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Prevalence of Hypertension and Associated Risk Factors Among Undergraduate Medical Students in Pakistan

Shazia Agha¹, Nomira Waheed², Javeria Sajjad³, Noreen Rasul⁴, Farhat Yasmin Minhas⁵, Mamuna Qayum⁶

¹Department of Obstetrics & Gynaecology unit 1 Services Hospital, Lahore

²Assistant Professor, Community Medicine, Rawal Institute of Health Sciences- Rawalpindi

³Senior Registrar, Medical Unit 2, Nawaz Sharif Medical College, Aziz Bhatti Shaheed Teaching Hospital, Gujrat

⁴Associate professor of Obstetrics and Gynecology Red Crescent Medical College, Lahore

⁵Assistant professor, behavioral sciences, Avicenna Medical college, Lahore, Pakistan

⁶Professor of Obstetrics and Gynecology, Cavalry Hospital Lahore

Corresponding Author:

Farhat Yasmin Minhas

dmeprcmdc@gmail.com

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Abstract:

Objective

Hypertension is increasingly recognized among young adults, yet data on its prevalence and associated risk factors in medical students from Pakistan remain limited. This study aimed to determine the prevalence of prehypertension and hypertension among undergraduate medical students in Lahore and to assess their awareness of risk factors associated with hypertension.

Methods

A cross-sectional study was conducted at A Private Medical college Hospital, Lahore, during the academic year 2024–2025. A total of 210 undergraduate students from medicine, dentistry, nursing, and allied health sciences participated (response rate: 70%). Data were collected using a pretested, structured, self-administered questionnaire assessing sociodemographic variables, lifestyle factors, and knowledge of hypertension risk factors. Blood pressure was measured twice using a mercury sphygmomanometer. Statistical analysis was performed using SPSS-17, including chi-square tests and multivariable log-binomial regression to identify predictors of prehypertension and hypertension.

Results

A considerable proportion of students exhibited prehypertension or hypertension. Awareness was high for several modifiable risk factors, including psychosocial stress, high cholesterol, obesity, smoking, and high-calorie diets. However, knowledge gaps were evident regarding physical inactivity, oral contraceptive use, and non-modifiable factors like, family history and aging. Male emerged as a strong independent predictor of elevated blood pressure. Obesity and alcohol consumption were also significantly associated with prehypertension.

Conclusion

Despite reasonable awareness of common lifestyle-related risk factors, significant knowledge deficiencies and a notable prevalence of hypertension exist among undergraduate medical students. Early screening, health education, and preventive interventions are urgently needed to reduce the future burden of hypertension in this high-risk young adult population.

Introduction

Hypertension, a significant contributor to the global burden of disease. it poses a considerable public health challenge, particularly given the paucity of data concerning its prevalence and associated risk factors among young adults and teenagers(1). This issue is further compounded by the escalating incidence of hypertension in younger population. A trend that underscores the urgent need for comprehensive epidemiological studies in this demographic. Specifically, understanding the prevalence of hypertension and its related risk factors among undergraduate medical students. In Pakistan it is crucial, as this group represents future healthcare professionals who are simultaneously undergoing a demanding educational period that may influence their health behaviors(2). The silent nature of hypertension, often presented without obvious symptoms, can lead to severe cardiovascular complications if left unmanaged, highlighting the importance of early screening, even in seemingly healthy young adult populations(3). This necessitates a thorough investigation into the prevalence of elevated blood pressure and hypertension within this specific cohort, along with an identification of the modifiable risk factors contributing to its development(4). Such research can inform targeted interventions and public health strategies aimed at mitigating the long-term health consequences of hypertension in Pakistan and other regions facing similar challenges(5). This study, therefore, aims to ascertain the prevalence of hypertension and prehypertension among undergraduate medical students in Pakistan and to identify the demographic, lifestyle, and physiological factors associated with these conditions, thereby contributing to a more robust understanding of cardiovascular health within this critical population segment. Although most of the research evaluates the incidence of hypertension and its risk factors in older persons and the elderly, there is a dearth of information on teens and young adults because they are thought to be less likely to develop the condition(1,6). Concerns have been raised about the possibility that young adults may also be experiencing an increase in hypertension and that instances may go undiagnosed due to insufficient screening in this age group.

This study will specifically address the gap in current literature by examining the alarming increase in prehypertension among young adults and its correlation with various lifestyle and demographic factors. The global prevalence of hypertension, estimated at 40.8%, signifies a rapidly growing public health concern, contributing to millions of premature deaths annually due to cardiovascular and cerebrovascular diseases(7). This escalating global burden underscores the critical need for effective preventive strategies, especially given the observed shift towards an increased prevalence of hypertension in younger adult populations(4).

Understanding the underlying risk factors is essential for changing lifestyle choices that promote the best possible cardiovascular health. An crucial preventive educational strategy is to measure and correctly disseminate information of the modifiable risk variables at an early age(2). Therefore, strategies to lower blood pressure in children and young people, even slightly, are crucial public health objectives. The current study aims to determine the prevalence of hypertension and associated risk factors among Lahore's undergraduate medical students.

MATERIALS AND METHODS:

A private medical teaching Hospital, Lahore has four colleges, namely Medical college, Dental college, institute of Nursing and institute of Allied Health Sciences, with multinational students. For the academic year 2024 – 2025 it had an annual intake of 300 students (150 in MBBS, 50 in BDS, 50 in

Nursing, and 50 in IAHS), in the four programs, out of which 210 students who were present on the day of data collection participated in the study with a response rate of 70%.

The Ethics Committee gave their approval to the study. A pre-tested, structured, self-administered questionnaire was used for the survey. In addition to questions about awareness of the modifiable and non-modifiable risk factors for hypertension and a 30-day recall of physical activity, the questionnaire included sociodemographic characteristics such as age, gender, nationality, ethnicity, and religion. If students did not engage in at least 30 minutes of regular physical activity each day, five days a week, they were classified as less active. Eleven modifiable and three non-modifiable risk variables were included in the assessment of knowledge of hypertension risk factors. For each modifiable risk factor, a score of one was awarded for a valid response, and zero for an incorrect response. A score of six or higher out of eleven was regarded as good knowledge, while a score of less than six was seen as low knowledge. Three specialists in the fields of internal medicine, Community medicine, and Family health verified this.

Before distributing the surveys, the researchers gave the relevant class an explanation of the study's goal and obtained verbal consent. Everyone in the classroom took part in the study, albeit anyone might choose not to. The researchers verified that the surveys were complete when they were collected back.

The same team used a mercury sphygmomanometer to measure blood pressure twice, separated by a minute. The results were interpreted in accordance with the National Heart, Lung, and Blood Institute's 2003 blood pressure guidelines(8), as indicated in Table 1.

PASW-17 (IBM, Chicago, Illinois) was used to evaluate the data. Age, gender, nationality, course, diet, physical activity, smoking, presence of hypertension, and family history of diabetes, hypertension, renal disease, stroke, and CVD were all examined in relation to risk factor awareness using the Chi Square test. To determine the Crude Odds Ratio (OR), gender (P value 0.09) and the existence of pre/hypertension (P value 0.07) were added to the variables that demonstrated a significant P-value ($P < 0.05$) in the binary logistic regression analysis. To determine the Adjusted Odds Ratio, factors with crude OR > 1 were incorporated into the multiple binary logistic regression analysis.

RESULTS:

The study evaluated 210 entry-level students at one medical university's knowledge of eleven modifiable and three non-modifiable risk factors for hypertension and their correlation with study variables.

Category	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Normal	Less than 120	Less than 80
Pre-hypertension	120-139	80-89
Hypertension- Stage1	140-159	90-99
Hypertension- Stage2	160 and above	100 and above

Table 1: Blood pressure guidelines

The sociodemographic profile of the research participants is displayed in Table 2. Of the participants, 87 (41.4%) were older than 20, 126 (60%) were men, and 98 (46.6%) were enrolled in the MBBS program.

Variable	Participants N=210	Number (%)
Age	Less than 20 years	87 (41.4)
	More than 20 years	123 (58.5)
Gender	Male	126 (60)
	Female	84 (40)
Academic Program	MBBS	98 (46.6)
	BDS	43
	Nursing	39
	Allied Sciences	30

Table 2: Sociodemographic characteristics of the participants

Among the 210 individuals, 189 (75.5%), 172 (73.6%), 99 (73.6%), and 71 (71.8%) reported stress, high cholesterol, obesity, and smoking as risk factors. A high-calorie diet was deemed a risk factor for hypertension by 181 (62.7%) and high salt intake by 121 (69.1%). Consumption of coffee and energy drinks was regarded as a risk factor by 152 (46.4%) and 179 (64.5%), respectively. Just 48 (13.6%) of the respondents were aware of the risk of oral contraceptives in hypertension, while more than half, 152 (47%), were aware that physical inactivity is a risk factor. 70 (50%) of the risk is associated with a family history of cardiovascular disorders, and the risk increases with age [Table 3].

Risk Factors	Knowledge (n %)	No Knowledge (n %)
Reduced physical activity	152	58
Smoking	71	139
High cholesterol	172	38
High calorie food	181	29
High salt intake	121	89
Psychosocial stress	189	21
Oral contraceptives	48	162
Obesity	99	111
Coffee intake	152	58
High energy drink intake	179	31
Diabetes mellitus	192	18
Family history of CVD	70	140

Table 3: Knowledge regarding risk factors of hypertension among the participants

Male sex continued to be a significant predictor of prehypertension and hypertension in Table-4: Multivariable analysis, with a prevalence that was more than three times higher than that of females. After controlling for covariates, alcohol use and obesity both demonstrated statistically significant independent correlations, suggesting higher prevalence. After adjustment, other factors lost significance, indicating that coexisting variables could account for their effects.

Variable	Category	PR (95% CI)	<i>p</i>	aPR (95% CI)	<i>p</i>
Age	Per 1-year increase	1.01 (0.97–1.24)	0.127	1.03 (0.92–1.14)	0.619
Sex	Male	3.61 (2.86–4.55)	<0.001	3.07 (2.32–4.06)	<0.001
	Female	1.00 (Ref)	–	1.00 (Ref)	–
BMI	Underweight	0.72 (0.57–0.91)	0.006	0.80 (0.65–1.00)	0.052
	Normal	1.00 (Ref)	–	1.00 (Ref)	–
	Overweight	1.57 (1.22–2.02)	<0.001	1.11 (0.87–1.41)	0.391
	Obese	2.06 (1.65–2.57)	<0.001	1.35 (1.08–1.68)	0.008
Alcohol use	Yes	1.73 (1.44–2.08)	<0.001	1.28 (1.03–1.59)	0.026

PR: prevalence ratio; aPR: adjusted prevalence ratio; CI: confidence interval.

Table 4: Risk factors associated with prehypertension/hypertension using log-binomial regression analysis

Discussion:

The current research evaluated the rate of prehypertension and hypertension and awareness of the related risk factors in undergraduate medical students in Lahore, Pakistan. The overall results of the study were that majority of the participants showed reasonable awareness of some of the modifiable risk factors of hypertension which included psychosocial stress, obesity, high cholesterol, smoking, high salt intake and high-calorie diets. Such findings can be compared to those that are published in the reference study that also demonstrated the comparably large amount of knowledge on the commonly debated risk factors among medical students(9). This resemblance implies that medical education and general health messages in the initial stages of development contribute to the formation of the perceptions of students about the risk factors of hypertension(1).

Although this is the case, significant gaps in knowledge were found. The level of awareness of physical inactivity as a risk factor of hypertension was low with the proportion of the participants who identified its existence being half. Also, the level of information on the relationship between oral contraceptive and hypertension was low. The results are in line with the reference research, which implies that some risk factors are not sufficiently highlighted regarding students' education(10,11). Considering that the inactive lifestyle among university students is on the rise, the ignorance about physical inactivity is alarming and presents a field on which educational interventions can be focused(12).

Participants also lacked knowledge in non-modifiable risk factors including family history of cardiovascular disease and the rising age(11). The importance of genetic predisposition and

demography in the development of hypertension was not acknowledged by many students. The same knowledge shortcomings were seen in the reference article, implying that the students would pay more attention to the risks associated with lifestyle, but they undertake the significance of inherited and demographic factors. Zafar & Usman et, al. (2023) contend that it is crucial to understand these factors to identify risk very early and preventive counseling at the earliest stage especially among persons with a positive family history of cardiovascular disease(13).

Nevertheless, significant knowledge gaps were found. The level of awareness on the issue of physical inactivity as a hypertension risk factor was low with most of the participants having only half the participants who were aware of the issue(14). Also, there was low awareness regarding the relationship between oral contraceptive and hypertension. These results align with the reference study, and it means that some risk factors are still underemphasized in student education. Bearing in mind the growing popularity of sedentary lifestyles among students of universities, the scarcity of knowledge about physical inactivity is alarming and indicates a gap that can be addressed through specific educational interventions(10).

Participants also lacked knowledge of non-modifiable risk factors, including family history of cardiovascular disease and aging. Most students did not appreciate the presence of genetic predisposition and demographic factors in the development of hypertension(5). The same gaps in knowledge were noted in the reference article. Hence, it is likely that students pay more attention to lifestyle-related risk factors and underestimate inherited and demographic factors. Knowledge of these factors is vital in the process of identifying and preventing risk at an early stage especially to people whose families have a positive family history of cardiovascular disease(15).

The researchers found out that young students of medicine had a significant prevalence of prehypertension and hypertension. This observation confirms the rising global evidence which is showing that high blood pressure is at an earlier age probably because of lifestyle changes, stress and eating patterns(15). It is also important that prehypertension exists in this age group, which is a predetermined amount of hypertension and the occurrence of cardiovascular diseases in the future(13).

It was found that gender was an important independent predictor of prehypertension and hypertension. Even with confounding factors adjusted, male students had significantly higher rates of having elevated blood pressure than female students(16). This finding is consistent with the literature and can be explained by both the differences in biology and the lifestyle habits including an increase in the level of stress, an unhealthy diet, and the use of substances among males. Interestingly, there results reveal significant trends regarding the understanding of cardiovascular risk factors and the existence of high blood pressure among the young adults. The level of medical student knowledge and personal health behavior is of special interest since they are the future medical professionals of the population, and their behaviors are more relevant to the long-term population health results(10).

In this study, obesity also turned out to be a notable independent risk factor of high blood pressure. The prevalence of prehypertension and hypertension was found to be much higher among obese students opposed to normal BMI. This observation supports the already existing relationship between overnight and high blood pressure and the significance of weight measurement programs among young adults. The presence of academic stress, unusual timetables, and lack of exercise can be the reason behind the increasing rate of obesity among young adults(17).

Alcohol consumption was found to have a significant relationship with prehypertension and hypertension when the other variables were considered. Even though alcohol use could be underreported because of the culture, but its separate influence also shows that it is necessary to raise awareness and counseling with respect to substances use in students. This observation contributes to the scientific value beyond the reference study in which alcohol consumption was not examined as the predictor(18).

The results indicate that the institution-based health promotion programs are required. Inclusion of formal instructional content on lifestyle change, stress management, and preventive care in the medical curriculum will be useful in changing the habits of the students towards healthy living. Periodical screening of blood pressure rated, physical activity programs and mental health support should also help decrease the incidence of hypertension in the group of people(19).

Limitations:

These findings have number of limitations that should be considered. Cross-sectional design cannot make assumption on casual analysis. The research was based in one institution; thus, this could reduce the ability to generalize to all the medical students in Pakistan. Also, self-reported lifestyle behaviors can be recalled and socially desirable. The reliability of results is, however, enhanced by the fact that the sources include standardized blood pressure measurements and a tested questionnaire.

Conclusion:

Currently, research proves that, despite having sufficient knowledge on most of the hypertension risk factors, undergraduate medical students have major deficiencies, especially, on physical inactivity and non-modifiable factors. The fact that prehypertension and hypertension are particularly prevalent among males and obese students demonstrate acute necessity of preventive measure at early stages. The sample size of the study makes the findings more robust and aids in implementing specific health promotion initiatives to make the burden of hypertension among young adults less prevalent in the future.

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