e-ISSN: 0975-1556, p-ISSN:2820-2643
Available online on www.ijpcr.com
International Journal of Pharmaceutical and Clinical Research 2024; 16(2); 854-860
Original Research Article

A Study on the Correlation between Blood Pressure and Body Mass Index (BMI) among High School Students in Rural Area of Karnataka.

Massrat Firdos[1], Seema Chandrakant Takras[2], Syed Anam Inayatullah[3], Mujtaba Nausheen[4*]

[1]Assistant Professor, Department of Physiology, Dr. Shankarrao Chavan Government medical college, Nanded, Maharashtra, India.
[2]Assistant Professor, Department of Physiology, Dr. Shankarrao Chavan Government medical college, Nanded, Maharashtra, India.
[3]JR1 Resident, Department of Physiology, S.R.T.R Government medical college, Ambajogai, Maharashtra, India.
[4*]Assistant professor, Department of Physiology, Parbhani medical college , RP Hospital & Research Institute, Pedgaon, Maharashtra, India.

Received: 27-12-2023 / Revised: 23-01-2024 / Accepted: 16-02-2024
Corresponding Author: Dr. Mujtaba Nausheen
Conflict of interest: Nil

Abstract:

Background: This study addresses the increasing concern of hypertension in adolescents, particularly focusing on the correlation between Body Mass Index (BMI) and blood pressure in high school students in a rural area of Karnataka.

Methods: Conducted as a cross-sectional observational study at Government High School in Markhal Taluqa, District Bidar, Karnataka, it involved stratified random sampling of students from 8th and 10th grades. Measurements included height, weight (for BMI calculation), and blood pressure, along with demographic information gathered through a questionnaire.

Results: Gender-based analysis revealed significant differences in average height, weight, and diastolic blood pressure between males and females. The study identified moderate to strong correlations between BMI and both systolic and diastolic blood pressure, along with correlations involving age, height, and weight.

Conclusion: The study demonstrates a clear correlation between BMI and blood pressure among adolescents, underscoring the importance of monitoring and managing BMI to prevent hypertension and related health issues in this demographic.

Keywords: Adolescents, Blood Pressure, BMI, Hypertension, Rural Health.

Introduction

Hypertension, once considered a disorder predominantly affecting adults, has now emerged as a significant concern among adolescents globally. The rising prevalence of high blood pressure in this age group is alarmingly paralleled with the increasing rates of obesity, a major risk factor for hypertension. This epidemiological shift underscores the need for a comprehensive understanding of the relationship between body mass index (BMI) and blood pressure among adolescents, particularly in rural settings where healthcare resources and awareness may be limited.

In rural areas, high school students often face unique health challenges compared to their urban counterparts. Factors such as limited access to healthcare facilities, dietary differences, and varying levels of physical activity contribute to health disparities. The influence of these factors on BMI and blood pressure is an area of growing interest and concern. BMI, a widely accepted measure of obesity, is calculated based on height and weight. An elevated BMI in adolescents is linked to an increased risk of hypertension, which in turn, can lead to long-term cardiovascular complications.[1]

For instance, a study conducted in rural Andhra Pradesh found a high prevalence of prehypertension and hypertension, with a significant correlation between BMI and blood pressure[2]. Similarly, a study in rural areas of Karnataka assessed the association of behavioral risk factors with hypertension and found a significant association between BMI and hypertension[3]. Furthermore, a study conducted among adults in Delhi showed a significant positive correlation between BMI, fat percentage, and blood pressure[4].

The purpose of this study is to investigate the association between blood pressure and BMI in high school students residing in rural areas. This research seeks to identify the prevalence and patterns of hypertension and its correlation with BMI in this demographic. Understanding this relationship is crucial for early intervention and prevention strategies aimed at reducing the risk of hypertension and its associated health complications in later life.

The objectives of this study are to:

1. Assess the prevalence of high BMI and hypertension among high school students in rural areas.
2. Explore the relationship between BMI and blood pressure in this demographic.

Material and methods:

This study, conducted as a cross-sectional observational study in Government High School, MarkhalTaluqa, District Bidar, Karnataka, involves high school students of class 8th and 10th . Using a stratified random sampling method, students from each grade are included to ensure representative data. Total of 153 student were included in our study. The study specifically targets those regularly attending school, excluding individuals with known chronic conditions that could influence blood pressure or BMI, such as heart diseases or chronic kidney disease, and those on long-term steroid therapy.

The data collection involves measuring each student's height and weight following standard protocols, from which the Body Mass Index (BMI) is calculated using the weight in kilograms divided by the square of the height in meters (kg/m^2). Blood pressure measurements are taken using a calibrated sphygmomanometer, ensuring the student has been resting for at least 5 minutes. Alongside these measurements, a structured questionnaire gathers information on demographic details.

Informed consent (and assent, where applicable) is obtained from the students and their parents or guardians, ensuring confidentiality and privacy in handling the participants[5] data.

The data analysis is performed using Microsoft Office Excel 2021. Descriptive statistics are employed to outline the demographic and clinical characteristics, while inferential statistics, such as chi-square tests and t-tests or ANOVA, examine the association between BMI and blood pressure. Data was presented in in the form of frequencies and percentages. Vancouver style of referencing used for citations.[5]

Results

Table: Gender-Based Comparative Analysis of Age, Height, Weight, Blood Pressure, BMI, and Mean Arterial Pressure

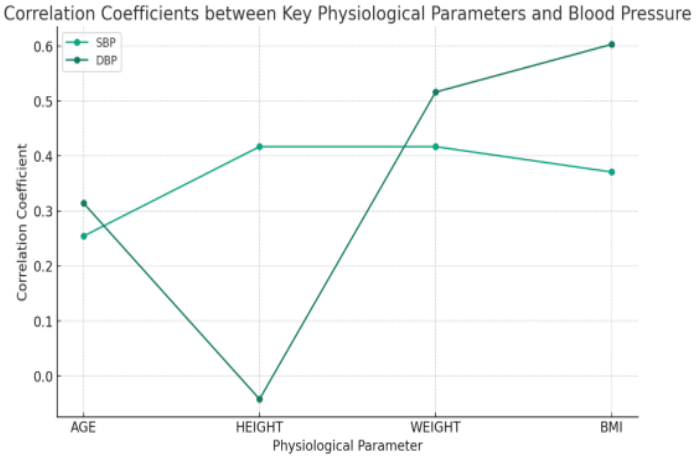
	Female		Male		P-Value
	Mean	**St. Deviation**	**Mean**	**St. Deviation**	
Age	14.4	1.0	14.9	1.5	0.013858
Height	149.1	5.2	157.5	8.9	**0.00001**
Weight	42.5	8.2	45.5	5.6	**0.01399**
SBP	111.7	14.8	114.5	17.2	0.27315
DBP	67.9	15.1	61.8	15.0	**0.01571**
BMI	19.1	3.4	18.4	2.2	0.17041
MAP	82.5	13.7	79.4	14.4	0.17981

Table 2: Overall Mean, Standard Error, Standard Deviation, Variance, Range, and Confidence Level of Key Physiological Parameters

	Mean	Standard Error	Standard Deviation	Variance	Range	Confidence Level (95.0%)
Age	14.63	0.10	1.23	1.51	6.00	0.20
Height	152.39	0.65	8.01	64.08	41.00	1.28
Weight	43.71	0.60	8.01	55.09	37.00	1.19
Systolic BP	112.79	1.28	15.80	249.54	72.00	2.53
Diastolic BP	65.50	1.24	15.32	234.79	83.00	2.46
BMI	18.83	0.24	2.98	8.90	16.20	0.48
Mean Arterial Pressure	81.26	1.13	13.98	195.33	70.00	2.24

Table 3: Correlation Coefficients between Key Physiological Parameters and Blood Pressure (Systolic and Diastolic) with figure

	SBP	DBP
Age	0.2543	0.3142
Height	0.4170	-0.0422
Weight	0.4170	0.5162
BMI	0.3709	0.6030
Mean Arterial Pressure	0.8065	0.9524



The study analyzed various physiological parameters across male and female adolescents. The mean age for females was 14.4 years (SD = 1.0) and for males was 14.9 years (SD = 1.5), with a statistically significant difference (p = 0.013858). The average height for females was 149.1 cm (SD = 5.2), significantly lower than males, who averaged 157.5 cm (SD = 8.9; p = 0.0). In terms of weight, females averaged 42.5 kg (SD = 8.2) and males 45.5 kg (SD = 5.6; p = 0.0).

Systolic blood pressure (SBP) showed a mean value of 111.7 mmHg (SD = 14.8) in females and 114.5 mmHg (SD = 17.2) in males, with no significant difference (p = 0.27315). Diastolic blood pressure (DBP) was higher in females (67.9 mmHg, SD = 15.1) compared to males (61.8 mmHg, SD = 15.0; p = 0.0). The mean BMI was 19.1 (SD = 3.4) in females and 18.4 (SD = 2.2) in males, with no significant difference (p = 0.2). Mean arterial pressure (MAP) was slightly higher in females (82.5 mmHg, SD = 13.7) compared to males (79.4 mmHg, SD = 14.4), though this difference was not statistically significant (p = 0.2).

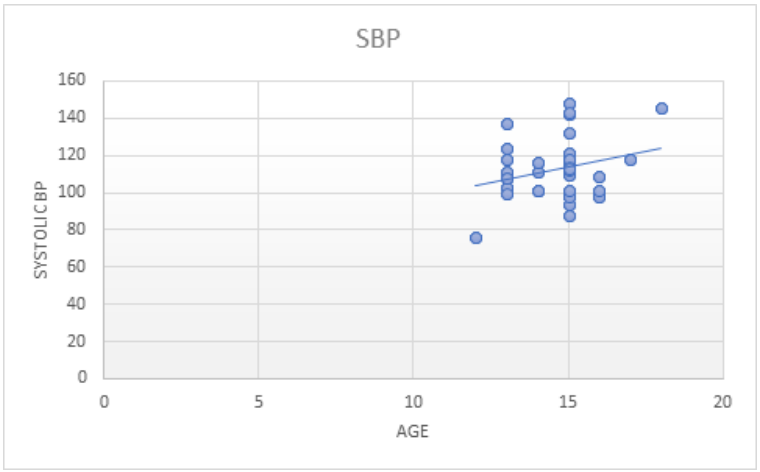
The mean age of participants was 14.6 years, with a standard error of 0.1 and a range of 6.0 years. The average height recorded was 152.4 cm, with a standard deviation of 8.0 cm and a range of 41.0 cm. Participants' mean weight was 43.7 kg, showing a standard deviation of 8.0 kg. The mean systolic blood pressure (SBP) was 112.8 mmHg, with a large range of 72.0 mmHg, while the mean diastolic blood pressure (DBP) was 65.5 mmHg, with an even wider range of 83.0 mmHg. The mean BMI was calculated at 18.8, with a standard deviation of 3.0 and a range of 16.2. Lastly, the mean arterial pressure averaged 81.3 mmHg. The data also includes the confidence level at 95.0% for each parameter, ensuring a high degree of reliability in these measurements.

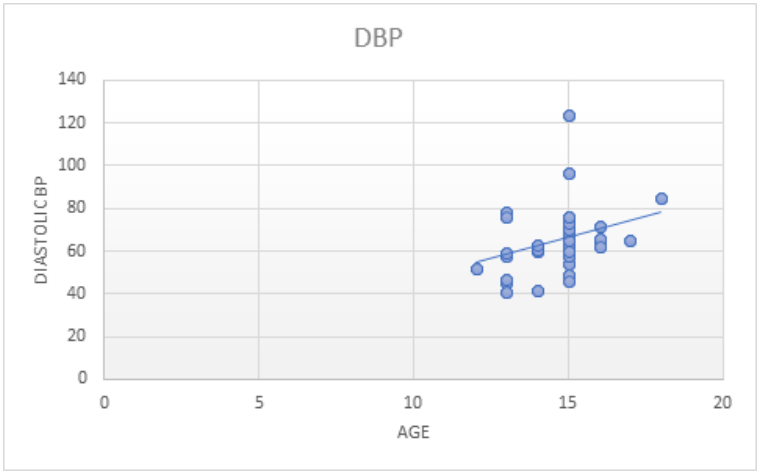
A moderate positive correlation of age with both SBP (r = 0.25) and DBP (r = 0.31) indicates that blood pressure slightly increases with age. There's a moderate positive correlation of height with SBP (r = 0.42), suggesting taller individuals generally have higher SBP, but a negligible correlation with DBP (r = -0.04). Weight Shows moderate to strong positive correlations with SBP (r = 0.42) and DBP (r = 0.52), indicating that higher weight is associated with higher blood pressure. BMI Exhibits a moderate to strong positive correlation with SBP (r = 0.37) and a strong correlation with DBP (r = 0.60), suggesting higher BMI is linked to higher blood pressure. Mean Arterial Pressure Displays very strong positive correlations with both SBP (r = 0.81) and DBP (r = 0.95), highlighting a significant increase in blood pressure with rising mean arterial pressure.

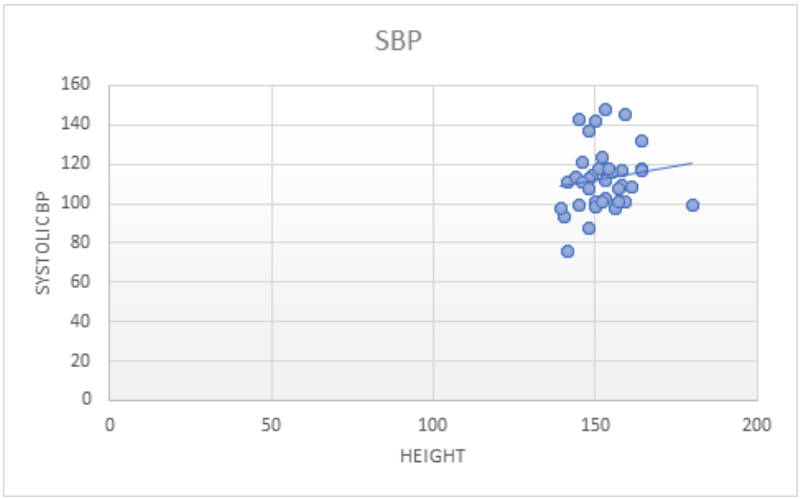
Discussion

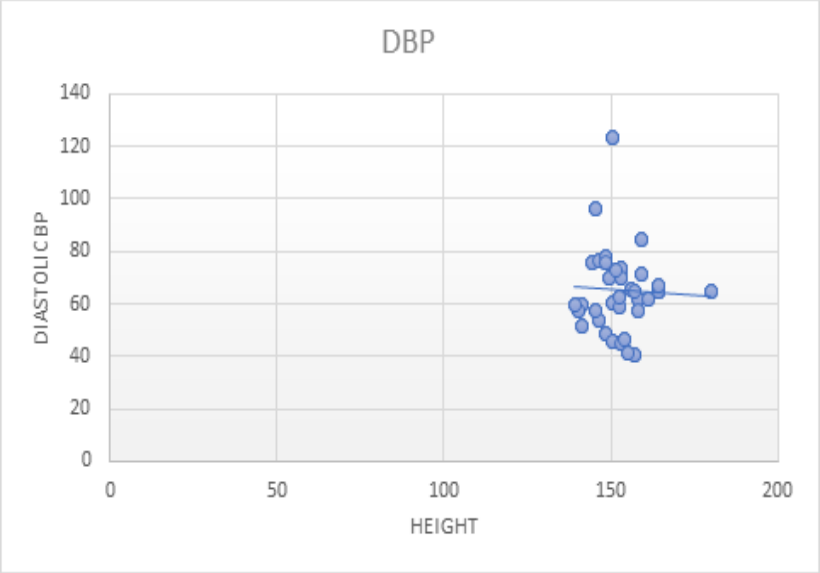
In our study, we observed gender differences in blood pressure, which aligns with the "Madmoli et al"[6] study, showing an average SBP of 113.1 ± 13.3 mmHg in males and 106.7 ± 13.2 mmHg in females. Our findings of SBP (114.5 ± 17.2 mmHg in males, 111.7 ± 14.8 mmHg in females) and DBP (67.9 ± 15.1 mmHg in females, 61.8 ± 15.0 mmHg in males) reflect these trends. The "Vanderlei et al"[7] study's emphasis on BMI's impact on blood

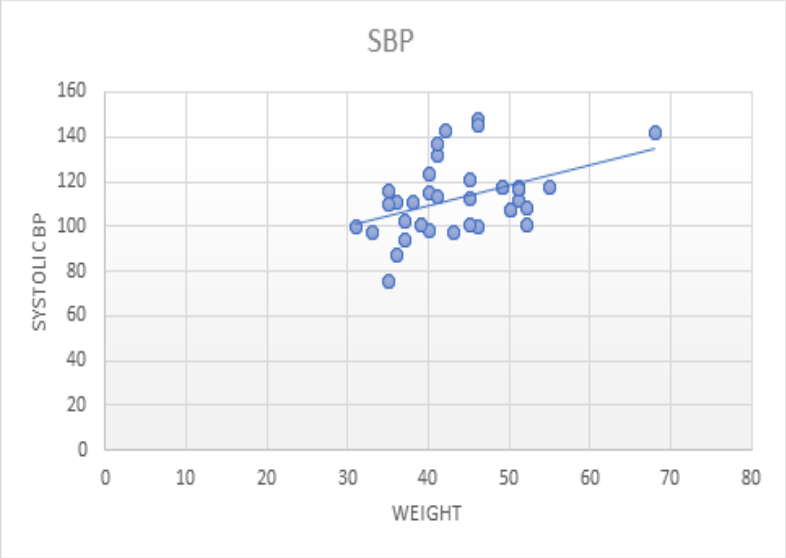
pressure is evident in our results, showing a moderate to strong correlation between BMI and both SBP and DBP. Manjeet Kaur et al[8], highlighting the global rise in adolescent obesity, contextualizes our findings within a broader public health perspective. Our results contribute to the understanding of blood pressure dynamics in adolescents, emphasizing the importance of monitoring BMI as a key influencing factor.

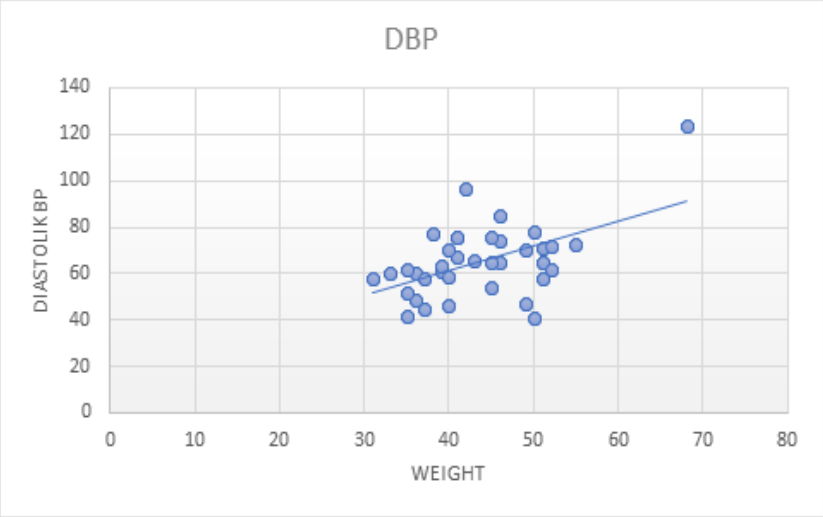


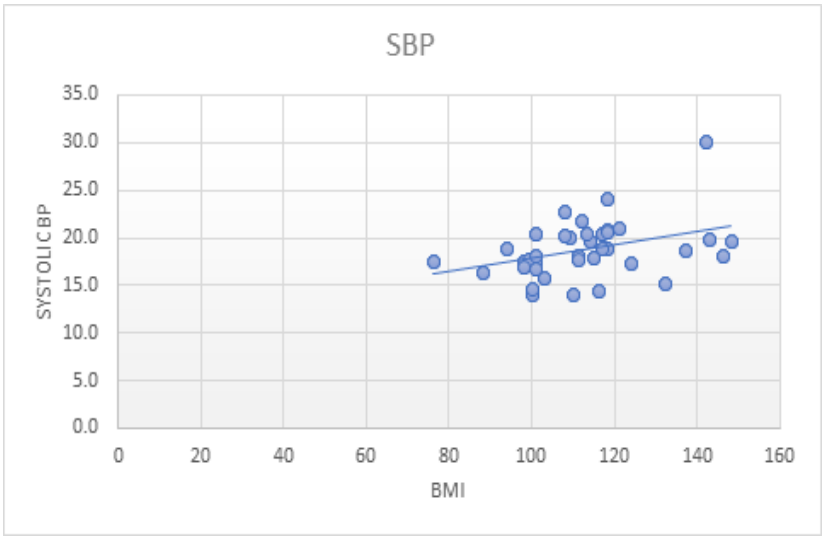


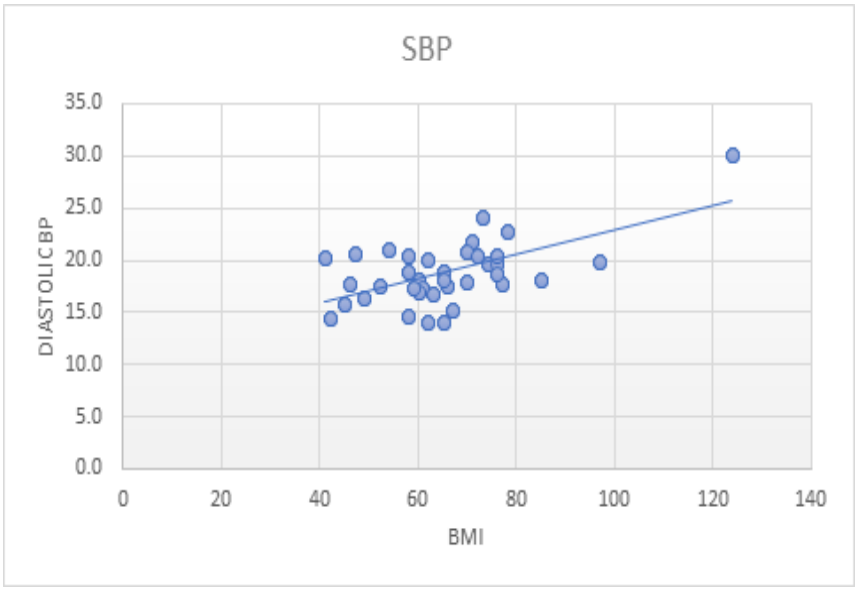


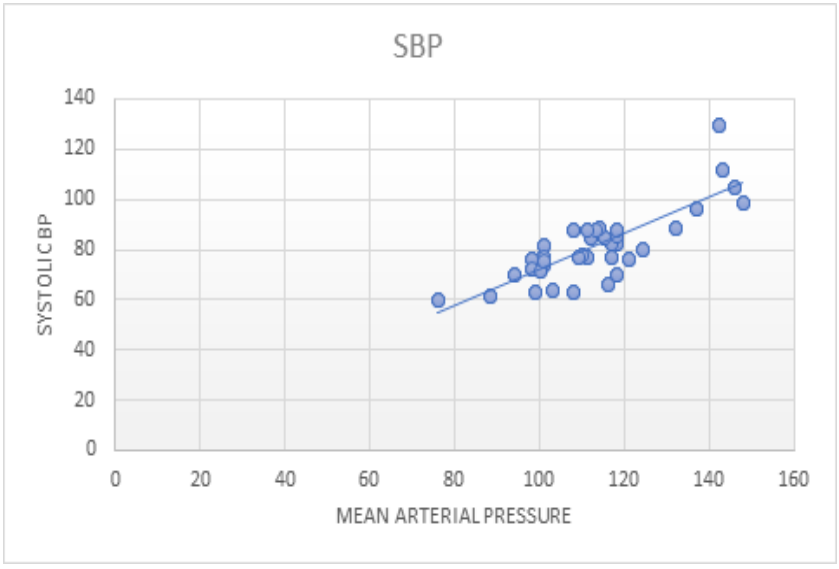

DBP
DIASTOLIC BP
HEIGHT
0
20
40
60
80
100
120
140
0
50
100
150
200

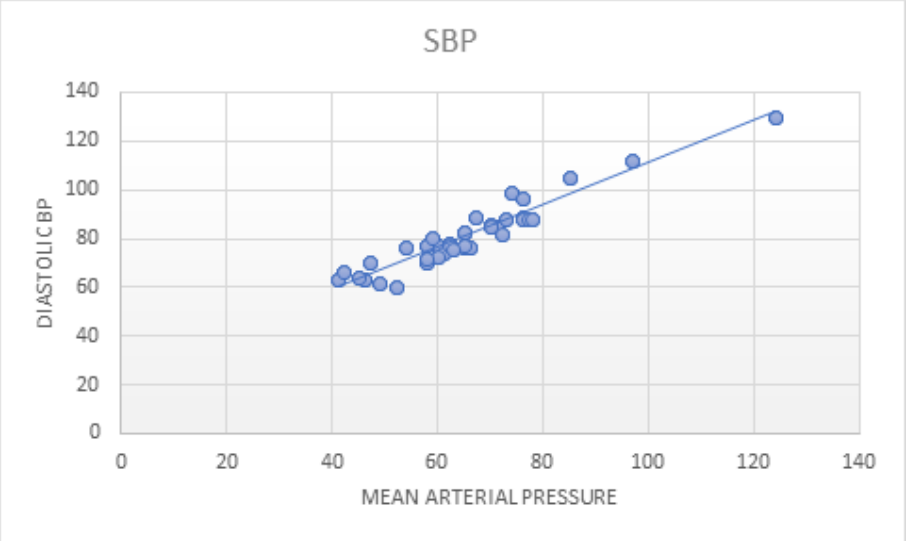

SBP
SYSTOLIC BP
WEIGHT
0
20
40
60
80
100
120
140
160
0
10
20
30
40
50
60
70
80


DBP
DIASTOLIK BP
WEIGHT
0
20
40
60
80
100
120
140
0
10
20
30
40
50
60
70
80


SBP
SYSTOLIC BP
BMI
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160


SBP
DIASTOLIC BP
BMI
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140


SBP
SYSTOLIC BP
MEAN ARTERIAL PRESSURE
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160



Conclusion

In conclusion, our study highlights a significant correlation between BMI and blood pressure among high school students in rural Karnataka. The findings underscore the necessity for regular monitoring and management of BMI to prevent hypertension and associated health complications in this demographic. Recommendations include implementing targeted health education programs and promoting lifestyle interventions to address obesity and physical inactivity. Limitations of the study include its cross-sectional nature, which restricts causal interpretations, and the focus on a specific rural area, which may limit the generalizability of the findings. Future research should consider longitudinal studies and a wider geographic scope to enhance understanding and intervention effectiveness.

References

1. Nair S, Mishra N, Ganesh KS. Behavioural Risk Factors, Hypertension Knowledge, and Hypertension in Rural India. Indian J Community Med. 2013;38(4):213-7. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7085393/
2. Kamath R, Bhat V, Rao R, Das A, Ganesh KS, Kamath A. High Blood Pressure Prevalence and Significant Correlates: A Quantitative Analysis from Coastal Karnataka, India. J Fam Med Prim Care. 2014;3(1):33-8. Available from: https:// www.ncbi.nlm.nih.gov/pmc/ articles/PMC4062860/
3. International Committee of Medical Journal Editors (ICMJE). Vancouver Style: Documenting Sources [Internet]. Calgary: University of Calgary; 2019 Aug. Available from: https://www.ucalgary.ca/live-uc-ucalgary-site/sites/default/files/teams/9/vancouver-style-documenting-sources-lib-update-aug-2019.pdf
4. Ghose B. Body Mass Index Relates to Blood Pressure Among Adults. N Am J Med Sci. 2014;6(3):89-95. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3968571/
5. University of Queensland Library. Referencing: Vancouver Style [Internet]. Brisbane: University of Queensland. Available from: https://guides.library.uq.edu.au/referencing/vancouver/journals
6. Madmoli, Mostafa & Zafari, Mahdi. The Correlation between Blood Pressure and BMI in Students of Shahrekord University of Medical Sciences in 2013-14. 2019.
7. Vanderlei LCM, Christofaro DGD. High blood pressure and its relationship to adiposity in a school-aged population: body mass index vs waist circumference. Hypertens Res. 2018; 41:135–140.
8. Kaur M. Correlation Between Body Mass Index and Blood Pressure in Adolescents. Pak J Physiol. 2016;12(1):47–50.