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Prevalence of prehypertension among adults: a study from Peshawar

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ABSTRACT

Background and Objectives: People with pre-hypertension (PHTN) are more likely to develop hypertension (HTN), and have a higher risk of developing cardiovascular disease and renal disorders. This study aims to determine the prevalence of PHTN among the adult subjects employed at a teaching institute in Peshawar, Pakistan.

Methods: A descriptive cross-sectional study was conducted including 176 adult subjects at a teaching institute in Peshawar. A close-ended questionnaire, containing demographic and medical information, was designed to fulfill the aim of the current study. Blood pressure measurement was taken from all subjects and data were analyzed by using statistical software. The p -value of ≤ 0.05 was taken as statistically significant.

Results: The prevalence of PHTN and HTN was 50.57% ($n = 89$) and 18.19% ($n = 32$), respectively. A statistically significant association was found between gender and PHTN ($p = 0.036$). PHTN was more prevalent among the male gender, i.e., 39.8% comparative to females, i.e., 10.8%.

Conclusion: Random sampling of the staff working at a teaching institute showed that more than half of the study population had PHTN. The prevalence of PHTN was found statistically significant among the male gender.

Keywords: Blood pressure, hypertension, prehypertension.

Received: 05 September 2023

Revised date: 21 November 2023

Accepted: 16 December 2023

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Introduction

The word prehypertension (PHTN) was first introduced in 2003 to attract attention toward the higher risks resulting from hypertension (HTN). According to the seventh report of the Joint National Committee (JNC7) on the prevention detection evaluation and treatment of high blood pressure (BP), PHTN is defined as a systolic blood pressure (SBP) of 120-139 mmHg and diastolic BP of 80-89mmHg which was known as transient HTN, borderline HTN, or high normal BP in the past.¹ The National Health and Nutrition Examination Survey of 1999-2006 showed that the overall prevalence of PHTN in healthy adults was 36.3% worldwide.² Detecting PHTN is crucial in preventing the progression of HTN, a major risk factor for cardiovascular diseases (CVDs). However, despite its significance, PHTN often goes undetected due to the absence of noticeable symptoms. Identifying individuals with PHTN provides an opportunity for early intervention

and lifestyle modifications, which can significantly reduce the risk of developing HTN and its associated complications.³ People with PHTN are at the greatest risk of developing HTN and have a higher risk of acquiring circulatory diseases, resulting in increased morbidity and mortality.⁴ PHTN is related to nearly 60% of stroke and about 50% of ischemic heart disease. Prehypertensive individuals also suffer from many diseases including cardiac and renal disorders.⁵ Presently, there is a higher effort for early prevention and detection of PHTN resulting in the reduction of its transition to HTN; therefore decreasing the risks of developing CVDs.⁶ Some previous studies have recognized several factors that put people at higher risk of developing HTN. Some of these factors are non-modifiable such as age, gender, positive family history, and ethnicity while others are modifiable factors that predispose to HTN such as smoking, alcohol consumption,

diet, physical inactivity, body mass index (BMI), abdominal obesity, stress, hyperglycemia, and hypercholesterolemia.⁷ Therefore, understanding the importance of early detection and implementing appropriate screening measures are essential in combating the global burden of HTN -related diseases.

Therefore, this study aimed to determine the prevalence and risk factors of PHTN among young adults at a teaching institute in Peshawar, Khyber Pakhtunkhwa.

Methods

This descriptive cross-sectional study was designed to assess the prevalence of PHTN among the adult population of a teaching institute in Peshawar, Khyber Pakhtunkhwa (KPK), Pakistan, from February 2019 to May 2019. After the approval from the Institutional research committee, a total of $n = 188$ adults of the age group 18-66 years were selected through systemic random sampling. The inclusion criteria included all the adult population either as students or employees at a teaching institute of Peshawar irrespective of gender, placement, or duration of the job. However, adults with already diagnosed HTN or taking any hypertensive medications were excluded. A close-ended and anonymous questionnaire was designed after reviewing the relevant and published literature. It included demographic variables (such as name, age, weight, height, and so on), BP measurement, and relevant questions about risk factors including family history of HTN, occupation, daily exercise status, marital status, and so on. A written informed consent was obtained from all the respondents before their participation in this study. BP was measured by a trained physician using a single sphygmomanometer device to maintain standardization. The subject had rested for at least 10 minutes in a chair before recording the BP. The measurement was taken from the right arm. Two measurements were taken with the help of a mercury sphygmomanometer with at least 3 minutes between successive measurements. The means of two measurements were used for SBP and diastolic blood pressure (DBP) values. Before the BP measurement, the subjects were directed to avoid using cigarettes, coffee/tea, any food and doing any exercise for at least 30 minutes. The subjects were divided into three categories based on their BP readings as per the eighth report of JNC-8 HTN guidelines⁸. SBP ≤ 120 mmHg and DBP ≤ 80 mmHg were considered as normotensive (NT). The participants in whom SBP was between 120 and 139 mmHg or DBP between 80 and 89 mmHg were labeled as prehypertensives whereas those subjects were considered as hypertensives who had SBP ≥ 140 mmHg or DBP ≥ 90 mmHg.

Statistical analysis

Statistical Package for Social Sciences Version 22.0 was used for the statistical analysis of the data collected from adult populations of a teaching institute in Peshawar. For the socio-demographic variables, descriptive statistics were computed which were stated (in tabulated and bar chart forms) as mean, frequencies, and standard deviations. The associations between each of the socio-demographic variables and the prevalence of PHTN among the study participants were computed by using chi-square tests. The p -values of ≤ 0.05 were taken as statistically significant for all statistical tests.

Results

The final sample size was $n = 176$ as 12 (6.38%) subjects were non-respondents. Table 1 represents the characteristics of the studied participants. The minimum and maximum ages observed were 18 and 66 years, respectively.

Figure 1 illustrates the BP status of the studied participants. The prevalence of prehypertensives was 50.57% ($n = 89$) followed by NTs, (31.25%) and undiagnosed hypertensives (18.19%).

Table 1. Socio-demographic characteristics of the study population ($N = 176$).

Variables	n (%)
Gender	
Male	124 (70.5%)
Female	52 (29.5%)
Age (mean \pm SD) years	22.26 \pm 4.79
History of HTN in family	
Male	44 (25.0%)
Female	21 (11.9%)
Discipline status	
Medical lab technology (MLT)	42 (23.9 %)
Doctor of physical therapy (DPT)	87 (49.4%)
Dental technology (DT)	27 (15.3%)
Medical imaging technology (MIT)	10 (5.7 %)
Supporting Staff	5 (2.8%)
Administration staff	5 (2.8%)
Ethnicity	
Pathan	172 (97.7%)
Punjabi	1 (0.6%)
Christian	3 (1.7 %)
Marital status	
Married	16 (9.1 %)
Un married	155 (88.1%)
Widowed	0 (0%)
Other	5 (2.8%)
Daily exercise status	
Yes	47 (26.7%)
No	129 (73.2%)
Living status	
Home	78 (44.3%)
Hostel	97 (55.1%)
Others	1 (0.6%)

The independent variables such as gender, daily exercise status, family history of HTN, and living status, were cross-tabulated with the dependent variable, i.e., BP status. The chi-square test was applied to check any statistically significant association between the variables.

A statistically significant association was found between gender and PHTN ($p = 0.036$). The male gender was found to be more prehypertensive, i.e., 39.8% as compared to the female gender, i.e., 10.8%. However, no statistically significant association was found among other variables. The present study showed high frequencies of unmarried individuals (i.e., 43.8% vs. 5.7% married) and individuals with no daily exercise status, i.e., 36.4% (vs. 14.2% individuals with daily exercise) were observed more in the prehypertensive group as compared to the NT group (Table-2).

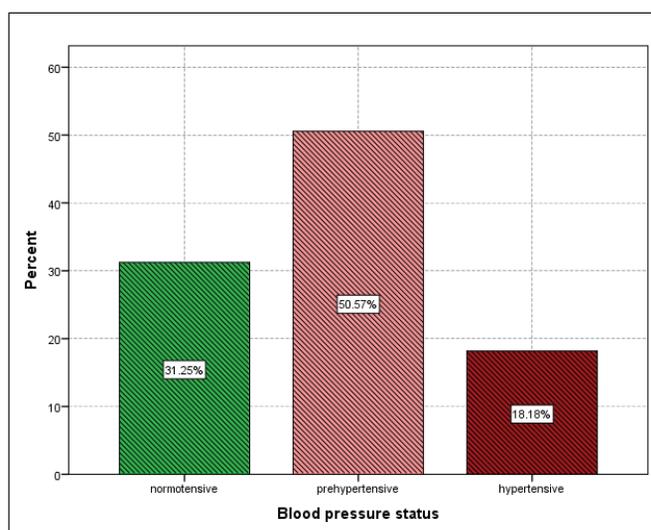


Figure 1. BP status of the study population (N = 176).

Moreover, it was also observed that a major portion (31.8%) of the prehypertensive individuals had no family history of HNT (Table 1).

Discussion

This study was designed to assess the prevalence of PHTN in adults at a teaching institute in Peshawar. The majority of the adults were Pushtoon students belonging to various areas of KPK, Pakistan. To the best of the authors' knowledge, this is the first study conducted in this region with a major emphasis on the prevalence of PHTN and its awareness. This study revealed that more than half of the study population (i.e., 50.57%) were prehypertensives, therefore, raising serious health concerns. Moreover, 18.19% of the participants were found to be hypertensive which is comparable to other studies done on the adult population of Hayatabad Peshawar KPK.⁹ High prevalence of PHTN (i.e., 56.07%) was observed in medical students of Northern Border University in Arar city, Saudi Arabia.¹⁰ Similar results were found in another study conducted in Saudi Arabia which concluded that the prevalence of PHTN in males and females was 66.1% and 48%, respectively.¹¹ According to another study, the prevalence of PHTN among medical students of various disciplines in Chennai was highest (55.6%).¹² Another study conducted in rural southern India showed that the overall prevalence of HTN and PHTN was 21.5% and 42.8%, respectively.¹³ Another study from Iran reported the prevalence of PHTN to be 33.7% in the adult population.¹⁴ A cross-sectional study conducted by Thapa et al.¹⁵ in western Nepal concluded that 20.8% of the study population had PHTN (24.6% in males and 18.0% in females). The discrepancies observed locally and globally

Table 2. Potential risk factors of PHTN in the study population (N = 176).

Variables		Total	BP status						X ²	p value
			NT		Prehypertensive		Hypertensive			
			N	%	N	%	N	%		
Gender*	Male	124	36	20.5%	70	39.8%	18	10.2%	6.635	0.036
	Female	52	19	10.8%	19	10.8%	14	8.0%		
Daily exercise	Yes	47	15	8.5%	25	14.2%	7	4.0%	0.478	0.788
	No	129	40	22.7%	64	36.4%	25	14.2%		
Marital status	Married	16	4	2.3%	10	5.7%	2	1.1%	4.072	0.396
	Unmarried	155	48	27.3%	77	43.8%	30	17.0%		
	Other	5	3	1.7%	2	1.1%	0	0.0%		
Living status	Home	78	23	13.1%	43	24.4%	12	6.8%	2.849	0.583
	Hostel	97	32	18.2%	45	25.6%	20	11.4%		
	Other	1	0	0.0%	1	0.6%	0	0.0%		
Family history of HTN	Yes	65	25	14.2%	33	18.8%	7	4.0%	4.831	0.089

*p-value of ≤ 0.05 was considered as statistically significant. HTN = Hypertension.

with reference to the prevalence of PHTN seem to be multifactorial.

The likely reasons may include social and cultural differences, target population and its size, sample collecting method, geographical, and racial differences.

In the current study, the chi-square test of independence was used to examine the dependence of dependent variable (BP status) with independent variables such as gender, daily exercise, family history of HTN, marital status, and living status. There was a statistically significant association of gender with BP status ($p = 0.036$). Males were found to be more prehypertensive, i.e., 39.8% as compared to females, i.e., 10.8%. This pattern is consistent with several other studies.^{16,17} Proportion of male students was higher in the present institute as compared to females. This factor may act as a confounding variable. Significant association was not found for the rest of the independent variables with PHTN contrary results are seen in other studies in the literature revealing that the risk of developing HTN increases in people who have a positive family history of HTN.^{18,19}

The findings of the current study regarding the prevalence of PHTN are of crucial importance because it has been estimated that prehypertensive individuals are at more risk of becoming hypertensive as compared to NT individuals. If such prevalence of PHTN remains unchecked, it may lead to even higher rates of clinical HTN and, subsequently, a higher prevalence of mortality from CVDs.

Conclusion

Random sampling of the staff working at a teaching institute showed that more than half of the study population had PHTN. The prevalence of PHTN was found statistically significant among the male gender.

Limitations of the Study

The major limitation of this study lies within the design of this study (i.e., descriptive cross-sectional study). This design permitted us only one-time contact with all the respondents for measuring BP. Multiple measurements at regular intervals may have produced dissimilar results. Moreover, we were unable to assess various globally reported risk factors (such as glucose, cholesterol levels in the blood, BMI, lifestyle, and so on) related to PHTN in our study population. Time and financial constraints were two major reasons for the above-said limitations.

List of Abbreviations

BP	Blood pressure
CVD	Cardiovascular disease
DBP	Diastolic blood pressure
HTN	Hypertension

KPK	Khyber Pakhtunkhwa
PHTN	Prehypertension
SBP	Systolic blood pressure ()

Conflict of interest

None to declare.

Grant support and financial disclosure

None to disclose.

Ethical approval

The manuscript was approved by the Ethical Review Committee of the University of Health Sciences Lahore, Pakistan, vide Letter No. REG/ERC/21/132 dated: 03-02-2021.

Authors' contributions

SN, FI, SA, TK: Drafting of manuscript, acquisition, and analysis of data, critical intellectual input to the manuscript.

KH: Conception and design of the study, critical intellectual input.

ALL AUTHORS: Approval of the final version of the manuscript to be published.

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References

1. Singh S, Shankar R, Singh GP. Prevalence and associated risk factors of hypertension: a cross-sectional study in Urban Varanasi. *Int J Hypertens*. 2017;2017:5491838. <https://doi.org/10.1155%2F2017%2F5491838>
2. Wang R, Lu X, Hu Y, You T. Prevalence of prehypertension and associated risk factors among health check-up population in Guangzhou, China. *Int J Clin Exp Med*. 2015;8(9):16424–33.
3. Jang I. Pre-hypertension and its determinants in healthy young adults: analysis of data from the Korean National health and nutrition examination survey VII. *Int J Environ Res Public Health*. 2021;18(17):9144–55. <https://doi.org/10.3390/ijerph18179144>
4. Mamdouh H, Alnakhi WK, Hussain HY, Ibrahim GM, Hussein A, Mahmoud I, et al. Prevalence and associated risk factors of hypertension and pre-hypertension among the adult population: findings from the Dubai Household Survey, 2019. *BMC Cardiovasc Disord*. 2022;22(1):18–27. <https://doi.org/10.1186/s12872-022-02457-4>.
5. Rahman MA, Parvez M, Halder HR, Yadav UN, Mistry SK. Prevalence of and factors associated with prehypertension and hypertension among Bangladeshi young adults: an analysis of the Bangladesh demographic and health survey

- 2017–18. *Clin Epidemiol Global Health*. 2021;12:100912. <https://doi.org/10.1016/j.cegh.2021.100912>.
6. Hu L, Huang X, You C, Li J, Hong K, Li P, et al. Prevalence and risk factors of prehypertension and hypertension in Southern China. *PLoS One*. 2017;12(1):e0170238. <https://doi.org/10.1371/journal.pone.0170238>.
 7. Princewel F, Cumber SN, Kimbi JA, Nkfusai CN, Keka EI, Viyoff VZ, et al. Prevalence and risk factors associated with hypertension among adults in a rural setting: the case of Ombe, Cameroon. *Pan Afr Med J*. 2019;34:147–55. <https://doi.org/10.11604/pamj.2019.34.147.17518>
 8. Mahdavi M, Parsaeian M, Mohajer B, Modirian M, Ahmadi N, Yoosefi M, et al. Insight into blood pressure targets for universal coverage of hypertension services in Iran: the 2017 ACC/AHA versus JNC 8 hypertension guidelines. *BMC Public Health*. 2020;20:347–55. <https://doi.org/10.1186/s12889-020-8450-1>
 9. Sara GUL, Atif H, Kashif Ur Rehman K, Imranullah, Muhammad I, Ghazi F, et al. Prevalence of hypertension in adult population of hayatabad peshawar. *J Saidu Med Coll*. 2021;5(1):644–7. <https://doi.org/10.52206/jsmc.2015.5.1.644-647>.
 10. Alanazi AMJ, Alenezi YM, Alanazi TH, Alruwaili BAS, Alanazi AMM, Alrawili AN, et al. Prehypertension and hypertension in medical students of Northern Border University in Arar, Saudi Arabia. *Egypt J Hospital Med*. 2018;70(1):33–8. <https://doi.org/10.12816/0042959>.
 11. Aldiab A, Shubair MM, Al-Zahrani JM, Aldossari KK, Al-Ghamdi S, Househ M, et al. Prevalence of hypertension and prehypertension and its associated cardioembolic risk factors; a population based cross-sectional study in Alkharj, Saudi Arabia. *BMC Public Health*. 2018;18(1):1–9. <https://doi.org/10.1186/s12889-018-6216-9>
 12. Abeetha S, Sureka V, Brinda S, Ganesh M, Olickal JJ. Prevalence of prehypertension and its association with levels of stress and anxiety among students of various disciplines in Chennai-A cross-sectional study. *Natl J Physiol, Pharm Pharmacol*. 2018;8(12):1599–604. <https://doi.org/10.5455/njppp.2018.8.0928210092018>
 13. Udayar SE, Thatuku ST, Jevergiyal DP, Meundi AM. Prevalence and predictors of prehypertension and hypertension in adult population of rural Southern India - an epidemiological study. *J Family Med Prim Care*. 2021;10(7):2558–65. https://doi.org/10.4103/jfmppc.jfmppc_2415_20
 14. Rahmanian K, Shojaie M. The prevalence of pre-hypertension and its association to established cardiovascular risk factors in south of Iran. *BMC Res Notes*. 2012;5(1):386. <https://doi.org/10.1186/1756-0500-5-386>
 15. Thapa J, Sundar Budhathoki S, Niraula SR, Pandey S, Thakur N, Pokharel PK. Prehypertension and its predictors among older adolescents: a cross-sectional study from eastern Nepal. *PLOS Global Public Health*. 2022;2(9):e0001117. <https://doi.org/10.1371/journal.pgph.0001117>.
 16. Lydia A, Setiati S, Soejono CH, Istanti R, Marsigit J, Azwar MK. Prevalence of prehypertension and its risk factors in midlife and late life: Indonesian family life survey 2014–2015. *BMC Public Health*. 2021;21(1):493–503. <https://doi.org/10.1186/s12889-021-10544-y>
 17. Rafan SN, Zakaria R, Ismail SB, Muhamad R. Prevalence of prehypertension and its associated factors among adults visiting outpatient clinic in Northeast Malaysia. *J Taibah Univ Med Sci*. 2018;13(5):459–64. <https://doi.org/10.1016/j.jtumed.2018.06.005>
 18. Booth JN, Li J, Zhang L, Chen L, Muntner P, Egan B. Trends in Prehypertension and hypertension risk factors in US adults. *Hypertension*. 2017;70(2):275–84. <https://doi.org/10.1161/hypertensionaha.116.09004>
 19. Ranasinghe P, Cooray DN, Jayawardena R, Katulanda P. The influence of family history of hypertension on disease prevalence and associated metabolic risk factors among Sri Lankan adults. *BMC Public Health*. 2015;15:576–84. <https://doi.org/10.1186/s12889-015-1927-7>