The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 4, 2025

HYPERTENSION AND PREHYPERTENSION AMONG APPARENTLY HEALTHY MEDICAL STUDENTS: AN ASSESSMENT OF MODIFIABLE CARDIOVASCULAR RISKS FACTORS

Komal Devi Alias Muskan[*1], Huzaifa Ather Rajar[2], Syed Meeran Hasnain[3], Muhammad Akbar[4], Subita Kafeel [5], Bushra Mehwish[6], Faryal Shoukat[7], Faseeha Rabbi Shah[8]

[*1,2,3,4,5,6,7,8]*Ziauddin College of Physical Therapy*

[*1]komal.muskan@zu.edu.pk,[2]huzaifa.ather@zu.edu.pk, [3]meeran.hasnain@zu.edu.pk,[4]m.akbar@zu.edu.pk, [5]subita.fazal@zu.edu.pk, [6] bushra.mehwish@zu.edu.pk, [7]faryal.shoukat@zu.edu.pk, [8]faseeha.shah@zu.edu.pk.

DOI: https://doi.org/10.5281/zenodo.15259594

Keywords
Hypertension, Prehypertension, Sedentary Behavior, Lifestyle, Riskfactors.

Article History
Received on 13 March 2025
Accepted on 13 April 2025
Published on 22 April 2025

Corresponding Author: *
Komal Devi Alias Muskan

Abstract

Background of the Study

Hypertension has emerged as a major public health issue and is among the top risk factors for mortality in low- and middle-income nationsPrehypertension serves as a precursor to hypertension and, on its own, has a significant positive linear correlation with the morbidity and mortality related to cardiovascular disease (CVD)

Methodology

Students from many medical institutions participated in a cross-sectional research. A non-probability convenience sampling technique was used to choose a sample.Blood pressure and anthropometric measures were performed. Fisher exact tests or chi-square tests were used to compare categorical variables.

Result

Among 386 participants 36 % were female and 64 % were males..there is a higher male ratio in elevated blood pressures that is 23.1% male and 5.7% females are lie in the category of prehypertension followed 4.1% male suffered from Grade 1 hypertension.

Conclusion

Hypertension and cardiovascular risk factors are significant among university students in Karachi, Pakistan. Physical inactivity and salt consumption are key risk factors in this demographic.

INTRODUCTION

Hypertension, a key contributor to cardiovascular disease, accounts for a significant portion of deaths from non-communicable diseases globally [1]. It has become a pressing public health challenge and ranks among the leading causes of mortality in low- and middle-income countries. While hypertension is prevalent in older adults, it is increasingly common among younger populations as well [2].The term "prehypertension" was first introduced in 2003 by the Seventh Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [3]. This classification represents blood pressure levels that precede hypertension and is strongly associated with increased cardiovascular

disease (CVD) morbidity and mortality [4]. Prehypertension often progresses to hypertension with advancing age, and its prevalence among younger individuals is rising, particularly in low- and middle-income regions [5].Globally, approximately one in four adults' experiences hypertension. Projections estimate that by 2025, the number of individuals with hypertension will increase by about 60%, reaching a staggering 1.56 billion adults [6].. In most societies, cardiovascular risk factors begin early, persist throughout youth, and become evident in middle age. In the competitive academic world, binge eating, smoking, and excessive caffeine intake are all behaviors related to increased stress levels, which further compound these risk factors [7]. Many university students also neglect routine check-ups or bodies or health examinations, thereby postponing the identification of early risks for cardiovascular disease [8]. Effective and evidence-based therapies are required to combat the global problem of CVD be implemented with younger populations in order to postpone or prevent the onset of CVD in maturity [9].However, to successfully execute these interventions, a more comprehensive understanding of the distribution of CVD risk factors in the younger population [10]. This study was intended to be conducted at the different universities of karachi including public and private , to determine the frequency of CVD risk factors among young university students. Identifying such risk factors in university students ought to guide targeted health promotions and preventive efforts, equipping this younger demographic with healthy lifestyle practices that may lower their risk of CVD later in life.

Methodology

This cross-sectional study was carried out to determine the incidence of hypertension and related cardiovascular-related risks among university students in Pakistan. The survey was conducted at numerous universities around the country. The data gathering period was between from January 2024 until July 2024.

Participants

The target population included students aged 18 to 25 years, enrolled in undergraduate programs .A sample size of 386 students was determined to be sufficient to achieve a 95% confidence level with a margin of error of 5%, based on an estimated prevalence of hypertension of approximately 10% among young adults in similar settings. Participants were selected using a non probability convenience sampling technique

Data Collection

Data were collected using a structured questionnaire, The questionnaire comprised sections on sociodemographic information,lifestyle habits (such as smoking and physical activity), and included anthropometric and blood pressure measurements.Informed consent was obtained from all participants prior to data collection.

Measurements

Blood Pressure (BP):Blood pressure (BP) was determined using a calibrated electronic sphygmomanometer. Participants were sat and relaxed for a minimum five minutes before taking measurements of their right arms. Three measurements were obtained at 5-minute intervals, with the latest two readings being averaged for analysis. Hypertension was described as having a systolic blood pressure of 140 mmHg or higher and a diastolic blood pressure of 90 mmHg or higher.

Anthropometric Measurements:

Weight was recorded using a digital scale and height with a stadiometer. The Body Mass Index (BMI) was calculated by dividing weight in kilograms by height squared in the meter and classified according to WHO classification as underweight, normal weight, overweight, or obese. The waist circumference was taken with a flexible non-stretchable measuring tape exactly midway between the lowest palpable rib and the top of the iliac crest.

Statistical Analysis

SPSS version 30 was utilised to enter and analyse the data. The demographic features and prevalence of hypertension and other risk factors were collected using descriptive statistics. We used percentages and frequencies to represent categorical data. The connections between categorical variables were evaluated using the Chi-square test.

Result

Among 386 participants 36 % were female and 64 % were males .age distribution shows that 42.2 percent student were lie in the age group of 18-20 followed by the age group 21-24 which comprised of 35.2 % students . level of study shows that most of students participated in the study were in the 3rd year i-e 24.1 % followed by the student of 1 year which comprised of 21.5 % of participants. 41.2% of participants indicated that they did not add salt to their food (23.8% female, 17.4% male), while 58.8% stated that they did add salt (12.2% female, 46.6% male), suggesting that a greater percentage of male participants added salt as shown in table 1

Table 1 :Demographic details

Characteristic	Category	Female Count	Male Count	Total Count	Female % of Total	Male % of Total	Total % of Total
Age Group	18-20	96	67	163	24.9%	17.4%	42.2%
	21-24	34	102	136	8.8%	26.4%	35.2%
	More than 25	9	78	87	2.3%	20.2%	22.5%
	Total	139	247	386	36.0%	64.0%	100.0%
Level of Study	1 year	46	37	83	11.9%	9.6%	21.5%
	2 year	50	15	65	13.0%	3.9%	16.8%
	3 year	13	80	93	3.4%	20.7%	24.1%
	4 year	22	53	75	5.7%	13.7%	19.4%
	5 year	7	62	69	1.8%	16.1%	17.9%
	Total	139	247	386	36.0%	64.0%	100.0%
Addition of Salt	No	92	67	159	23.8%	17.4%	41.2%
	Yes	47	180	227	12.2%	46.6%	58.8%
	Total	139	247	386	36.0%	64.0%	100.0%

Out of 386 participants ,64.8 % individual participated in the study had normal blood pressure .there is a higher male ratio in elevated blood pressures that is 23.1% male and 5.7% females are lie in the category of prehypertension followed 4.1% male suffered from Grade 1 hypertension .regarding tobacco use 21.5% male reported the use of tobacco as compared to females 3.9%.Regarding body mass index majority of participants were overweight 56.2 % with 15.5 % females and 40.7% males ,12.2 % participants were lie in the obese category with (4.4% female, 7.8% male) and 18.1 % participant were in the normal category .A greater waist circumference was seen in 37.8% of participants (7.8% female, 30.1% male).70.2% indicated that they did not engage in regular physical activity, with a greater inactivity rate among males (46.4%) compared to females (23.8%).Among the participants, 17.9% presented with one risk factor (14.0% female, 3.9% male), 33.4% with two (12.2% female, 21.2% male), 19.9% with three (0% female, 19.9% male), and 22.8% with four (3.9% female, 18.9% male) as shown in table 2 .

Table 2 :Health and Cardiovascular Risk Profiles by Gender

Category	Subcategory	Female Count	Male Count	Total Count	Female % of Total	Male % of Total	Total % of Total
High BP	Grade 1	3	16	19	0.8%	4.1%	4.9%
	Grade 2	0	5	5	0.0%	1.3%	1.3%
	Grade 3	0	1	1	0.0%	0.3%	0.3%
	Normal	114	136	250	29.5%	35.2%	64.8%
	Pre-hypertensive	22	89	111	5.7%	23.1%	28.8%
	Total	139	247	386	36.0%	64.0%	100.0%
Tobacco Use	No	124	164	288	32.1%	42.5%	74.6%
	Yes	15	83	98	3.9%	21.5%	25.4%
	Total	139	247	386	36.0%	64.0%	100.0%
BMI (kg/m²)	Normal (18.5–24.9)	10	60	70	2.6%	15.5%	18.1%
	Obesity (≥30)	17	30	47	4.4%	7.8%	12.2%
	Overweight (25–29.9)	60	157	217	15.5%	40.7%	56.2%
	Underweight (<18.5)	52	0	52	13.5%	0.0%	13.5%
	Total	139	247	386	36.0%	64.0%	100.0%
Waist Circumference (cm)	M >102; W >88	30	116	146	7.8%	30.1%	37.8%
	M ≤102; W ≤88	109	131	240	28.2%	33.9%	62.2%
	Total	139	247	386	36.0%	64.0%	100.0%
Physical Activity	No	92	179	271	23.8%	46.4%	70.2%
	Yes	47	68	115	12.2%	17.6%	29.8%
	Total	139	247	386	36.0%	64.0%	100.0%
Cardiovascular Risk Factors	1	54	15	69	14.0%	3.9%	17.9%
	2	47	82	129	12.2%	21.2%	33.4%
	3	0	77	77	0.0%	19.9%	19.9%
	4	15	73	88	3.9%	18.9%	22.8%
	None	23	0	23	6.0%	0.0%	6.0%
	Total	139	247	386	36.0%	64.0%	100.0%

In table 3: Individuals who used tobacco showed a greater rate of prehypertension (17.4%), while participants in the obese group had an increased rate of prehypertension (5.7%). Those with high waist circumference were associated with a higher prehypertension rate (17.9%). Moreover, participants who were physically inactive (70.2%) displayed a higher occurrence of prehypertension (22.5%).

Table 3:Association of Blood Pressure Levels with Lifestyle and Cardiovascular Risk Factors

Factor	Category	Grade 1	Grade 2	Grade 3	Normal	Pre-hypertensive	Total Count / % of Total
Tobacco Use	No	17(4.4%)	4 (1.0%)	0 (0.0%)	223(57.8%)	44 (11.4%)	288 (74.6%)
	Yes	2 (0.5%)	1 (0.3%)	1 (0.3%)	27 (7.0%)	67 (17.4%)	98 (25.4%)
	Total	19(4.9%)	5 (1.3%)	1 (0.3%)	250(64.8%)	111 (28.8%)	386(100.0%)
BMI (kg/m²)	Normal (18.5–24.9)	0 (0.0%)	0 (0.0%)	0 (0.0%)	40 (10.4%)	30 (7.8%)	70 (18.1%)
	Obesity (≥30)	0 (0.0%)	1 (0.3%)	0 (0.0%)	24 (6.2%)	22 (5.7%)	47 (12.2%)
	Overweight (25–29.9)	18(4.7%)	4 (1.0%)	1 (0.3%)	136(35.2%)	58 (15.0%)	217 (56.2%)
	Underweight (<18.5)	1 (0.3%)	0 (0.0%)	0 (0.0%)	50 (13.0%)	1 (0.3%)	52 (13.5%)
	Total	19(4.9%)	5(1.3%)	1(0.3%)	250(64.8%)	111 (28.8%)	386(100.0%)
WaistCircumference (cm)	M: >102; W: >88	9 (2.3%)	5 (1.3%)	1 (0.3%)	62 (16.1%)	69 (17.9%)	146 (37.8%)
	M: <102; W: <88	10(2.6%)	0 (0.0%)	0 (0.0%)	188(48.7%)	42 (10.9%)	240 (62.2%)
	Total	19 (4.9%)	5 (1.3%)	1 (0.3%)	250(64.8%)	111 (28.8%)	386 (100.0%)
Physical Activity	No	13 (3.4%)	3 (0.8%)	0 (0.0%)	168(43.5%)	87 (22.5%)	271 (70.2%)
	Yes	6 (1.6%)	2 (0.5%)	1 (0.3%)	82 (21.2%)	24 (6.2%)	115 (29.8%)
	Total	19 (4.9%)	5 (1.3%)	1 (0.3%)	250(64.8%)	111 (28.8%)	386 (100.0%)
Cardiovascular Risk Factors	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	67 (17.4%)	2 (0.5%)	69 (17.9%)
	2	3 (0.8%)	1 (0.3%)	0 (0.0%)	84(21.8%)	41 (10.6%)	129 (33.4%)
	3	16 (4.1%)	0 (0.0%)	0 (0.0%)	33 (8.5%)	28 (7.3%)	77 (19.9%)
	4	0 (0.0%)	4 (1.0%)	1 (0.3%)	43(11.1%)	40 (10.4%)	88 (22.8%)
	None	0 (0.0%)	0 (0.0%)	0 (0.0%)	23 (6.0%)	0 (0.0%)	23 (6.0%)
	Total	19(4.9%)	5 (1.3%)	1 (0.3%)	250(64.8%)	111 (28.8%)	386 (100.0%)

Discussion

Blood pressure is a known risk factor for cardiovascular disease, and other stresses could have an effect on it. Nevertheless, considering the specific effects of sex on blood pressure is undergoing difficulties since male and female differs physiologically, psychologically, and hormonally. Data obtained from our research indicate that hypertension holds a significant association with sex ($p = 0.001$), that is, males are more than two times likely to suffer from hypertension when compared to females. This result is consistent with findings of studies conducted in different contexts [11, 12].On the contrary, Adeloye et al. [13] have found that there was no significant relationships of hypertension by gender but a higher prevalence was among the female subjects than males. The difference might be due to their larger sample size and the different age groups analyzed in their study, which factors were not considered in our study. Similarly, Mouhtadi et al. [14] observed similar tendencies among young adults in Lebanon and related, among other things, the higher hypertension governments among females to sedentary lifestyles and obesity and unhealthy dietary habits [13]. Also, we found higher prevalence of hypertension among our subjects with BMI ≥ 25 kg/m², while another study also reported that 37.9% of the hypertensive subjects aged 18-35 years were within the same BMI category.

In the general population, a sedentary lifestyle has been put forward as one of the major contributory factors to cardiovascular disease risk. A study revealed that, among male students, 52% were sedentary, whereas in female students, a figure of 27% was reported [16]. Moreover, the university students did show research works done in Cameroon which revealed that 88.9% of subjects were considered inactive [17]. In this study, we found that 70.4% of the participants described themselves as inactive.

High salt consumption leads to elevated blood pressure and heart-related conditions. Nevertheless, the salt intake among students is not well studied. In this research, 58.8% of participants reported frequently adding extra salt to their food. Another

investigation conducted in Uganda showed that high salt consumption was one of the leading cardiovascular disease risk factors among university students (13.5%)[18]. The WHO has emphasized lowering dietary salt intake as one of the most important steps in combatting the global crisis of non-communicable diseases. It has additionally called on member nations to implement strategies aimed at reducing salt consumption in order to lower deaths caused by hypertension, heart disease, and strokes. [19].

Additional studies, particularly cohort studies, should be carried out in other universities in Karachi, Pakistan, to improve the evaluation of hypertension prevalence among young adults. Moreover, further investigation into health beliefs regarding hypertension and CVD would be advantageous for other studies, helping to more effectively customize interventions for this population.

Conclusion

Hypertension and cardiovascular risk factors prevail among students in Karachi, Pakistan, due much to sedentary lifestyles and excessive intake of salt. The promotion of healthy habits in university settings remains challenging. Moreover, comprehensive studies are still needed to assess the prevalence and incidence of such health issues among young adults at nationally representative level. Such studies could aid in the development of targeted health interventions in educational institutions throughout the country.

REFERENCES

1.Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. Nature Review Nephrology [Internet]. 2020 Feb 5;16(4):223–37. Available from: https://doi.org/10.1038/s41581-019-0244-2

2.Hou Y, Yang S. Association of risk factors for high blood pressure across 46 low- and middle-income countries: A multi-country cross-sectional analysis. Journal of Global Health [Internet]. 2024 May 24;14. Available from: https://doi.org/10.7189/jogh.14.04087

3.Andrade H, Pires A, Noronha N, Amaral ME, Lopes L, Martins P, et al. Importance of ambulatory blood pressure monitoring in the diagnosis and prognosis of pediatric hypertension. Revista Portuguesa De Cardiologia (English Edition) [Internet]. 2018 Sep 1;37(9):783–9. Available from: https://doi.org/10.1016/j.repce.2018.08.005

4.Rahut DB, Mishra R, Sonobe T, Timilsina RR. Prevalence of prehypertension and hypertension among the adults in South Asia: A multinomial logit model. Frontiers in Public Health [Internet]. 2023 Jan 27;10. Available from: https://doi.org/10.3389/fpubh.2022.1006457

5.Zhou B, Carrillo-Larco RM, Danaei G, Riley LM, Paciorek CJ, Stevens GA, et al. Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. The Lancet [Internet]. 2021 Aug 24;398(10304):957–80. Available from https://doi.org/10.1016/s0140-6736(21)01330-1

6.Singh S, Shankar R, Singh GP. Prevalence and associated risk factors of Hypertension: A Cross-Sectional Study in Urban Varanasi. International Journal of Hypertension [Internet]. 2017 Jan 1;2017:1–10. Available from: https://doi.org/10.1155/2017/5491838

7.Kartiosuo N, Raitakari OT, Juonala M, Viikari JSA, Sinaiko AR, Venn AJ, et al. Cardiovascular risk factors in childhood and adulthood and cardiovascular disease in middle age. JAMA Network Open [Internet]. 2024 Jun 24;7(6):e2418148. Available from: https://doi.org/10.1001/jamanetworkopen.2024.18148.

8.Mukhopadhay S, Mukherjee A, Khanra D, Samanta B, Karak A, Guha S. Cardiovascular disease risk factors among undergraduate medical students in a tertiary care centre of eastern India: a pilot study. The Egyptian Heart Journal [Internet]. 2021 Oct 26;73(1). Available from: https://doi.org/10.1186/s43044-021-00219-9

9.Rippe JM. Lifestyle strategies for risk factor reduction, prevention, and treatment of cardiovascular disease. American Journal of Lifestyle Medicine [Internet]. 2018 Dec 2;13(2):204–12. Available from: https://doi.org/10.1177/1559827618812395

10.Erhardt L, Moller R, Puig JG. Comprehensive cardiovascular risk management--what does it mean in practice? PubMed [Internet]. 2007 Jan 1;3(5):587–603. Available from: https://pubmed.ncbi.nlm.nih.gov/18078010

11.De Venecia T, Lu M, Figueredo VM. Hypertension in young adults. Postgraduate Medicine [Internet]. 2016 Jan 29;128(2):201–7. Available from: https://doi.org/10.1080/00325481.2016.1147927

12. Chattopadhyay A, Taraphdar P, Sahu BK, Maulik S, Ghosh R, Sinha A, et al. A study on prevalence of Hypertension and its related risk factors among undergraduate medical students in Kolkata. IOSR Journal of Dental and Medical Sciences [Internet]. 2014 Jan 1;13(11):01–7. Available from: https://doi.org/10.9790/0853-131150107

13.Adeloye D, Owolabi EO, Ojji DB, Auta A, Dewan MT, Olanrewaju TO, et al. Prevalence, awareness, treatment, and control of hypertension in Nigeria in 1995 and 2020: A systematic analysis of current evidence. Journal of Clinical Hypertension [Internet]. 2021 Feb 18;23(5):963–77. Available from: https://doi.org/10.1111/jch.14220

14.Elaziz KMA, Dewedar SA, Sabbour S, Gafaary MME, Marzouk DM, Fotouh AA, et al. Screening for hypertension among adults: community outreach in Cairo, Egypt. Journal of Public Health [Internet]. 2014 Oct 29;fdu085. Available from: https://doi.org/10.1093/pubmed/fdu085

15.AlWabel A, Almufadhi M, Alayed F, Aloraini A, Alobaysi H, Alalwi R. Assessment of hypertension and its associated risk factors among medical students in Qassim University. Saudi Journal of Kidney Diseases and Transplantation [Internet]. 2018 Jan 1;29(5):1100. Available from: https://doi.org/10.4103/1319-2442.243959

16. Ali M, Yusuf HI, Stahmer J, Rahlenbeck SI. Cardiovascular risk factors and physical activity among university students in Somaliland. Journal of Community Health [Internet]. 2014 Sep 1;40(2):326–30. Available from: https://doi.org/10.1007/s10900-014-9938-3

17. Nansseu JR, Kameni BS, Assah FK, Bigna JJ, Petnga SJ, Tounouga DN, et al. Prevalence of major cardiovascular disease risk factors among a group of sub-Saharan African young adults: a population-based cross-sectional study in Yaoundé, Cameroon. BMJ Open [Internet]. 2019 Oct 1;9(10):e029858. Available from: https://doi.org/10.1136/bmjopen-2019-029858

18.Nyombi KV, Kizito S, Mukunya D, Nabukalu A, Bukama M, Lunyera J, et al. High prevalence of hypertension and cardiovascular disease risk factors among medical students at Makerere University College of Health Sciences, Kampala, Uganda. BMC Research Notes [Internet]. 2016 Feb 16;9(1). Available from: https://doi.org/10.1186/s13104-016-1924-7

19.World Health Organization. Reducing salt intake in populations: report of a WHO forum and technical meeting, 5-7 October 2006, Paris, France.