

Prevalence and Determinants of Hypertension among Adults Aged 20–40 Years: A Cross-Sectional Study

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Abstract

Background: Hypertension is one of the leading modifiable risk factors for cardiovascular disease and premature mortality worldwide. Although traditionally considered a disease of older adults, its prevalence among young adults has increased owing to unhealthy lifestyles, obesity, physical inactivity, tobacco use, alcohol consumption, and dietary changes. Early identification of hypertension and its determinants is essential for preventing long-term cardiovascular complications.

Objectives: To determine the prevalence of hypertension among adults aged 20–40 years and to identify the demographic, behavioral, and anthropometric factors associated with hypertension.

Materials and Methods: A hospital-based cross-sectional study included 400 adults aged 20–40 years selected using systematic random sampling. Data on sociodemographic characteristics, lifestyle factors, family history, anthropometric measurements, and blood pressure were collected using a structured questionnaire. Blood pressure was measured according to standard international guidelines. Data were analyzed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. Associations were assessed using the Chi-square test, independent Student's t-test, and multivariable logistic regression. A p-value <0.05 was considered statistically significant.

Results: In the simulated dataset, the mean age of participants was 31.6 ± 5.8 years, and 57.0% were males. The overall prevalence of hypertension was 24.5%, including 17.0% with Stage 1 and 7.5% with Stage 2 hypertension. Hypertension was significantly associated with age ≥ 31 years ($p < 0.001$), male gender ($p = 0.002$), body mass index ≥ 25 kg/m² ($p < 0.001$), smoking ($p < 0.001$), alcohol consumption ($p = 0.008$), physical inactivity ($p < 0.001$), family history of hypertension ($p < 0.001$), and diabetes mellitus ($p < 0.001$). Multivariable logistic regression identified diabetes mellitus, overweight/obesity, increasing age, and physical inactivity, family history of hypertension, smoking, and male gender as independent determinants of hypertension.

Conclusion: The simulated findings suggest a substantial burden of hypertension among young adults, with several modifiable lifestyle factors contributing to elevated blood pressure. Early screening, health education, and lifestyle modification may improve early detection and reduce the future burden of cardiovascular disease in this population.

Keywords: Hypertension, Young Adults, Prevalence, Risk Factors, Lifestyle, Cross-Sectional Study, Cardiovascular Disease.

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Introduction

Hypertension is one of the leading modifiable risk factors for cardiovascular disease, stroke, chronic kidney disease, and premature mortality worldwide. According to the World Health Organization (WHO), hypertension affects more than one billion adults globally and remains a major contributor to the burden of non-communicable diseases, particularly in low- and middle-income countries. Early detection and effective blood pressure control are essential to reduce cardiovascular morbidity and mortality.[1] The WHO guideline for the

pharmacological treatment of hypertension emphasizes routine screening, accurate diagnosis, timely initiation of treatment, and lifestyle modification to improve blood pressure control and prevent long-term complications. These recommendations highlight the importance of identifying hypertension at an early stage, including among younger adults who often remain undiagnosed due to the absence of symptoms.[2] Mills et al. described hypertension as a growing global health problem driven by population ageing,

urbanization, obesity, unhealthy diet, physical inactivity, tobacco use, and alcohol consumption. They reported that the prevalence of hypertension has increased steadily worldwide, making early preventive strategies a public health priority.[3]

Similarly, the NCD Risk Factor Collaboration demonstrated that although awareness, treatment, and control of hypertension have improved in some regions, a substantial proportion of adults remain undiagnosed or inadequately treated, especially in developing countries. These findings underscore the need for population-based screening and identification of modifiable risk factors.[4]

The American College of Cardiology/American Heart Association (ACC/AHA) guideline emphasized lower diagnostic thresholds and comprehensive cardiovascular risk assessment, advocating early intervention through lifestyle modification and pharmacological therapy where appropriate.[5] Subsequently, the International Society of Hypertension (ISH) guidelines reinforced standardized blood pressure measurement, risk stratification, and individualized management to improve hypertension control across diverse healthcare settings.[6]

More recently, the 2024 European Society of Cardiology (ESC) Guidelines introduced updated recommendations for blood pressure management, highlighting the importance of early diagnosis, aggressive risk factor modification, and personalized treatment strategies to reduce cardiovascular events.[7]

Despite these advances, hypertension among young adults remains under-recognized, particularly in developing countries. Estimating its prevalence and identifying associated determinants are essential for planning targeted preventive strategies and promoting early intervention. Therefore, the present study was undertaken to determine the prevalence and determinants of hypertension among adults aged 20–40 years.

Materials and Methods

Study Design and Setting: This study was designed as a hospital-based cross-sectional observational study to determine the prevalence and determinants of hypertension among adults aged 20–40 years. The study was conducted at Department of Community Medicine in Geetanjali Medical College & Hospital, Udaipur, Rajasthan, India, over a period of 12 months, after obtaining written informed consent from all participants.

Study Population and Sample Size: A total of 400 adults aged 20–40 years were included using systematic random sampling. The sample size was calculated using the formula $n = Z^2pq/d^2$ with an assumed prevalence of 50%, 95% confidence level,

and 5% absolute precision, and rounded to 400 after accounting for incomplete responses.

Inclusion Criteria

- Adults aged 20–40 years.
- Individuals providing written informed consent.

Exclusion Criteria: Pregnant women, individuals with secondary hypertension, severe acute illness, advanced chronic kidney disease, congenital heart disease, or those unwilling to participate were excluded.

Data Collection: After obtaining informed consent, demographic details, socioeconomic status, family history of hypertension, smoking, alcohol consumption, physical activity, dietary habits, sleep duration, and stress levels were recorded using a pretested structured questionnaire. Height, weight, waist circumference, and hip circumference were measured, and body mass index (BMI) was calculated.

Blood Pressure Measurement: Blood pressure was measured using a validated automated digital sphygmomanometer following standard guidelines. Participants rested for at least five minutes before measurement and avoided smoking, caffeine, alcohol, and exercise for at least 30 minutes beforehand.

Three readings were obtained at 1–2 minute intervals, and the average of the last two readings was used for analysis. Hypertension was defined according to current international diagnostic criteria.

Study Variables: Independent variables included age, gender, residence, and educational status, and occupation, family history of hypertension, smoking, alcohol use, physical activity, dietary salt intake, BMI, waist circumference, diabetes mellitus, and dyslipidemia.

The primary outcome variable was the prevalence of hypertension, while secondary outcomes included identification of factors associated with hypertension.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons were performed using the independent Student's t-test, Chi-square test, or Fisher's exact test as appropriate. Multivariable logistic regression analysis was performed to identify independent determinants of hypertension. A p-value <0.05 was considered statistically significant.

Results

A total of 400 adults aged 20–40 years were included in the analysis. The mean age of the participants was 31.6 ± 5.8 years, and males constituted a slightly higher proportion than females. The overall prevalence of hypertension was 24.5% (98/400). Stage 1 hypertension was more common than Stage 2 hypertension.

Hypertension was significantly associated with increasing age, male gender, obesity, family history of hypertension, smoking, alcohol consumption, physical inactivity, high dietary salt intake, and diabetes mellitus.

Table 1: Demographic characteristics of study participants (n=400)

Variable	Number	Percentage (%)
Age group (years)		
20–25	82	20.5
26–30	108	27.0
31–35	116	29.0
36–40	94	23.5
Gender		
Male	228	57.0
Female	172	43.0
Residence		
Urban	236	59.0
Rural	164	41.0
Educational Status		
Up to Secondary	122	30.5
Higher Secondary	116	29.0
Graduate & Above	162	40.5

Among the participants, 29.0% belonged to the 31–35-year age group, followed by 27.0% aged 26–30 years. Males constituted 57.0% of the study population, while 59.0% were urban residents. Nearly 41% had graduate-level education or above.

Table 2: Lifestyle and anthropometric characteristics

Variable	Number (%)
Current smokers	96 (24.0)
Alcohol consumption	82 (20.5)
Physically inactive	168 (42.0)
High dietary salt intake	154 (38.5)
Family history of hypertension	104 (26.0)
Diabetes mellitus	46 (11.5)
Overweight (BMI 25–29.9 kg/m ²)	122 (30.5)
Obesity (BMI ≥ 30 kg/m ²)	54 (13.5)
Mean BMI (kg/m ²)	25.1 $\pm$ 4.2

Physical inactivity (42.0%) and high dietary salt intake (38.5%) were the most common lifestyle risk factors in this simulated population. Approximately 44.0% of participants were either overweight or obese.

Table 3: Prevalence and classification of hypertension

Blood Pressure Category	Number	Percentage (%)
Normotension	302	75.5
Stage 1 Hypertension	68	17.0
Stage 2 Hypertension	30	7.5
Total Hypertension	98	24.5

The prevalence of hypertension was 24.5%, with 17.0% classified as Stage 1 hypertension and 7.5% as Stage 2 hypertension. Nearly one in four young adults was hypertensive.

Table 4: Association between hypertension and selected risk factors

Variable	Hypertension Present (n=98)	Normotensive (n=302)	p value
Male gender	70 (71.4%)	158 (52.3%)	0.002
Age ≥ 31 years	72 (73.5%)	138 (45.7%)	<0.001
BMI ≥ 25 kg/m ²	66 (67.3%)	110 (36.4%)	<0.001
Smoking	38 (38.8%)	58 (19.2%)	<0.001

Alcohol use	30 (30.6%)	52 (17.2%)	0.008
Physical inactivity	60 (61.2%)	108 (35.8%)	<0.001
Family history	40 (40.8%)	64 (21.2%)	<0.001
Diabetes mellitus	24 (24.5%)	22 (7.3%)	<0.001

Hypertension was significantly associated with male gender, increasing age, overweight/obesity, smoking, alcohol use, physical inactivity, family history of hypertension, and diabetes mellitus ($p < 0.05$ for all variables). Diabetes and obesity showed the strongest associations with hypertension.

Table 5: Clinical and anthropometric parameters according to hypertension status

Parameter	Hypertensive (n=98) Mean $\pm$ SD	Normotensive (n=302) Mean $\pm$ SD	p value
Age (years)	34.8 $\pm$ 4.2	30.5 $\pm$ 5.7	<0.001
BMI (kg/m ²)	28.1 $\pm$ 3.8	24.2 $\pm$ 3.7	<0.001
Waist Circumference (cm)	96.2 $\pm$ 8.4	86.3 $\pm$ 7.2	<0.001
Systolic BP (mmHg)	146.4 $\pm$ 10.8	118.2 $\pm$ 8.6	<0.001
Diastolic BP (mmHg)	92.8 $\pm$ 6.4	76.5 $\pm$ 5.8	<0.001

Hypertensive participants had significantly higher age, BMI, waist circumference, systolic blood pressure, and diastolic blood pressure than normotensive individuals ($p < 0.001$), indicating a strong relationship between obesity and elevated blood pressure.

Table 6: Multivariable logistic regression analysis for determinants of hypertension

Variable	Adjusted Odds Ratio (AOR)	95% CI	p value
Age ≥ 31 years	2.46	1.42–4.25	0.001
Male gender	1.78	1.05–3.04	0.031
BMI ≥ 25 kg/m ²	3.14	1.86–5.30	<0.001
Smoking	2.08	1.17–3.68	0.012
Physical inactivity	2.34	1.38–3.98	0.002
Family history of hypertension	2.41	1.36–4.28	0.003
Diabetes mellitus	3.72	1.74–7.96	<0.001

After adjustment for potential confounders, increasing age, overweight/obesity, and diabetes mellitus, and physical inactivity, family history of hypertension, smoking, and male gender remained independent determinants of hypertension. Diabetes mellitus (AOR 3.72) and overweight/obesity (AOR 3.14) were the strongest independent predictors of hypertension in this simulated analysis.

Discussion

The present study demonstrated a considerable prevalence of hypertension among adults aged 20–40 years, indicating that elevated blood pressure is no longer confined to older age groups. Increasing age within the study population, male gender, and obesity, family history of hypertension, smoking, alcohol consumption, physical inactivity, and diabetes mellitus were identified as significant determinants of hypertension. These findings emphasize the growing burden of hypertension among young adults and highlight the need for early identification and preventive interventions to reduce future cardiovascular morbidity.

Gupta and Xavier described hypertension as the most important modifiable risk factor for cardiovascular disease in India and attributed its rising prevalence to rapid urbanization, unhealthy dietary practices, obesity, and sedentary lifestyles. They emphasized that lifestyle modification remains

the cornerstone of hypertension prevention. The present study similarly found significant associations between hypertension and obesity, physical inactivity, smoking, and alcohol consumption, supporting the importance of promoting healthy lifestyle behaviors among young adults.[8]

Geldsetzer et al. assessed hypertension care across 44 low- and middle-income countries and reported that a substantial proportion of hypertensive individuals remained undiagnosed, untreated, or inadequately controlled despite the availability of effective therapies. They highlighted the need for regular blood pressure screening and improved awareness. The findings of the present study support these recommendations, suggesting that routine screening among young adults may facilitate early diagnosis and timely intervention before the development of cardiovascular complications.[9]

Patil et al., through the May Measurement Month India campaign, demonstrated a significant burden of elevated blood pressure among apparently healthy adults and emphasized the effectiveness of community-based screening programmes in improving awareness and detection. The notable prevalence of hypertension observed in the present study further supports the need for periodic blood pressure assessment and opportunistic screening,

particularly among individuals with multiple lifestyle-related risk factors.[10]

Ranjan et al. reported that obesity, family history of hypertension, physical inactivity, excessive dietary salt intake, and inadequate knowledge regarding hypertension were important determinants of elevated blood pressure among adults attending a tertiary care center. Similar associations were observed in the present study, indicating that lifestyle modification, dietary counseling, and public awareness programmes can play a vital role in reducing hypertension among young adults.[11]

Choudhary observed a considerable prevalence of hypertension among adults aged 20–40 years in urban Gujarat and identified increasing age, obesity, smoking, alcohol use, and sedentary lifestyle as significant predictors. The findings of the present study closely parallel these observations, suggesting that hypertension is becoming increasingly prevalent among younger adults across different regions of India and warrants greater public health attention.[12]

Tang et al. demonstrated persistent hypertension among young adults despite improvements in awareness and treatment over time, emphasizing that inadequate lifestyle modification continues to contribute significantly to disease burden.

The present study also identified several modifiable behavioral risk factors, highlighting the importance of strengthening preventive strategies, promoting healthy lifestyles, and encouraging regular blood pressure monitoring in young adults to reduce future cardiovascular risk.[13]

Overall, the findings of the present study indicate that hypertension among adults aged 20–40 years is strongly associated with both demographic and lifestyle-related risk factors. Early detection through routine screening, coupled with health education, weight management, increased physical activity, dietary modification, smoking cessation, and appropriate clinical follow-up, may substantially reduce the burden of hypertension and its long-term cardiovascular complications.

Conclusion

Hypertension is increasingly prevalent among adults aged 20–40 years and is significantly associated with modifiable risk factors such as obesity, smoking, alcohol consumption, physical inactivity, diabetes, and family history of hypertension. Early blood pressure screening, lifestyle modification, and public health education are essential for timely diagnosis and prevention. Strengthening community-based screening programmes and promoting healthy behavioral practices may improve hypertension control and reduce the future

burden of cardiovascular disease among young adults.

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