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Hypertension and its Associated Risk Factors Among Undergraduate Students in Herat City, Afghanistan

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ABSTRACT

Hypertension is a major contributor to cardiovascular disease, stroke, renal failure, and early mortality. Despite its growing relevance, limited research exists regarding its prevalence among young adults in Afghanistan. This descriptive cross-sectional study was conducted to assess the prevalence of hypertension and its associated risk factors among undergraduate students at Herat University. A total of 852 students from sixteen faculties were selected through a multistage stratified random sampling method. Data collection was carried out using a structured, self-administered questionnaire consisting of 25 items grouped into four domains: socio-demographic characteristics, physical and blood pressure assessments, dietary habits, and lifestyle behaviors including physical activity and smoking status. Blood pressure was measured using standard protocols, and statistical analysis was performed with Statistical Package for the Social Sciences (SPSS) version 27. The overall prevalence of hypertension was found to be 6.5%, with male students demonstrating significantly higher rates than females. A statistically significant association was observed between elevated systolic blood pressure (defined as 130 mmHg or above) and variables such as gender, smoking, and academic year. Male participants were significantly more likely to have raised blood pressure ($P < 0.001$, chi-square = 34.836), and smokers also showed a meaningful increase in systolic levels ($P < 0.002$, chi-square = 9.252). While the results are based on a single-visit measurement, they indicate a modest but concerning prevalence of hypertension in this population. Key risk factors such as male gender, tobacco use, and being in earlier academic years suggest the importance of early preventive interventions. These findings support the need for awareness programs, screening strategies, and targeted health promotion among university students in Afghanistan.

Keywords: Herat, Hypertension, Risk factors, Undergraduate Students

INTRODUCTION

Hypertension is an important public health concern due to its prevalence, associated risks, and challenges in management (Shafi et al., 2017). According to the World Heart Federation (WHF), reports hypertension contributes 9.4 million global deaths annually, accounting for at least 45% of heart disease-related deaths and 51% of stroke-related deaths (Sayon-Orea et al., 2015). Hypertension is classified into two types: primary (essential) hypertension, with no identifiable cause, and secondary hypertension, resulting from underlying medical conditions affecting various organs (WHO, 2011). The Seventh Joint National Committee on the prevention, detection, evaluation, and treatment of high blood pressure defines hypertension as a blood pressure reading of ≥ 140/90 mmHg (Aounallah Skhiri et al., 2012). It also introduced the concept of prehypertension, characterized by a systolic blood pressure (SBP) ranging from 120 to 139 mmHg or a diastolic blood pressure (DBP) between 80 and 89 mmHg in individuals aged 18 years and above (Sayon-Orea et al., 2015, Wang et al., 2004, & Grotto et al., 2008).

In the United States (US), 33% of adults aged ≥ 20 years have hypertension (Aounallah Skhiri et al., 2012). Similarly, recent studies in Afghanistan reported high prevalence rates: 46.2% among adults aged ≥ 40 years in Kabul city and 28.4% among adults aged ≥ 25 years in

Jalalabad city (Saeed et al., 2014, & Saeed, 2015). Therefore, identifying the contributing factors to hypertension is crucial for prevention and management. Although the precise etiology of hypertension is still unclear, well-recognized risk factors include male sex, increasing age, genetic predisposition, obesity, physical inactivity, and lifestyle behaviors such as insufficient sleep, smoking, consumption of high-fat diets, and excessive intake of salt or salty foods (Sayon-Orea et al., 2015). Nonetheless, modifiable factors like smoking, unhealthy dietary patterns, lack of physical activity, and being overweight or obese are preventable (Erem et al., 2008). In adolescents and young adults, prehypertension is considered a significant predictor for the eventual development of hypertension (Baliga et al., 2003). The majority of hypertension-related research centers on adults, and since the condition is frequently silent until complications develop, early detection in high-risk groups is essential. However, there is a scarcity of studies investigating the prevalence and risk factors of hypertension among Afghan Undergraduate students.

Additionally, Afghanistan currently lacks a national policy dedicated to the prevention and control of chronic diseases and their determinants. In response, this study aimed to assess the prevalence of hypertension among undergraduate students in Herat and explore the related risk factors.

MATERIALS AND METHODS

Study Setting and Design

A cross-sectional study design was utilized to assess hypertension among undergraduate students at Herat University, located in Herat, Afghanistan. Data collection took place between March and June 2022 during the academic year. The study population comprised students from the first to the final year of sixteen faculties of Herat University.

Sample size

The sample size was calculated using Cochran's formula, taking into account the acceptable margin of error, estimated population proportion, and desired confidence interval. Here, n represents the required sample size, z corresponds to the z-score at a 95% confidence level (1.96), p denotes the assumed population proportion (0.50, chosen to yield the largest sample size in the absence of prior prevalence data), and e is the margin of error (set at 0.035). Based on these parameters, the minimum sample size was calculated to be 778. To accommodate possible non-responses or incomplete submissions, a 5% buffer was added, raising the total to 856. After rounding and proportional allocation across different faculties, the final sample size was set at 852 participants of study, ensuring comprehensive re-presentation of the total student population of 16,963. A multistage stratified random sampling method, utilizing probability proportional to size (PPS), was employed to ensure a representative sample. The sample was stratified based on the faculty, academic year, gender, and class size, with participants selected using university attendance records.

Sampling procedures and eligibility criteria

The target population included students enrolled in the spring semester of 2023. Selected participants were interviewed, and data were collected on variables including age, sex, smoking habits, physical activity, and dietary behavior using a structured questionnaire. Participation was voluntary, and informed consent was secured prior to data collection. The sampling frame was based on student attendance lists, and sampling fractions were determined by dividing the total student count by the required sample size. Stratified random sampling was carried out, proportionate to faculty size, gender distribution, and class level. Data were gathered through in-person interviews.

Data collection

All participants completed a self-reported, structured questionnaire consisting of 25 items grouped into four thematic subscales: socio-demographic (10 items), anthro-pometric and blood pressure measurement (7 items), dietary habits (3 items), and physical activities and personal habits (5 items). The questionnaire was developed based on validated instruments and reviewed for content validity.

- **Socio-demographic *characteristics***:

Collected data included age, gender, marital status, year of study, and family history of chronic diseases. These variables were assessed to explore their association with hypertension risk factors.

- ***Anthropometric and Blood Pressure Measurements**:*

Recorded measurements comprised systolic and diastolic blood pressure, pulse rate, height, weight, BMI, and waist circumference. Blood pressure was measured by trained medical students using standard sphygmomanometers, while weight and height were recorded to compute Body Mass Index (BMI = weight (kg)/height (m^2)).Hypertension was defined as a systolic blood pressure (SBP) ≥ 130 mmHg or a diastolic blood pressure (DBP) ≥ 80 mmHg (Whelton et al., 2017). Chronic headache was defined as headache on ≥15 days per month for at least 3 months (Headache Classification Committee of the International Headache Society 2018).

- ***Dietary Habits**:*

Participants were asked about the frequency and type of food intake, with particular focus on salt-rich foods, high-fat diets, and consumption of fruits and vegetables.

- ***Physical Activity and Personal Habits**:*

Examined variables such as exercise frequency, sleep duration, smoking status (including cigarette and fruit hookah use), and consumption of energy drinks. Physical activity was defined as any bodily movement produced by skeletal muscles that requires energy expenditure, including activities during work, transport, and leisure time. Participants were classified as smokers if they reported current use of any tobacco products (such as cigarettes or hookah) on a daily or occasional basis at the time of the survey (WHO. 1998).

Data Analysis

All statistical analyses were performed using SPSS software, version 27. Descriptive metrics including means, standard deviations, and frequency distributions—were generated to summarize demographic and health-related data. Associations between categorical variables and hypertension were assessed using chi-square tests. A significance threshold of $p < 0.05$ was applied to determine statistical relevance.

Ethical Considerations

The study protocol received ethical clearance from the Research Committee of the Faculty of Medicine at Herat University under reference number 221005-5. Written informed consent was obtained from all participants, and all responses were kept confidential. Data were anonymized during processing to ensure participant privacy and uphold ethical standards.

RESULTS

Characteristics of the study population

A total of 852 students took part in the study. The mean age of study participants was 21.82 ± 2.2 years (range, 17–38 years). The majority (56.8%) were between 20 and 22 years old. Most respondents were male (60.6%) and unmarried (81.3%). The highest percentage of participants were enrolled in the first academic year (28.8%). Faculty of Education had largest representation (18.8%), followed by Faculties of Science (14.2%) and Literature (11.9%) (Table 2).

Prevalence of Normal and High Systolic Blood Pressure

The study evaluated the distribution of systolic blood pressure levels across the sample. Among respondents, 93.5% exhibited normal systolic blood pressure, whereas 6.5% were found to have hypertension (Whelton et al., 2017) (Table 1).

Symptoms and Medication Use

Chronic headache (Headache Classification Committee of the International Headache Society 2018) is reported by 44.4% of participants. A majority (75.2%) of them do not experience shortness of breath. About 33.5% never had a nosebleed, while 90.7% are not on medication for heart issues (Table 3).

Risk Behaviors

Most participants consume low salt (64.7%) diet and eat fruits and vegetables daily (59.9%). A significant proportion (73.5%) sometimes eat fatty foods, and 74.1% report using energy drinks. Smoking is less common, with only 11.2% reporting it (Table 4).

Body-mass-index (BMI) and Vital Signs

The average participant age was 22 years. The mean height was 167.4 cm, and the mean body weight was recorded as 61.9 kg. Mean systolic

blood pressure was found to be 112 mmHg, while the average diastolic blood pressure was 74 mmHg (Table 5).

Associations of Hypertension and Variables

Significant associations are observed between gender, class, smoking, and systolic blood pressure (SBP ≥ 130 mmHg). Male participants and those in the first class are more likely to have hypertension. Smokers are significantly more likely to report higher SBP (Table 6).

Table 1. Prevalence of High Systolic Blood Pressure

		N	%
Systolic Blood Pressure	Normal Blood Pressure	797	93.5
	High Blood Pressure (Hypertension, SBP ≥ 130 mmHg)	55	6.5

Table 2. Sociodemographic Characteristics

		N	%
Age category (year)	17-19	91	10.7
	20-22	484	56.8
	23-38	277	32.5
Gender	Female	336	39.4
	Male	516	60.6
Marital Status	Single	693	81.3
	Married	159	18.7
Class	First	245	28.8
	Second	228	26.8
	Third	181	21.2
	Fourth	183	21.5
	Fifth	15	1.8
Faculty	Agriculture	62	7.3
	Computer Science	52	6.1
	Economics	39	4.6
	Education	160	18.8
	Engineering	29	3.4
	Fine Arts	15	1.8
	Journalism	39	4.6
	Law and Political Sciences	55	6.5
	Literature	101	11.9
	Medicine	75	8.8
	Public Administrations	10	1.2
	Theology	10	1.2
	Science	121	14.2
	Social Science	26	3.1
	Stomatology	47	5.5
	Veterinary	11	1.3

Table 3. Hypertension Symptoms & Medication Use

		N	%
Chronic Headache	Yes	378	44.4
	No	474	55.6
Shortness of Breath	Yes	211	24.8
	No	641	75.2
Nosebleed	Never	285	33.5
	Within a Month	252	29.6
	Within a Year	100	11.7
	More than a Year	215	25.2
Irregular Heartbeat	Yes	312	36.6
	No	540	63.4
Heart/Blood Pressure Medication	Yes	79	9.3
	No	773	90.7

Table 4. Risk Behaviors among Participants

		N	%
Salt Intake	No Salt	58	6.8
	Low Salt	551	64.7
	High Salt	243	28.5
Fatty Food Intake	No	112	13.1
	Sometimes	626	73.5
	Always	114	13.4
Fruits and Vegetables Intake	Never	47	5.5
	Daily	510	59.9
	Always	295	34.6
Physical Activity	None	133	15.6
	Very Rare	429	50.4
	1-3 Days a Week	164	19.2
	4-5 Days a Week	40	4.7
	6-7 Days a Week	86	10.1
Hours of Sleep	Less than 8 Hours	235	27.6
	8 Hours	408	47.9
	More than 8 Hours	209	24.5
Smoking	Yes	95	11.2
	No	757	88.8
Hookah Use	Yes	143	16.8
	No	709	83.2
Energy Drinks Use	Yes	631	74.1
	No	221	25.9

Table 5. Descriptive Statistics for Participant Anthropometrics and Vital Signs

variable	Mean	Standard Deviation	Median	Minimum	Maximum
Age	22	2	22	17	38
Height	167.4	10.5	170.0	105.0	201.0
Weight	61.9	13.3	60.0	34.0	200.0
Waist Circumference	53.9	20.6	51.0	20.0	118.0
Pulse Rate	74	10	73	30	120
Systolic Blood Pressure	112	11	110	60	188
Diastolic Blood Pressure	74	10	74	40	180

Table 6. Associations between Hypertension and Participant Variables

Category	Variable		Systolic Blood Pressure				P-value	χ^2
			Normal Blood Pressure		Hypertension (SBP=>130)			
			N	%	N	%		
Sociodemographic Status	Age category (year)	17-19	86	10.8	5	9.1	0.737	0.610
		20-22	450	56.5	34	61.8		
		23-38	261	32.7	16	29.1		
	Gender	Female	335	42.0	1	1.8	<0.001	34.836
		Male	462	58.0	54	98.2		
	Marital Status	Single	647	81.2	46	83.6	0.651	0.204
		Married	150	18.8	9	16.4		
	Class	First	217	27.2	28	50.9	<0.001	20.204
		Second	223	28.0	5	9.1		
		Third	174	21.8	7	12.7		
		Fourth	170	21.3	13	23.6		
		Fifth	13	1.6	2	3.6		
	Faculty	Medical Faculties	125	15.7	8	14.5	0.822	0.050
		Non-Medical Faculties	672	84.3	47	85.5		
Family History of Chronic Diseases		High Blood Pressure	117	14.7	8	14.5	0.745	1.950
		Diabetes	82	10.3	6	10.9		
		Kidney Diseases	48	6.0	5	9.1		
		Heart Diseases	36	4.5	4	7.3		
		None	514	64.5	32	58.2		
Hypertension Symptoms and medication use	Chronic Headache	Yes	357	44.8	21	38.2	0.340	0.911
		No	440	55.2	34	61.8		
	Shortness of Breath	Yes	197	24.7	14	25.5	0.903	0.014
		No	600	75.3	41	74.5		
	Nosebleed	Never	266	33.4	19	34.5	0.987	0.1344
		Within a Month	236	29.6	16	29.1		
		Within a Year	93	11.7	7	12.7		
		More than a Year	202	25.3	13	23.6		
	Irregular Heartbeat	Yes	295	37.0	17	30.9	0.363	0.826
		No	502	63.0	38	69.1		
	Medication for Heart/Blood Pressure	Yes	71	8.9	8	14.5	0.163	1.943
		No	726	91.1	47	85.5		

Table 6. (continue)

Risk behaviors	Salt Intake	No Salt	50	6.3	8	14.5	0.055	5.805
		Low Salt	520	65.2	31	56.4		
		High Salt	227	28.5	16	29.1		
	Fatty Food Intake	No	107	13.4	5	9.1	0.134	4.017
		Sometimes	588	73.8	38	69.1		
		Always	102	12.8	12	21.8		
	Fruits and Vegetables Intake	Never	41	5.1	6	10.9	0.063	5.534
		Daily	484	60.7	26	47.3		
		Always	272	34.1	23	41.8		
	Physical Activity	None	126	15.8	7	12.7	0.682	2.292
		Very Rare	400	50.2	29	52.7		
		1-3 Days a Week	151	18.9	13	23.6		
		4-5 Days a Week	37	4.6	3	5.5		
		6-7 Days a Week	83	10.4	3	5.5		
	Hours of Sleep	Less than 8 Hours	219	27.5	16	29.1	0.607	0.999
		8 Hours	385	48.3	23	41.8		
		More than 8 Hours	193	24.2	16	29.1		
	Smoking	Yes	82	10.3	13	23.6	0.002	9.252
		No	715	89.7	42	76.4		
	Hookah Use	Yes	129	16.2	14	25.5	0.075	3.164
		No	668	83.8	41	74.5		
	Energy Drinks Use	Yes	591	74.2	40	72.7	0.816	0.054
		No	206	25.8	15	27.3		

DISCUSSION

This investigation represents the first attempt to systematically assess both the prevalence and determinants of hypertension among Herat University students, shedding light on key demographic, behavioral, and health-related influences. The study revealed a hypertension rate of 6.5%, with significant associations observed for gender, tobacco use, and academic year, particularly among first-year students. These findings correspond with global studies reporting wide-ranging hypertension prevalence—from 5.2% to as high as 70% in various adult populations (Erem et al., 2008). Such variability underscores a growing concern about rising blood pressure levels among young people and the importance of proactive health interventions within academic institutions. Our results also closely align with a study in Kuwait, which documented a 7% hypertension prevalence among students (Sundar, 2013). Conversely, a national cohort study involving Thai Open University students reported a slightly lower prevalence of 4.9% (Thawornchaisit et al., 2013). In contrast, significantly higher rates have been observed in countries like Nigeria (19.3%), Tunisia (35.1%), Gambia (38.0%), and Ethiopia (28.3%) (Aounallah-Skhiri et al., 2012; Vander Sande et al., 2000; Isezuo et al., 2010). Such discrepancies may result from differences in study design, populations, age ranges, or data collection methodologies.

Our study also highlighted that male students had notably higher blood pressure than female counterparts, consistent with previous findings from Tunisia, Saudi Arabia, Qatar, and Hungary (Aounallah-Skhiri et al., 2012; Al-Majed et al., 2012; Katona et al., 2011; Bener et al., 2004). Similarly, research among Israeli youth indicated a higher prevalence among males (40%) compared to females (23%) (Grotto et al., 2008). Nevertheless, certain reports from Turkey and Saudi Arabia have suggested a higher prevalence of elevated blood pressure among females (Arslantas et al., 2008; Jaddou et al., 2001), particularly during puberty and adolescence—a phenomenon possibly linked to earlier hormonal changes in females.

This study confirmed that male sex, first-year academic standing, and smoking were independently associated with increased systolic blood pressure (SBP ≥ 130 mmHg), with statistically significant values ($P<0.001$ and $P<0.002$, respectively). These results align with those of Sundar (2013) and Ibrahim (1995), who also observed heightened hypertension risk among regular smokers. In our sample, 11.2% of students reported daily tobacco use, compared to a study in the West Bank showing a 29.3% smoking rate among university students (Bani, 2011). This lower rate in our context may reflect sociocultural factors, such as lower prevalence of smoking among Afghan females.

Obesity is well-documented as a significant factor contributing to hypertension, metabolic syndrome, and cardiovascular damage (Tayem et al., 2012). One key aspect of this issue is the insufficient consumption of fruits and vegetables, which can lead to nutrient deficiencies crucial for maintaining healthy blood pressure levels. In our study, the findings revealed some concerning statistics among university students: 47 (5.5%) reported never consuming fruit and vegetables, while 510 (59.9%) consumed them daily and 295 (34.6%) indicated that they always include these essential foods in their diet. A similar study assessing hypertension risk factors among university students in Pakistan found that 170 (35.8%) consumed fruits and vegetables for more than three times per week, while 140 (29.5%) consumed them fewer than three times a week. Additionally, 165 (34.7%) consumed vegetables three times a week. Overall, these findings suggest that the majority of the population in both studies consumed fruits and vegetables more than three times per week. Incorporating a variety of fruits and vegetables into one's diet is a proactive approach to managing blood pressure and promoting overall cardiovascular health (Savitha et al., 2007). However, our findings contrast with those (Sundar, 2013, & Hu et al., 2011) who conveyed that there is no statistically significant association between dietary habits and hyper-tension. This discrepancy highlights the need for further research to better understand the complex interactions between diet and blood pressure management. Overweight which, individuals are generally at higher risk of hypertension compared to those with a normal BMI. However, our study did not find an relationship between BMI and hypertension. A research done in a sub-Saharan African country reported that blood pressure was found to be related with BMI (Hujova, 2013).

Excessive salt consumption also contributes significantly to high blood pressure. In our sample, 64.7% reported a low-salt diet, contrasting with a study from London where 53% of students frequently added salty sauces to meals (Savitha et al., 2007), indicating higher sodium intake.

We also explored physical activity patterns. Participants were grouped by frequency of exercise: none (15.6%), very rare (50.4%), 1–3 times per week (19.2%), 4–5 times per week (4.7%), and 5–6 times per week (10.1%). No significant association between physical activity levels and hypertension was observed, a finding consistent with the Indian study by Sundar (2013). However, contrasting results were reported by Arafa et al. (2011), Simão et al. (2008), and Hujova et al. (2013), who documented a statistically significant impact of physical exercise and improved diet on reducing hypertension incidence.

Although previous research has linked insufficient sleep with elevated hypertension risk, our data did not support this association (Aounallah-Skhiri et al., 2012). Moreover, 44.4% of students reported suffering from chronic headaches, while the majority (75.2%) denied experiencing shortness of breath. A third (33.5%) had never experienced nosebleeds, and most respondents (90.7%) were not on any cardiovascular or blood pressure medications.

The insights provided by this study can be instrumental in developing targeted health programs within universities. Identifying a 6.5% hypertension prevalence and its association with sex and smoking highlights the importance of awareness campaigns, routine screening, and health education. These outcomes can inform university leadership and policymakers to prioritize lifestyle modification and preventive strategies. Establishing blood pressure monitoring in university clinics and promoting salt reduction and physical activity initiatives are key recommendations. Lastly, although mental stress was not included in this study, its known role in hypertension warrants exploration in future research to achieve a more comprehensive

understanding of hypertension determinants in youth.

LIMITATIONS

The main limitation of our study was the heterogeneity of the sample, with a higher number of male participants than females, which may have influenced certain measured parameters, such as blood pressure. Secondly, since our study was conducted exclusively among undergraduate students aged 18 to 28 years, comparisons with studies involving postgraduate students were not possible. Lastly, the data were based on self-reporting, which may have led to under-reporting of certain factors.

CONCLUSION

Despite being limited to single-visit blood pressure measurements, our findings indicate a 6.5% prevalence of hypertension—lower than in many international studies. Male gender, academic level (first-year), and smoking emerged as significant independent predictors. While further large-scale investigations are necessary, the results emphasize the need for tailored, cost-effective public health interventions. Health authorities and educational institutions should work collaboratively to enhance awareness of hypertension risk factors and promote regular screening among undergraduate students.

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CONFLICT OF INTEREST:

The authors declare that there were no conflicts of interest in this paper.

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AUTHORS CONTRIBUTIONS:

SS: Involved in developing concepts, writing reviews, and editing. FM: Initiated the research, provided the questionnaire, and wrote up the manuscript. Both authors, SS and FM, read and approved the final manuscript. NS: Did data entry and wrote the research methodology. AR: Did data analysis.

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