONOMIC STATUS	Post Graduate	2	0.72
	APL	161	57.91
	BPL	117	42.08
FAMILY HISTORY OF HYPERTENSION	Yes	83	29.85
	No	195	70.14

Lifestyle Factors and Co-morbidities

VARIABLES	RESPONSES	FREQUENCY (N)	PERCENTAGE (%)
DIET	Vegetarian	45	16.18
	Non-Vegetarian	233	83.81
SMOKING	Smokers	24	8.63
	Non-Smokers	254	91.36
ALCOHOL CONSUMPTION	Alcoholics	33	11.87
	Non-Alcoholics	245	88.12
DIABETES MELLITUS	Known Diabetic	62	22.30
	Non-Diabetic	216	77.69
HYPERCHOLESTEROLEMIA	Known cases Hypercholesterolemia	47	16.90
	No Hypercholesterolemia	231	83.09

Prevalence of Hypertension and Treatment Status

VARIABLES	FREQUENCY (N)	PERCENTAGE (%)
PREHYPERTENSIVE CASES	97	34.89
NEWLY DIAGNOSED HYPERTENSIVE	70	25.17
PREVIOUSLY DIAGNOSED HYPERTENSIVE	80	28.78
TOTAL HYPERTENSIVE (NEW + PREVIOUS)	150	54.00
TREATED WITHOUT MEDICINES (LIFESTYLE MODIFICATIONS)	2	2.50
ON REGULAR MEDICATION	67	85.90
ON IRREGULAR MEDICATION	11	14.10
ON TREATMENT & BP WITHIN NORMAL RANGE	3	3.75
ON TREATMENT BUT BP IS HIGH	77	96.25

Body Mass Index (BMI) Classifications (Asian Standards)

BMI CLASSIFICATION	FREQUENCY (N)	PERCENTAGE (%)
UNDER NUTRITION (BMI <18.5)	16	5.75
NORMAL NUTRITION (BMI 18.5 - 22.9)	96	34.56
OVERWEIGHT (BMI 23 - 24.9)	50	18.01
OBESITY CLASS I (BMI 25 - 29.9)	66	23.73
OBESITY CLASS II (BMI >30)	50	18.01

Association of Risk Factors with Hypertension

RISK FACTOR	HYPERTENSION PRESENT (%)	HYPERTENSION ABSENT (%)	P VALUE
AGE			
26 TO 30 YEARS	36.84	63.1	0.000
31 TO 35 YEARS	19.04	80.95	
36 TO 40 YEARS	31.57	68.4	
41 TO 45 YEARS	51.72	48.27	
46 TO 50 YEARS	46.51	53.48	
51 TO 55 YEARS	68.1	31.81	
56 TO 60 YEARS	62.5	37.5	
61 TO 105 YEARS	67.7	32.2	

GENDER			0.292
MALE	58.6	41.37	
FEMALE	51.8	48.16	
DIET			0.028
VEGETARIAN	68.8	31.1	
NON-VEGETARIAN	51.07	48.92	
SMOKING			0.003
SMOKERS	83.3	16.66	
NON-SMOKERS	51.18	48.81	
DIABETES			0.001
YES	72.5	27.41	
NO	48.6	51.38	
FAMILY HISTORY OF HYPERTENSION			0.031
PRESENT	63.9	36.1	
ABSENT	49.7	50.3	

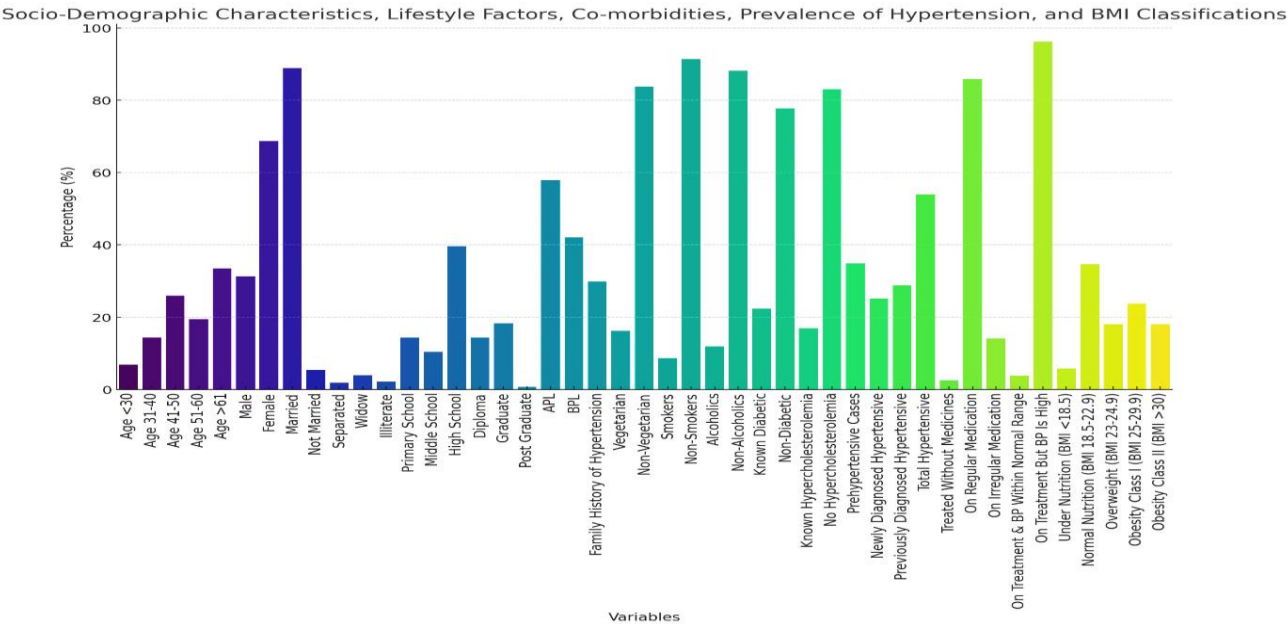


Figure: socio-demographic characteristics, lifestyle factors, co-morbidities, prevalence of hypertension, and BMI classifications

Discussions

The findings from this study highlight several important aspects of hypertension prevalence in rural Lahore District, focusing on socio-demographic characteristics, lifestyle factors, co-morbidities, and BMI classifications. The results indicate clear associations between various risk factors and hypertension, which are discussed below, supported by relevant literature to provide context and justification. The study found a clear increase in hypertension prevalence with age. In participants aged

51-60 years (68.1%) and 61-105 years (67.7%), the prevalence of hypertension was significantly higher compared to younger age groups. This finding is consistent with the existing literature that links increasing age with an elevated risk of developing hypertension. Liu et al. (2020) argue that with age, there is progressive stiffening of the arteries, which increases peripheral vascular resistance and subsequently blood pressure. Additionally, Kario et al. (2018) highlight that older adults tend to have higher systolic blood pressure, contributing to the higher

rates of hypertension in this demographic. In our study, while males had a slightly higher prevalence of hypertension (58.6%) than females (51.8%), the difference was not statistically significant ($p = 0.292$). This finding contrasts with other studies that have shown a higher prevalence of hypertension in men at younger ages, but with women surpassing men in later years, particularly post-menopause. Khan et al. (2018) and Thompson et al. (2017) support this by showing that hormonal changes in women after menopause increase the risk of hypertension, which might explain the lack of significance in the gender differences observed in our study. Socio-economic status (SES) did not show a significant association with hypertension in this study ($p = 0.314$). While low SES has been widely linked to hypertension due to factors such as poor access to healthcare and unhealthy lifestyles, Marmot et al. (2019) and Dinu et al. (2017) emphasize that in rural settings like the one in our study, socio-economic disparities may not manifest as significantly as in urban populations. The lack of a strong association in this rural context could be attributed to the general access to health interventions and community outreach programs that mitigate the effects of SES. Dietary patterns were found to be significantly associated with hypertension in this study ($p = 0.028$), with vegetarians having a higher prevalence of hypertension (68.8%) compared to non-vegetarians (51.07%). While the relationship between vegetarian diets and lower blood pressure is well-documented, especially due to lower fat and sodium intake, our results suggest that other dietary factors might influence blood pressure in vegetarians. Dinu et al. (2017) discuss how a vegetarian diet may sometimes include high-sodium foods like pickles or processed plant-based products, which can elevate blood pressure. In contrast, Chrysafides et al. (2018) found that a balanced non-vegetarian diet is typically associated with lower hypertension risk. Smoking was significantly associated with hypertension ($p = 0.003$) in this study, with smokers exhibiting an 83.3% prevalence compared to 51.18% in non-smokers. This result aligns with substantial evidence linking smoking to hypertension, as smoking leads to the release of catecholamines, which increase heart rate and blood pressure. Pescatello et al. (2019) and the American Heart Association (AHA) emphasize that smoking causes both acute and long-term increases in

blood pressure, contributing to the development of chronic hypertension. While alcohol consumption showed a borderline significant association ($p = 0.053$), the higher prevalence of hypertension in alcoholics (69.7%) compared to non-alcoholics (51.8%) is consistent with studies that link excessive alcohol intake with elevated blood pressure. Ezzati et al. (2004) found that chronic alcohol use increases the risk of hypertension by influencing the sympathetic nervous system and renal function, which in turn increases vascular resistance. The borderline significance in our study might be due to the relatively low proportion of alcohol consumers in the sample (11.87%). The relationship between diabetes and hypertension was highly significant ($p = 0.001$) in our study, with diabetic individuals showing a 72.5% prevalence of hypertension compared to 48.6% in non-diabetics. This result is consistent with the literature indicating that diabetes is a significant risk factor for hypertension. Kario et al. (2018) suggest that insulin resistance, common in diabetics, exacerbates hypertension by promoting sodium retention and altering blood vessel function. This interrelation between diabetes and hypertension increases the burden of both conditions, particularly in older adults. A family history of hypertension was significantly associated with hypertension ($p = 0.031$). Those with a family history had a prevalence of 63.9%, compared to 49.7% in those without a family history. This finding supports the existing body of research, which suggests that genetic factors play a key role in hypertension susceptibility. Zhou et al. (2017) found that a family history of hypertension increases the risk of developing the condition through genetic inheritance and shared environmental factors. The relationship between BMI and hypertension was also notable. Participants with Obesity Class I (BMI 25–29.9) and Obesity Class II (BMI ≥ 30) had a higher prevalence of hypertension (68.1% and 67.7%, respectively) compared to those with normal nutrition (BMI 18.5–22.9) (51.07%). Wang et al. (2017) and the World Health Organization (WHO) emphasize that obesity is a well-established risk factor for hypertension, as excess body fat increases vascular resistance, cardiac output, and sodium retention. The high prevalence of hypertension in obese participants further supports the need for targeted interventions to manage weight and prevent hypertension.

Conclusion

In conclusion, this study highlights the critical role of **age, diabetes, smoking, family history, and obesity** in the development of hypertension. The significant associations found in this study are well-supported by existing literature and underscore the need for targeted public health interventions in rural settings, particularly for high-risk groups. Interventions should focus on **lifestyle modifications**, including **smoking cessation, weight management, and diabetes control**, as well as **early detection and appropriate management** of hypertension.

Author

Nazia Praveen conceptualized the study and contributed to data collection and analysis. Tariq Hassan contributed to the design and interpretation of results. Rabiya Masood and Syed Ahmad Hussain assisted with the literature review and manuscript preparation. Nasreen Ghazi contributed to data analysis and manuscript revision. Mohammad Imran Younus supervised the research process, guided the analysis, and reviewed the manuscript.

Contributions

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Conflicts of Interest

The authors declare that there are no conflicts of interest.

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