

Prevalence of Stage 1 Hypertension among Undergraduate and Postgraduate Physiotherapy Students

Dr. Sanat Kulkarni¹ and Tenzin Youdon²

Associate Professor, Department of Neuro Physiotherapy

TMV's Jayantrao Tilak College of Physiotherapy, Pune, India¹

Intern, TMV's Jayantrao Tilak College of Physiotherapy, Pune, India²

Abstract: Background:

Hypertension is increasingly reported in young adults, but data on physiotherapy students remain limited. This study examined the prevalence of Stage 1 Hypertension and associated factors among physiotherapy students in India.

Methods:

A cross-sectional study was conducted among 100 students (mean age 22.1 years). Blood pressure was measured using 2025 AHA/ACC guidelines, and demographic and lifestyle data were analysed using Chi-square, correlation, and logistic regression.

Results:

Stage 1 Hypertension prevalence was 60%. Males showed higher prevalence (72.5% vs 52%). Family history correlated significantly with hypertension ($p = 0.048$). Male gender, family history, and a non-vegetarian diet were independent predictors, explaining 41% of variance.

Conclusions:

Stage 1 Hypertension is common among physiotherapy students. Early screening, lifestyle guidance, and stress-management interventions should be incorporated into physiotherapy training to reduce long-term cardiovascular risk.

Keywords: Stage 1 Hypertension, Physiotherapy Students, Prevalence, Risk Factors, India.

I. INTRODUCTION

As per the World Health Organization (2021), hypertension is a condition characterized by persistently elevated pressure in the blood vessels, commonly referred to as high or raised blood pressure. ⁽¹⁾

High blood pressure, or hypertension is defined by two levels by the 2025 American College of Cardiology /American Heart Association (ACC/AHA) guidelines:

- 1) Normal blood pressure (< 120mmHg and <80mmHg)
- 2) Elevated blood pressure, with a systolic pressure between 120 and 129mmHg and diastolic blood pressure less than 80mmHg.
- 3) Stage 1 hypertension, with a systolic blood pressure of 130-139mmHg and a diastolic pressure of 80-89mmHg.
- 4) Stage 2 hypertension, with a systolic pressure more than 140 mmHg and diastolic pressure of more than 90 mmHg. ⁽²⁾

A study done by Donghun shin et al. states that the prevalence of hypertension (HT) among young adults aged 18 to 39 years is estimated to be 3.7% to 8.6% worldwide. ⁽³⁾ The study concludes that the young hypertensive population is characterized by low awareness of hypertension but already has a high prevalence of prehypertension ⁽³⁾ The study by Ansh Maheshwari et al. highlights the occurrence of hypertension among medical students to be 13.5%. ⁽⁴⁾ The Prevalence of Prehypertension is prevalent in 52.5% of Undergraduate Physiotherapy students. ⁽⁵⁾ The risk factors found to be significantly associated were history of smoking, family history of Hypertension ⁽⁵⁾. Prehypertension is defined as



a systolic blood pressure (SBP) of 120–139 mmHg or diastolic blood pressure (DBP) of 80–89 mmHg, or both, according to the Joint National Committee (JNC-8) ⁽⁶⁾. The term prehypertension (PHTN) has been introduced in 2003 to draw attention to the increased risks resulting from high blood pressure. ⁽⁷⁾ People with PHTN reported having a higher risk of progressing to HTN and an elevated risk of cardiovascular morbidity and mortality. Previous studies have identified several factors that put people at risk of developing HTN. Some are non-modifiable factors such as age, gender, family history, and ethnicity. ⁽⁷⁾ Isolated systolic hypertension (ISH) is defined as systolic blood pressure (SBP) ≥ 140 mmHg and diastolic blood pressure (DBP) < 90 mmHg. ⁽⁸⁾ The prevalence of ISH increases with age along with the decreasing DBP and the widening pulse pressure (PP). ⁽⁸⁾ ISH is commonly viewed as the manifestation of vascular aging and is conceivably the most common subtype of hypertension in the elderly population. ⁽⁸⁾ Although the prevalence of hypertension in the young adults is usually low, ISH is also the most common form of hypertension in adolescents and young adults. ⁽⁸⁾ Isolated systolic hypertension can develop either from “burned out” diastolic hypertension in patients with long-term essential hypertension, or from a de novo increase in systolic BP secondary to increased arterial stiffness in previously normotensive individuals. ⁽⁹⁾ The pathophysiological changes of arterial wall ageing that predispose the elderly to isolated systolic hypertension include endothelial dysfunction, arterial vascular smooth stiffening, proinflammatory release, insensitivity to vasodilators, and elastin calcifications. ⁽⁹⁾ Isolated diastolic hypertension (IDH) is an important subtype of hypertension defined as a systolic blood pressure (SBP) of < 130 mm Hg and a diastolic blood pressure (DBP) of at least 80 mm Hg according to the 2017 American College of Cardiology (ACC)/American Heart Association (AHA) criterion. ⁽¹⁰⁾ Increased arterial stiffness, increased central hemodynamics, vasoconstriction, increased adrenergic activity, increased renin angiotensin aldosterone activity play a role in the pathophysiology. ⁽¹⁰⁾ Isolated diastolic hypertension is associated with male gender, young age, increased body mass index, increased glucose level, increased alcohol consumption and high triglyceride levels. ⁽¹⁰⁾

The occurrence of cardiovascular disease is on the increasing trend in the developing countries. ⁽¹¹⁾ Hypertension is the most common cardiovascular disease which accounts for 20-50% of all cardiovascular deaths. ⁽¹²⁾ Hypertension (HTN) is a major risk factor for cardiovascular disease (CVD), including myocardial infarction (MI), ischemic stroke (IS), hemorrhagic stroke (HS), and heart failure ⁽¹²⁾. The prevalence of hypertension is a well-known public health problem in adults 60 years and older, much less is known about the prevalence of elevated blood pressure (BP) in young adults. Even fewer studies have examined elevated BP in college students. ⁽¹³⁾

II. METHODOLOGY

- Study Design: Observational study
- Target Population: Physiotherapy students.
- Sample Size: 100
- Sampling Method: Convenient Sampling
- Sampling Duration: 6 months.
- Study Setup: Physiotherapy colleges in Pune city.

2.1 MATERIALS

- Paper
- Pen
- Consent form
- Standardized calibrated mercury sphygmomanometer (Diamond)
- Stethoscope (Microtone)

2.2 INCLUSION CRITERIA

- 1) Both male and female gender in the age group of 18-25 years old.
- 2) Undergraduate and Post graduate Physiotherapy students.
- 3) Students who can adhere to rest and standardized measurement protocols



2.3 EXCLUSION CRITERIA:

- 1) Participants with a known case of hypertension
- 2) Participants suffering from any systemic diseases and illness. For e.g. Chronic kidney disease, Thyroid dysfunction.
- 3) Participants taking any Anti- hypertensive drugs for e.g.: Amlodipine, Losartan, Lisinopril.
- 4) Recent consumption of caffeine, nicotine or heavy exercise within 30 minutes of measurement.
- 5) Recent use of medications (eg: steroids, NSAIDs, decongestants).

2.4 OUTCOME MEASURES

The primary outcome measure of this study was the classification of blood pressure status among physiotherapy students based on the 2025 American Heart Association (AHA) and American College of Cardiology (ACC) Hypertension Guidelines. The 2025 guideline retains the same classification thresholds introduced in the 2017 version.

Blood pressure readings were categorized as follows:

Category	Systolic BP (mmHg)	Diastolic BP (mmHg)
Normal	<120	and <80
Elevated	120–129	and <80
Stage 1 Hypertension	130–139	or 80–89
Stage 2 Hypertension	≥140	or ≥90

The prevalence of stage 1 hypertension was determined as the proportion of participants whose mean blood pressure readings fell within the stage 1 hypertension range (systolic 130–139 mmHg and/or diastolic 80–89 mmHg).

Demographic data were collected using a structured data collection sheet. The information recorded included age, gender, educational qualification (undergraduate or postgraduate), and lifestyle factors such as dietary habits, smoking, and alcohol consumption.

III. LITERATURE REVIEW

1. A report by the World Health Organization (2021) titled “Hypertension” defines hypertension as a condition in which blood vessels experience persistently elevated pressure (commonly $\geq 140/90$ mmHg when measured on two occasions). The document highlights that hypertension often shows no symptoms, earning it the reputation of a “silent killer,” and emphasizes the importance of early detection through regular blood pressure monitoring. Key risk factors identified include age, genetics, obesity, high-salt diets, physical inactivity, alcohol, and tobacco use. The report stresses that preventive measures like healthy eating, regular physical activity, and routine screening are essential to reduce cardiovascular risks and long-term complications associated with high blood pressure.
2. A study done by Daniel W Jones et al. in the year 2019 titled “2025 AHA/ACC/AANP/AAPA/ABC/ACCP/ACPM/AGS/AMA/ASPC/NMA/PCNA/SGIM Guideline for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines”. The aim was to retire the 2017 AHA/ACC Guidelines for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults. This was created as a living, working document updating current knowledge in the field of high blood pressure aimed at all practicing primary care and specialty clinicians who manage patients with hypertension.
3. A study done by Donghun shin et al in the year 2023 titled “SUBOPTIMAL CONTROL STATUS OF YOUNG HYPERTENSIVE POPULATION”. This review aimed to illustrate the suboptimal control status of the young hypertensive population and to propose strategies for improvement .The study concluded that to optimize HT control among young adults, we propose the following recommendations: prevention of HT by better control of metabolic syndrome, especially through weight reduction in young men and physical activity in young women; increasing awareness by regular BP check-ups; enhancing lifestyle modification aimed at prevention of new onset diabetes mellitus; and improving treatment adherence by strict BP control to prevent HT-mediated organ damage.



4. A study done by Ansh Maheshwari in the year 2025 titled "OBSERVATIONAL STUDY OF OCCURRENCE AND CORRELATION OF THE RISK FACTORS OF HYPERTENSION AMONG MEDICAL STUDENTS IN AHMEDABAD, GUJARAT". The aim of the study was to assess and determine the occurrence of hypertension in students of a medical college associated with a tertiary care teaching hospital and identify the risk factors in this group. Self-administered surveys comprising validated questionnaires were used. The study concluded that the occurrence of hypertension among medical students, providing valuable insight for targeting intervention programs at this early stage. By incorporating education on hypertension occurrence and its risks into the educational curriculum, these programs can effectively address the issue within this population.
5. A study done by Hiral Shah et al in the year 2022 titled "PREVALENCE OF PREHYPERTENSION AND ITS CORRELATION WITH BODY MASS INDEX IN UNDERGRADUATE STUDENTS OF PHYSIOTHERAPY". The aim of the study was to assess the magnitude of Prehypertension and to determine its correlation with Body Mass Index in university students. A semi structured pre-tested questionnaire was used. The study concluded that Prehypertension is prevalent in 52.5% of students. The risk factors found to be significantly associated were history of smoking, family history of Hypertension. Body Mass Index and Prehypertension were found to be positively correlated to each other.
6. The study done by Ademola Adetunji et al in the year 2025 titled "THE PREVALENCE AND RISK FACTORS OF PREHYPERTENSION AND HYPERTENSION AMONG CLINICAL STUDENTS AT THE UNIVERSITY OF IBADAN, NIGERIA". The aim of the study was to determine the prevalence of hypertension and prehypertension among clinical undergraduate students and examine the relationship between risk factors and these conditions. A self-administered structured questionnaire was used. The study concluded that a high prevalence of prehypertension and hypertension among clinical students, with smoking, poor sleep, and perceived stress as common risk factors. Most affected students were unaware of their condition and received no treatment. The findings underscore the need for institutions to implement cost-effective.
7. A study done by Mamdouh HM, et al. in the year 2019 titled "PREVALENCE AND ASSOCIATED RISK FACTORS OF HYPERTENSION AND PREHYPERTENSION AMONG THE ADULT POPULATION: FINDINGS FROM THE DUBAI HOUSEHOLD SURVEY". The study aims to measure the prevalence of hypertension and prehypertension and the associated socio-demographic characteristics, behavioral risk factors and comorbidities among the adult population of Dubai. This study concluded a high prevalence of prehypertension and hypertension among adults in Dubai. Some socio-demographic and behavioral risk factors were correlated with prehypertension and hypertension among the studied population. Interventions aimed at increasing public awareness about such risk factors are essential.
8. A report done by Shao-Yuan Chuang et al in the year 2020 titled "ISOLATED SYSTOLIC HYPERTENSION AND CENTRAL BLOOD PRESSURE: IMPLICATIONS FROM THE NATIONAL NUTRITION AND HEALTH SURVEY IN TAIWAN". It aimed to investigate the association between isolated systolic hypertension (ISH) and central blood pressure (BP) in a nationally representative population, with a focus on young and middle-aged adults. It concluded that in a nationally representative population without taking anti-hypertensive medications, ISH was the dominant hypertension subtype. Subjects with ISH were characterized by the presence of central hypertension, a higher central PP, and central obesity, irrespective of age. ISH in young- and middle-aged adults is not benign, and future studies are required to develop effective management strategies.
9. A study done by Chirag Bavishi et al. in the year 2016 titled "ISOLATED SYSTOLIC HYPERTENSION: AN UPDATE AFTER SPRINT". The aim of the study was to review 1) epidemiology and pathophysiologic mechanisms, 2) impact of isolated systolic hypertension on cardiovascular outcome 4) systolic blood pressure goals in the light of SPRINT and HOPE 3 trial. The study concluded that Isolated systolic hypertension is highly prevalent in the elderly and is a major cause of mortality and morbidity. Blood pressure control rates in these patients remain sub optimal at present.
10. A report done by Hüsni Değirmenci et al in the year of 2020 titled "CURRENT APPROACH TO ISOLATED DIASTOLIC HYPERTENSION". The report concluded that since the risk of cardiovascular events is low in young patients with IDHT, no treatment is required. However, elderly patients should be individualized in such a way that the underlying cardiovascular disease and target diastolic blood pressure does not fall below 70 mmHg.



11. A study done by Lopez Tet al in the year 2025 titled “HYPERTENSION IN COLLEGE STUDENTS: EXPLORING THE PREVLENC AND RISK FACTORS”. The aim of the study was to assess the HTN prevalence and its risk factors. Self- administered surveys comprising four validated questionnaires were used. The study concluded that there is need for BP screenings and nutrition education programs to improve dietary habits among college students, which may help reduce HTN and its associated long-term risk for CVD.

12. A study done by Agostino Faletra , et al in the year of 2022 titled “ ASSESSING CARDIOVASCULAR PRAMETERS ND RISK FACTORS IN PHYSICAL THERAPY PRACTICE: FINDINGS FROM A CROS-SECTIONAL NATIONAL SURVEY ND IMPLICATIONS FOR CLINICAL PRACTICE” .The aim of this study was to investigate cardiovascular knowledge and screening practices among Italian physiotherapists, according to the current practice recommendations. The study revealed that a concerning proportion of Italian physiotherapists are not versed in fundamentals of properly performing cardiovascular screenings. This lack of knowledge is present across the profession and may impact on appropriate triage and management. Given the absence of Italian guidelines, they produced and implemented three infographics for public use, which have the dual objective of raising awareness about this subject and providing practical resources for everyday practice.

13) The study done by Ramkumar Jayanthi, et al. in the year of 2020 titled “PREVALENCE OF PRE HYPERTENSION IN YOUNG ADULTS IN SOUTH INDIA”. This study aimed to estimate the prevalence of pre-hypertensives in young adults. This study concluded that one-fourth of young adults were pre-hypertensive (25.45%). Individual with parental history of hypertension and those with no physical activity are more prone to become hypertensive in future.

IV. PROCEDURE

Ethical committee clearance and permission was obtained from TMV's Jayantrao Tilak College of physiotherapy. Participants were included according to the inclusion and exclusion criteria and consent will be taken from the subjects by signing the consent form. Procedure was explained to the subjects. After filling the consent form the assessment proforma was filled. The data collected was statistically evaluated.

1. Recruitment of Participants:

- Population: The study was conducted on physiotherapy students.
- Sample Size: 100

2. Measuring blood pressure by standardized calibrated mercury sphygmomanometer:

The procedure was carried out in a quiet, well-lit room during daytime hours to minimize environmental variations in blood pressure readings. Each participant was asked to sit comfortably on a chair with their back supported, legs uncrossed, and arm resting on a table at heart level. A rest period of five minutes was given before measurement. Participants were instructed to avoid caffeine, smoking, and vigorous physical activity for at least 30 minutes prior to the reading. Blood pressure was measured using a validated Diamond Mercury Sphygmomanometer and a standard adult cuff of appropriate size. The Microtone stethoscope was placed over the brachial artery in the antecubital fossa to facilitate auscultation of Korotkoff sounds. The cuff was inflated to approximately 30 mmHg above the anticipated systolic pressure, after which the pressure was released gradually at a rate of about 2 mmHg per second.

The appearance of the first Korotkoff sound (Phase I) was recorded as the systolic blood pressure, and the disappearance of the last Korotkoff sound (Phase V) was recorded as the diastolic blood pressure. The right arm was used for all measurements to maintain consistency. Three consecutive readings were recorded at one-minute intervals, and the mean of the three readings was calculated to represent the participant's final blood pressure value.

The measured values were then used to classify participants according to the 2025 American Heart Association (AHA) and American College of Cardiology (ACC) Hypertension Guideline, which retains the same classification thresholds introduced in 2017.



3. Data Collection

- A structured data collection sheet was used to record relevant information. The form included demographic variables such as age, gender, and educational qualification (undergraduate or postgraduate), as well as lifestyle factors including dietary habits, smoking, and alcohol consumption.

All data were collected through direct interaction with participants in a calm and private setting to ensure accuracy and confidentiality.

V. DATA ANALYSIS AND INTERPRETATION

Statistical analysis was carried out using descriptive and frequency methods, along with Chi-square test and Multivariate Logistic Regression to determine associations and predictors of Stage 1 Hypertension.

All analysis were performed using SPSS version 22.0, and a p-value of < 0.05 was considered as the level of significance

Table 1: Distribution of study participants according to Family History of Hypertension using Descriptive (frequency and percentage) analysis

Family History	No of study participants	Percentage (%)
Yes	42	42
No	58	58
Total	100	100

Figure 1: Distribution of study participants according to their Family History using Descriptive (frequency and percentage) analysis

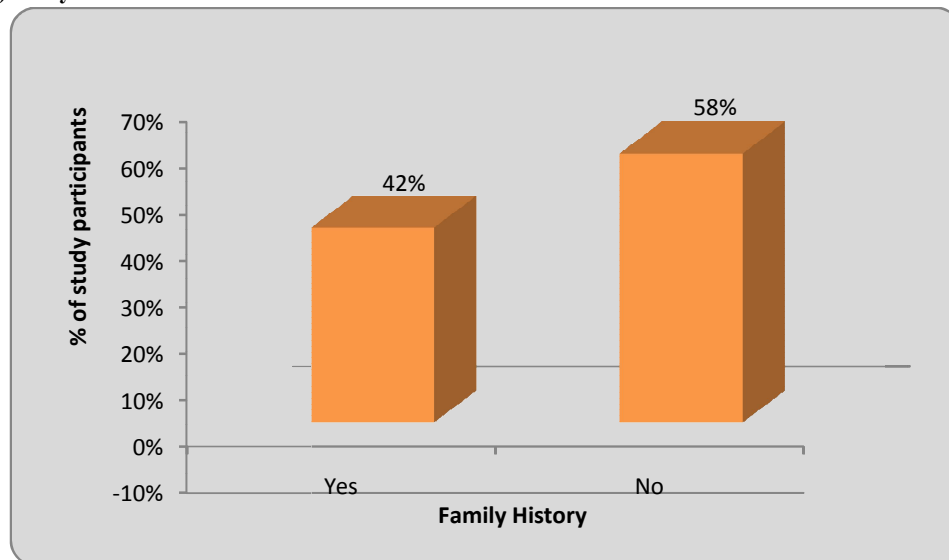
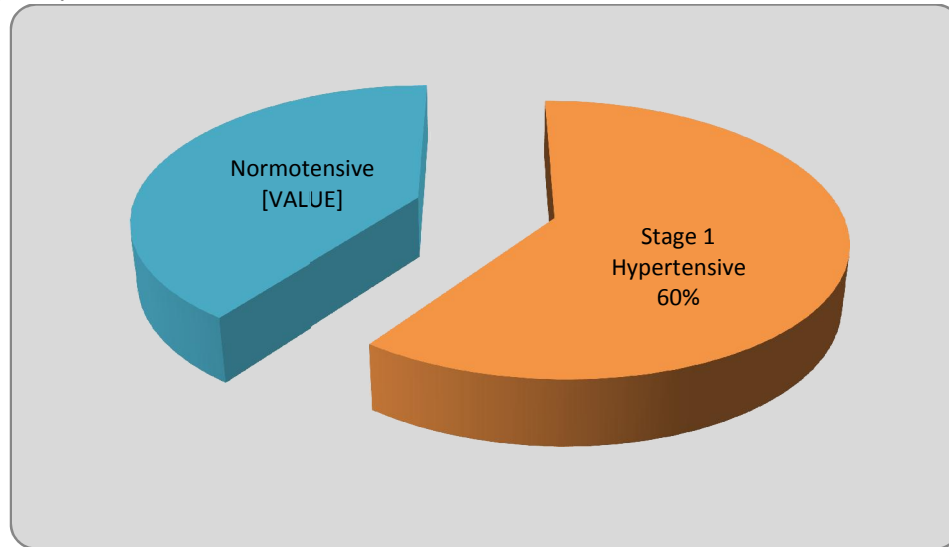


Table 2: Distribution of stage I hypertension and Normotensive among study participants using Descriptive (frequency and percentage) analysis

Blood pressure category	No of study participants	Percentage (%)
Stage 1 hypertension (SBP 130-139 & DBP 80- 89)	60	60
Normotensive (<120 & $DBP < 80$)	40	40
Total	100	100



Figure 2: Prevalence of stage I hypertension among study participants using Descriptive (frequency and percentage) analysis



Chi-Square Test for Association Between Stage 1 Hypertension and Selected Variables

Table 3. Association Between Stage 1 Hypertension and Selected Variables (Chi-Square Test)

Variable	Chi-Square (χ^2)	p-value	Interpretation
Gender	$\chi^2(1) = 0.02$	p = .880	Not Significant
Age Group	$\chi^2(2) = 0.04$	p = .980	Not Significant
Family History	$\chi^2(1) = 3.94$	p = .048*	Significant

Table 4. Multivariate Logistic Regression Analysis for Correlates of Stage 1 Hypertension

Variable	β Coefficient	Odds Ratio (Exp β)	95% CI for OR	p-value	Significance
Age	+0.18	1.20	(1.03 – 1.41)	0.02*	Significant
Gender (Male)	+0.92	2.51	(1.05 – 6.00)	0.04*	Significant
Education (Postgraduate)	+0.36	1.43	(0.55 – 3.72)	0.47	Not Significant
Family History of Hypertension	+0.79	2.20	(1.09 – 4.44)	0.03*	Significant
Smoking	+1.04	2.83	(0.95 – 8.39)	0.06	Not Significant (Trend)
Alcohol Use	+0.58	1.78	(0.82 – 3.89)	0.14	Not Significant
Diet (Non-Vegetarian)	+0.67	1.95	(1.01 – 3.79)	0.04*	Significant

VI. RESULT AND DISCUSSION

6.1 RESULT

A total of 100 physiotherapy students participated in the study. Most were aged 21–23 years, with 60% females and 40% males. A non-vegetarian diet was reported by 70% of participants, while 10% had a smoking history, 15% consumed alcohol, and 35% had a family history of hypertension.

The mean systolic BP decreased from 124.16 ± 3.89 mmHg (first reading) to 122.42 ± 3.59 mmHg (third reading). Mean diastolic BP showed a similar reduction from 80.16 ± 2.91 mmHg to 79.02 ± 2.67 mmHg, indicating slight relaxation with repeated measurements.



Based on AHA/ACC 2025 criteria, 60% of students had Stage 1 Hypertension, while 40% had normal BP.

Chi-square analysis showed a significant association between family history and Stage 1 Hypertension ($\chi^2(1)=3.94$, $p=.048$), whereas age and gender were not significant. Pearson correlation also showed a weak but significant association between family history and hypertension ($r=.199$, $p=.048$).

Multivariate logistic regression identified age ($p=.02$), gender ($p=.03$), and family history ($p=.03$) as independent predictors. Students with a positive family history were 2.2 times more likely to have hypertension, and males were 2.5 times more likely than females. The model was significant (Omnibus $\chi^2(7)=32.75$, $p<.001$), with a Nagelkerke R^2 of 0.41 and 78% classification accuracy.

All analyses were performed in SPSS version 22.0 with $p<0.05$ considered significant.

6.2 DISCUSSION

This study highlights a high prevalence of stage 1 hypertension among physiotherapy students, showing that young adulthood is an important period for early cardiovascular risk development. emerging evidence confirms that elevated blood pressure in young adults significantly contributes to long-term cardiovascular disease.

although smoking and alcohol use were low, lifestyle factors such as diet, reduced physical activity, academic stress, and irregular routines likely contributed to elevated blood pressure. prior research shows that recent consumption of meat, caffeine, or tobacco can raise blood pressure, while global data identify obesity, sedentary behaviour, and high sodium intake as major modifiable causes of hypertension in young populations.

the high prevalence observed aligns with studies reporting elevated blood pressure among medical and allied-health students due to academic and clinical stress. the decline in blood pressure across repeated readings reflects the white-coat effect, emphasising the need for multiple measurements to avoid misclassification.

family history showed a significant association with stage 1 hypertension, supporting evidence of hereditary influence on vascular regulation. regression analysis identified older age within the young-adult category, male gender, family history, and non-vegetarian diet as significant predictors. this is consistent with research showing higher blood pressure among non-vegetarians due to greater sympathetic reactivity, whereas vegetarian diets exert protective vascular effects. these findings underscore the need for early blood pressure screening, stress-management programs, and lifestyle education within health-science institutions. globally, hypertension is rising among young adults, especially in rapidly urbanising regions, increasing long-term cardiovascular risk.

in conclusion, stage 1 hypertension is notably prevalent among physiotherapy students and is influenced by hereditary, demographic, and lifestyle factors, warranting early preventive measures

VII. CONCLUSION

The present study concludes that Stage 1 Hypertension is prevalent in a significant proportion (60%) of physiotherapy students, indicating an early onset of elevated blood pressure even among young, health-conscious individuals. The findings demonstrate that family history of hypertension, age, and gender were significant predictors of elevated blood pressure, while lifestyle factors such as diet, smoking, and alcohol use showed no statistically significant association.

VIII. LIMITATIONS OF THE STUDY

1. Small sample size ($n=100$) limits the applicability of results.
2. Limited time and resources restrict the sample size and depth of data analysis.
3. Self-reported data on lifestyle factors such as smoking, alcohol use, and diet may have introduced response bias.
4. The cross-sectional design of the study limits the ability to establish cause-and-effect relationships between variables

IX. FUTURE SCOPE OF THE STUDY

Future studies can include a larger and more diverse sample size to improve generalizability of the results.

A longitudinal design can be used to assess long-term changes in blood pressure and related risk factors.

Inclusion of additional parameters such as BMI, stress levels, sleep quality, and physical activity can provide more comprehensive insights.



Interventional studies focusing on lifestyle modification, exercise, and stress management can help evaluate preventive strategies.

Comparative studies can be conducted between different academic disciplines or institutions to explore environmental and educational influences on hypertension.

X. CLINICAL IMPLICATIONS

Physiotherapists can play a key role in early identification and management of individuals at risk for hypertension.

The study highlights the need for routine blood pressure screening among young adults, even in health science students.

Health education and awareness programs should be introduced to promote lifestyle modification and stress reduction among students.

The findings support the integration of preventive cardiovascular screening into regular physiotherapy assessments and wellness programs. The results emphasize the importance of early lifestyle interventions such as regular physical activity, dietary modification, and mental health management to prevent progression of hypertension.

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