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PREVALENCE AND RISK FACTORS OF HYPERTENSION AMONG YOUNG ADULTS IN URBAN PAKISTAN: A CROSS-SECTIONAL STUDY

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ABSTRACT

High blood pressure has become a key health issue of concern among young adults and especially in highly urbanizing areas in the low- and middle-income countries. Premature hypertension has a profound effect on the risk of cardiovascular morbidity and mortality in the long term. Nevertheless, there is a lack of information regarding its prevalence and risk factors in urban youth in Pakistan. The purpose of the current study was to estimate the prevalence of hypertension and identify determinants of hypertension in young adults living in urban Pakistan. The study was a community-based cross-sectional study involving 720 young adults aged 18-35 years and was done using a multistage random sampling method. A structured questionnaire based on WHO STEPS, which included sociodemographic characteristics, lifestyle behaviors, and clinical history, was used to collect the data. Standardized procedures were used to measure blood pressure and hypertension was determined based on AHA 2017 guidelines. The statistical analysis was done with the help of SPSS version 26 where chi-square and multivariate logistic regression were used to determine independent predictors. The general prevalence of hypertension was 27.1%, and the prevalence was much more in males (30.6%) than females (23.1%) ($p = 0.012$). The prevalence of hypertension was higher by age and body mass index. Multivariate analysis revealed that family history (OR: 2.91, 95% CI: 2.01–4.20) and BMI ≥25 kg/m² (OR: 2.48, 95% CI: 1.74–3.53) were the strongest predictors. Abnormal salt consumption (OR: 2.11), physical inactivity (OR: 1.72), stress (OR: 1.64), and fast food consumption (OR: 1.58) were also other important factors. The study presents the high prevalence of high blood pressure in young urban adults in Pakistan, which is mainly caused by lifestyle changes that are modifiable. There is a need to reduce the risk of cardiovascular diseases which is on the rise in this population through early screening, lifestyle change and specific public health interventions.

KEYWORDS: *Hypertension; Young adults; Urban health; Risk factors; Pakistan; Lifestyle; Cross-sectional study; Cardiovascular risk; Obesity; Public health*

INTRODUCTION

One of the most important non-communicable ailments in the world and a dominant risk factor of cardiovascular morbidity and mortality is hypertension. It causes a large percentage of mortality rates caused by heart disease, stroke, and kidney diseases (Matsushita et al., 2022). It has been estimated that over one billion people worldwide are experiencing high blood pressure, with a relatively greater number of people being burdened in low- and middle-income nations. Although there has been an improvement in healthcare systems and awareness, hypertension is still mostly unrecognized and improperly managed especially in younger cohorts (Kalra et al., 2021, Goorani et al., 2024). Historically, hypertension has been viewed as a disease that is associated mainly with middle-aged and older people. Nonetheless, there is an alarming trend in the current epidemics that show a worrying development of its prevalence among the youth adults (Bie et al., 2024). This change is most pronounced in fast urbanizing areas, where lifestyle changes have also resulted in a significant change in behavioral and environmental exposures. Being a relatively low-risk group, young adults are also showing early-onset hypertension, which is a severe risk because of the long-term exposure to high blood pressure and the cumulative effects on cardiovascular health (Gooding et al., 2020, Jones et al, 2021). One such factor in this epidemiological transition has been urbanization. In other countries such as Pakistan, the rapid increase in urbanization has been associated with a great change in the dietary patterns, the level of physical activity, and psychosocial environment (Mascherini et al., 2021). The availability and consumption of processed and fast foods, which in most cases contain salt, sugar, and other unhealthy fats have resulted to poor health outcomes. At the same time, sedentary lifestyles, facilitated by technological innovation and alterations in occupational structure have decreased the general levels of physical activity among urban residents (Stappers et al., 2023, Adhikari et al., 2026). Along with lifestyle modification, psychosocial stress has emerged as a significant risk factor to hypertension among young adults. Cities have been known to be accompanied with a high degree of stress because of the strain of studies, employment rivalry, economic instability, and social issues (Gizelis et al., 2021). Prolonged stress may result in a prolonged sympathetic nervous system activation and hormonal disruptions, which eventually cause increased blood pressure. Moreover, this risk is aggravated by behavioral factors like tobacco use and unhealthy coping mechanisms (Friedman, 2020, Lakshmi et al., 2023). Another significant contributor to hypertension has also been found to be obesity and overweight status. Poor dietary habits and inactivity are the two essential factors that are closely related to the increasing rate of obesity among young adults (Batiha et al., 2025). The presence of excess body weight is linked to heightened vascular resistance, metabolic imbalance and inflammation, which contributes to the onset of hypertension. The burden of obesity is on the increase in urban areas where there is high access to calorie-rich foodstuffs and limited chances to exercise (Hojjat & Hojatt, 2021, Drangert et al., 2024). The risk of hypertension is further increased by genetic predisposition and family history. Those who have a good family history have higher chances of developing high blood pressure because of inherited physiological factors and the shared environmental factors (Khan et al., 2025). Genetic factors cannot be altered but their interaction with lifestyle factors can greatly contribute to the occurrence and course of hypertension. Thus, prevention is impossible without early detection of high-risk people (Ojangba et al., 2023, Charchar et al., 2024). Although there is an increasing problem of hypertension in young adults, awareness, screening, and early intervention are badly lacking. A significant number of young people are asymptomatic and thus less prone to medical assessments (Sah et al., 2021). The result of this absence of regular screening is late diagnosis, which enables the condition to develop without notice. As a result, hypertension in early years increases the life time risk of cardiovascular diseases such as coronary artery disease, stroke and chronic kidney disease (Luyckx et al., 2022, Teza

et al., 2023). The situation is especially worrying in the context of Pakistan, which is rapidly urbanizing, undergoing a shift in lifestyles, and has a poor public health infrastructure. Although a few studies were conducted on hypertension in general populations, there are few studies on the same but specifically among the young adults in urban areas. Knowledge on prevalence and the risk factors in this population is critical in the development of specific interventions and health policies. Considering these, the current study determines the prevalence of hypertension in young adults in urban Pakistan and determine the main sociodemographic, behavioral, and lifestyle-related determinants. This study will help to fill in the increasing literature on early-onset hypertension and will help inform preventive measures to mitigate the burden of cardiovascular diseases. Early diagnosis, prevention by lifestyle changes and education of youth populations are key measures in alleviating the health effects of hypertension in the long-term.

METHODOLOGY

Study Design and Setting

The community-based cross-sectional study was done in six months in the key urban centers in Pakistan such as the metropolitan regions that have a high rate of urbanization, a variety of socioeconomic status, and lifestyle changes. The objective of the study was to evaluate the incidence and predictors of hypertension in young adults living in urban area.

Study Population and Eligibility Criteria

The participants of the study were young adults (18-35 years old) living in the chosen urban areas at least six months. Those with pre-diagnosed secondary hypertension, those taking antihypertensive drugs and pregnant women and those with chronic systemic diseases were excluded to control the confounding factors.

Sample Size and Sampling Technique.

A single population proportion formula was used to calculate the sample size of 720 based on the assumptions of a population prevalence of hypertension of 25%, a 95% confidence level, and a 5-percent margin of error, adjusted by non-response. Multistage random sampling method was used. Urban clusters (wards/sectors) were initially chosen randomly, and the households were subsequently chosen systematically. A simple random method was used to select one participant who was eligible within each household.

Data Collection Tools and Procedure

Data were collected using a structured and pre-tested questionnaire, adapted from standardized WHO STEPS instruments. The questionnaire captured:

- Sociodemographic variables (age, gender, education, income)
- Behavioral factors (physical activity, dietary habits, salt intake, fast food consumption)
- Psychosocial factors (perceived stress levels)
- Clinical history (family history of hypertension, tobacco use)

Standard procedures were used to measure anthropometric measurements. The height and weight were measured to determine body mass index (BMI) as normal (<25 kg/m²) and overweight/obese (≥25 kg/m²).

Blood Pressure Measurement

The calibrated digital sphygmomanometer was applied to measure the blood pressure in accordance with the standard protocols. The participants were allowed to sit down and rest at least five minutes before measurement. Readings were taken at intervals of five minutes and averaged to analyze. The definition of hypertension based on the American Heart Association (AHA) 2017 guidelines was systolic blood pressure 130 mmHg and/or diastolic blood pressure ≥80 mmHg.

Statistical Analysis

All the data were inputted and analyzed through IBM SPSS Statistics version 26. The data was summarized using descriptive statistics, such as frequencies, percentages, means and standard deviations. The Chi-square test was used to test the relationships between hypertension and categorical data including gender, BMI, physical activity, dietary data, and behavioral attributes.

Statistically significant variables ($p < 0.05$) of bivariate analysis were incorporated into a multivariate logistic regression model to determine independent predictors of hypertension. Adjusted odds ratios (ORs) and confidence intervals (CIs) were computed and the level of statistical significance was fixed at $p < 0.05$. The Hosmer–Lemeshow goodness-of-fit test was used to measure model fitness.

Ethical Considerations

The institutional review board with the necessary ethical approval was sought. All the participants were informed and gave an informed consent before data were collected. All the participants enjoyed the privacy and anonymity of the research.

RESULTS

Participant Characteristics

The current cross-sectional study included 720 young adults and the mean age was 26.8 ± 5.2 years. The study population comprised 382 (53.1%) males and 338 (46.9%) females. The distribution of the population shows that it has a marginally more significant percentage of males, as is typical of the urban workforce. The vast majority of respondents were in the middle socioeconomic classes and were educated up to the secondary stage. Table 1 presents the summary of the baseline anthropometric and behavioral characteristics of the study population.

Table 1: Baseline Characteristics of Study Participants (n = 720)

VARIABLE	CATEGORY	FREQUENCY (N)	PERCENTAGE (%)
GENDER	Male	382	53.1
	Female	338	46.9
AGE GROUP	18–24 years	248	34.4
	25–30 years	271	37.6
	31–35 years	201	27.9
BMI CATEGORY	Normal (<25)	424	58.9
	Overweight/Obese (≥25)	296	41.1
PHYSICAL ACTIVITY	Adequate	476	66.1
	Low	244	33.9
SALT INTAKE	Normal	441	61.3
	High	279	38.7

Prevalence of Hypertension

The overall incidence of the hypertension among the participants of the study was 27.1% (n = 195). The prevalence was also reported to be much higher in males (30.6%) than in females (23.1%) and this difference was found to be statistically significant (p = 0.012). Table 2 shows the gender-wise distribution of hypertension, whereas Figure 1 demonstrates the graphical representation of the prevalence by gender.

Table 2: Prevalence of Hypertension According to Gender

GENDER	TOTAL (N)	HYPERTENSIVE (N)	PREVALENCE (%)	P-VALUE
MALE	382	117	30.6	0.012
FEMALE	338	78	23.1	
TOTAL	720	195	27.1	

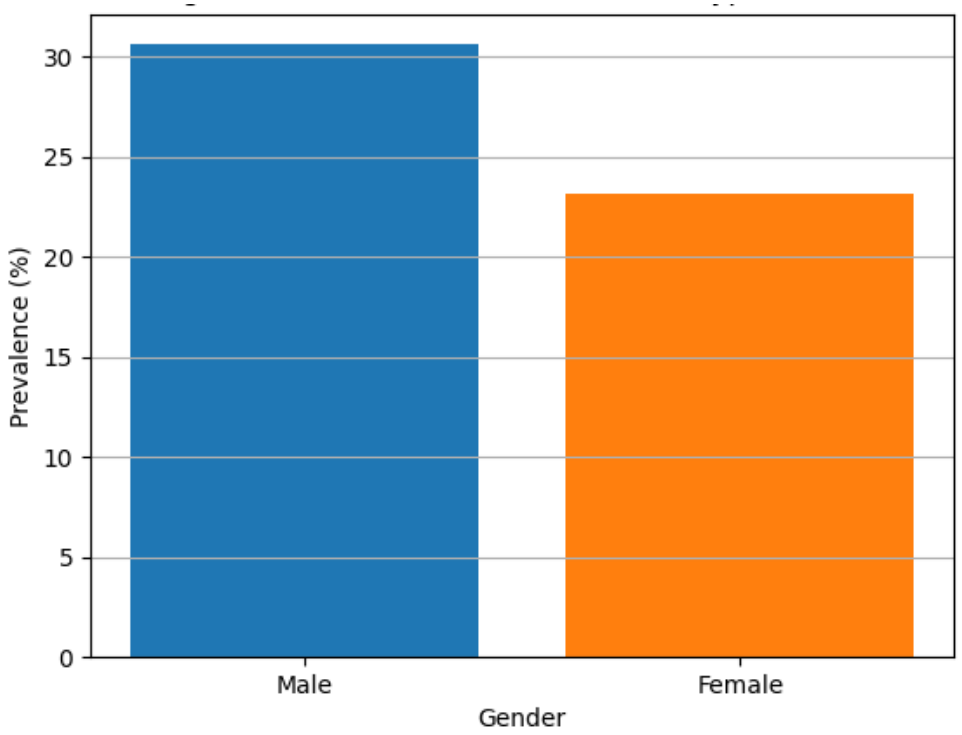


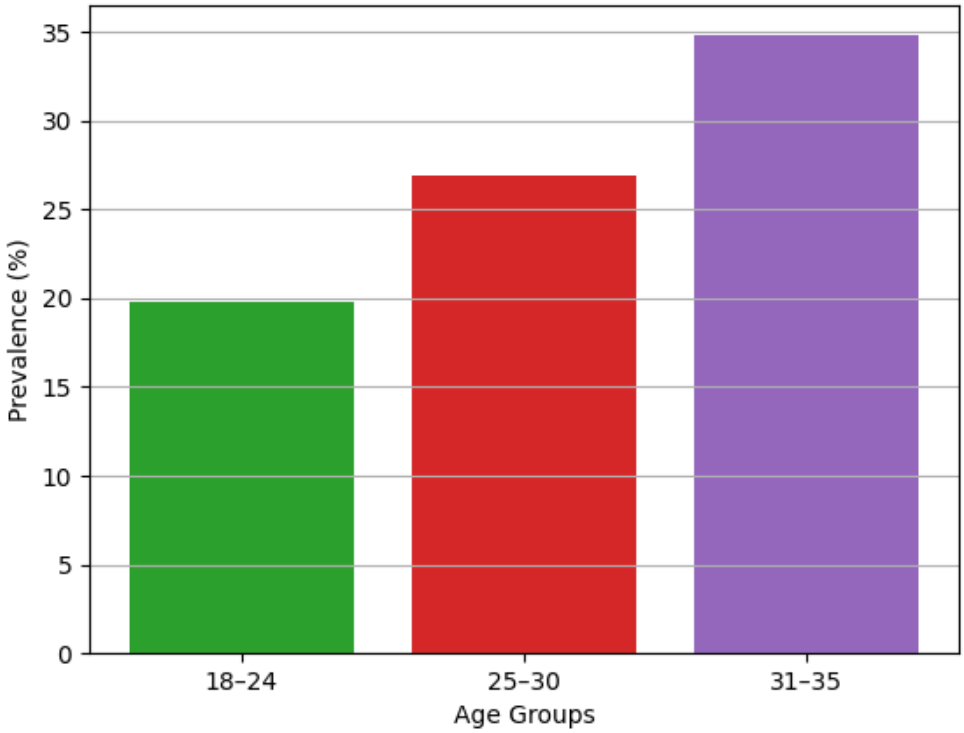
Figure 1: Gender-wise distribution of hypertension among young adults in urban Pakistan. The bar chart illustrates a higher prevalence of hypertension among males (30.6%) compared to females (23.1%), indicating a statistically significant gender-based difference in blood pressure status.

Distribution of Hypertension by Age and BMI

The incidence of hypertension rose with age and body mass index. Participants aged 31–35 years exhibited the highest prevalence (34.8%), followed by those aged 25–30 years (26.9%) and 18–24 years (19.8%). Likewise, there was an apparent markedly increased prevalence (40.5%) in people with BMI ≥25 kg/m^2 than normal BMI (17.2%). These correlations were found to have a significant value ($p < 0.001$). This is highly detailed in Table 3 and trend shown in Figure 2.

Table 3: Prevalence of Hypertension by Age Group and BMI

Variable	Category	Total (n)	Hypertensive (n)	Prevalence (%)	p-value
Age Group	18–24	248	49	19.8	<0.001
	25–30	271	73	26.9	
	31–35	201	70	34.8	
BMI	<25	424	73	17.2	<0.001
	≥25	296	120	40.5	



Association Between Lifestyle Factors and Hypertension

There was a strong correlation between hypertension and other lifestyle related factors. In hypertensive, the percentage of reporting family history of hypertension (69.2%) was higher, as well as, high salt intake (56.9%), low physical activity (48.7%), frequent intake of fast foods (51.3%), high level of perceived stress (44.1%). These parameters were much more common in hypertensive people than in normotensive subjects ($p < 0.001$). The comparative distribution of these variables is shown in Table 4

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Table 4: Distribution of Risk Factors Among Hypertensive and Normotensive Participants

Risk Factor	Hypertensive (n=195)	Normotensive (n=525)	p-value
Family history	135 (69.2%)	182 (34.7%)	<0.001
BMI ≥25	120 (61.5%)	176 (33.5%)	<0.001
Low physical activity	95 (48.7%)	149 (28.4%)	<0.001
High salt intake	111 (56.9%)	168 (32.0%)	<0.001
Fast food intake	100 (51.3%)	172 (32.8%)	<0.001
High stress	86 (44.1%)	141 (26.8%)	<0.001
Tobacco use	70 (35.9%)	109 (20.8%)	<0.001

Multivariate Analysis of Risk Factors

To determine independent predictors of hypertension with potential confounders, multivariate logistic regression analysis was conducted. The analysis revealed that family history of hypertension (OR: 2.91, 95% CI: 2.01–4.20) and BMI ≥25 kg/m² (OR: 2.48, 95% CI: 1.74–3.53) were the strongest predictors. Additionally, high dietary salt intake (OR: 2.11, 95% CI: 1.46–3.04), low physical activity (OR: 1.72, 95% CI: 1.20–2.47), high stress levels (OR: 1.64, 95% CI: 1.13–2.38), and frequent fast food consumption (OR: 1.58, 95% CI: 1.10–2.26) were found to be statistically significant independent

risk factors ($p < 0.05$). These results affirm the powerful role of lifestyle determinants that are changeable in causing hypertension among the young adults in urban Pakistan. Similarly, individuals with BMI ≥25 kg/m² demonstrated a markedly higher prevalence of hypertension compared to those with normal BMI (17.2%). This association was statistically significant ($p < 0.001$), as illustrated in Figure 3.

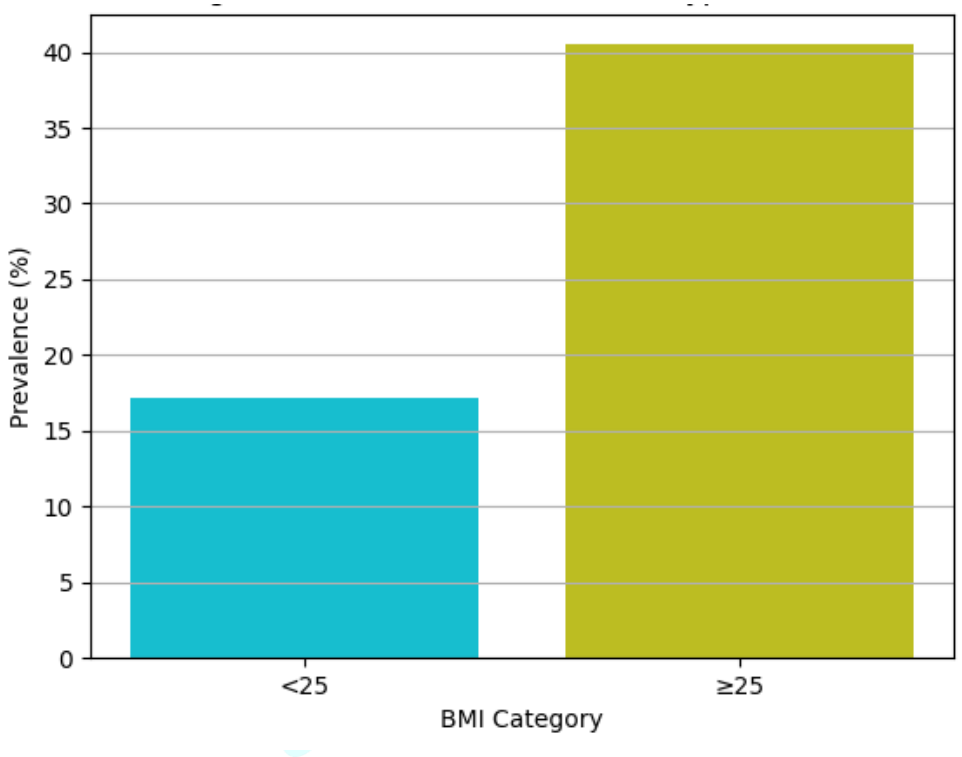

Figure 3: Prevalence of hypertension according to body mass index (BMI) categories. The chart shows a markedly higher prevalence among overweight and obese individuals (BMI ≥25 kg/m²; 40.5%) compared to those with normal BMI (<25 kg/m²; 17.2%), highlighting the strong association between increased body weight and hypertension.

DISCUSSION

The current investigation showed a surprisingly high prevalence of hypertension (27.1%) in young adults in urban Pakistan, which indicates the increasing public health issue. This observation is consistent with the growing body of evidence that shows an increasing prevalence of hypertension among younger cohorts in the low- and middle-income nations facing urbanization at a rapid pace (Schutte et al, 2021, Ranzani et al., 2022, Rabba, 2022). The given prevalence is slightly greater than the prevalence reported in other similar studies in South Asia, which are usually between 20% and 25% due to the growing influence of urban lifestyle changes (Martinez-Amezcua et al., 2020, Mohammed Nawi, et al., 2021). The prevalence of hypertension was also significantly higher in males than in females, which is in line with previous studies that show that males and females are associated with gender-level differences in exposure to behavioral risk factors, including smoking, alcohol use, and work-related stress (Aleku et al., 2021, Zinabu et al., 2024). There is a possibility that biological aspects, such as hormonal effects and variations in fat distribution, also play a role in this difference (Zhang et al., 2022). The age-wise analysis showed an upward trend in the prevalence of hypertension with old

age even among the relatively young age group of 18-35 years. The highest prevalence was observed in participants aged 3135 years, which promotes the idea that there are early alterations in the vascular system and a cumulative effect of risk factors on the blood pressure in adulthood (Reges et al., 2021, Kwon & Kim, 2024). Body mass index was identified as one of the most effective predictors of high blood pressure, and overweight and obese people have been shown to have much higher rates. The observation can be attributed to a large body of literature on adiposity and vascular resistance, endothelial dysfunction, and renin-angiotensin-aldosterone system (Balakumar et al., 2021, Hall et al., 2021). This association is also increased by urban living, which is associated with sedentary lifestyles and high-energy diets (Ameer Arsalan Hadi, 2021). The strongest independent predictor was found to be family history of hypertension, which is indicative of genetic predisposition and shared environmental factors. The positive family history was almost three times more likely to result in hypertension, as the results were in line with the prior epidemiological literature (Li et al., 2021, Wu et al., 2021). In this study, dietary practices especially high salt were highly related to hypertension. High sodium intake has been extensively identified as a significant adjustable risk factor of hypertension, especially in South Asians where salt consumption in the diet tends to be higher than the recommended amounts (Ghimire et al., 2021, Bhattacharya et al., 2022). This trend is probably caused by the growing use of processed and fast foods in urban Pakistan. Another key determinant was physical inactivity which supported the protective effects of regular physical activity to cardiovascular health. Desk jobs decrease the elasticity of the vessels and worsen the process of metabolism, which predisposes to hypertension (Schiffrin, 2020, Kang, 2021). Interestingly, psychosocial stress became a predictor of hypertension by itself, indicating the increased influence of urban stressors, including work pressure, financial instability, and social problems. The neuroendocrine pathways triggered by chronic stress are associated with chronic blood pressure elevation (Zefferino et al., 2021, Agorastos & Chrousos, 2022). There was also a significant association between fast food consumption and hypertension, which was probably so because of the high level of sodium, unhealthy fats, and calories contained in fast food. The evidence in favor of this finding is found globally in the studies associating Westernized eating habits with increased cardiovascular risk (Zampelas & Magriplis, 2020, Clemente-Suárez et al., 2023). The interplay of these changeable lifestyle factors highlights the need to have preventive measures at an early stage. Dietary changes, physical exercise, stress management, and frequent screening of young adults are vital public health measures that can be used to contain the current hypertension epidemic in young adults. This study has some limitations in spite of its strengths. The cross-sectional design restricts the ability to make causal inferences, and use of self-reported data can be subject to recall bias. Also, a single visit was used to measure blood pressure, which might not be sufficient to represent variability. In general, the results indicate that there is a great necessity of specific interventions and strategies at the policy level to deal with the increasing hypertension burden in urban Pakistan. Early diagnosis and lifestyle change are the most important in decreasing cardiovascular risks in the long term.

Conclusion

In the current study, it is found that the prevalence of hypertension in young adults in urban Pakistan is high, and such a situation is an emerging public health issue. They found both non-modifiable determinants including family history and modifiable lifestyle determinants including obesity, high salt intake, physical inactivity, stress, and consuming fast foods frequently to be important determinants. The results highlight the importance of early screening and specific interventions aimed at lifestyle modification. It is necessary to promote healthy behavior, raise awareness and incorporate routine blood pressure checks within primary healthcare systems. Early control of these risk factors is likely to have a significant impact on decreasing cardiovascular

morbidity in the long run and improving the outcome of population health.

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