RESEARCH PAPER

Influence of Lifestyle Behaviors on Selective Cardiovascular Risk Factors among College Students

[1]Karthikeyan S, [2*]Arvind M, [3]Giriprasath Thuyamani, [4]Santhosh Kumar Sankar, [5]Suresh TN, [6]Mariyam Farzana SF, [7]Ashish Mathew A, [8]Prithiha V and [9]Preethi M

SRM College of Physiotherapy, Faculty of Medical and Health Sciences, SRM Institute of Science and Technology, SRM Nagar, Kattankulathur, Chengalpattu, Tamilnadu, India – 603203
[1]ks6610@srmist.edu.in, [3]gt4260@srmist.edu.in, [4]ss6879@srmist.edu.in, [5]vp.pt.ktr@srmist.edu.in, [6]mariyamf@srmist.edu.in, [7]ashishma@srmist.edu.in, [8]prithihv@srmist.edu.in and [9]mp8130@srmist.edu.in
Corresponding Author: arvindm@srmist.edu.in

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ABSTRACT

Objective: To examine the association between sleep quality, perceived stress, physical activity, and selected cardiovascular risk factors among college students.

Methods: A non-experimental, correlational study was conducted among 384 college students selected using predefined inclusion and exclusion criteria. Following informed consent, participants completed standardized questionnaires assessing sleep quality, perceived stress, and physical activity. BMI and blood pressure were measured. Correlation analyses were performed to evaluate relationships among lifestyle behaviors and cardiovascular risk factors.

Results: BMI showed weak positive correlations with perceived stress and poor sleep quality, and a slight negative correlation with physical activity. Systolic blood pressure showed a weak positive association with physical activity and negligible negative correlations with stress and sleep quality. Diastolic blood pressure demonstrated weak negative correlations with stress and physical activity, with no meaningful association with sleep quality. Regression analysis indicated minimal predictive value of these variables, with only physical activity showing a small significant association with systolic blood pressure.

Conclusion: Physical activity, stress, and sleep quality showed weak and largely non-significant associations with BMI and blood pressure among college students, indicating limited short-term impact and the need for longitudinal studies to assess long-term cardiovascular risk.

Keywords: *Blood pressure, Body mass index, Cardiovascular disease, Perceived stress, Physical activity, Sleep quality.*
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INTRODUCTION

According to the latest Global Burden of Disease special report published in the Journal of the American College of Cardiology, the number of global deaths from cardiovascular disease (CVD) is projected to reach 19.8 million in 2022, up from 12.4 million in 1990[1]. Between 2010 and 2022, an additional 10,951,403 deaths from CVD were primarily driven by preventable metabolic, environmental, and behavioral risk factors, along with population growth and aging. Of these deaths, 75.6% were due to heart disease, while 16.9% were attributable to stroke. Although the national age-adjusted mortality rate (AAMR) for CVD fell by 8.9% between 2010 and 2019, it subsequently rose by 9.3% between 2019 and 2022, returning approximately to 2010 levels. Notably, there were 228,524 additional CVD deaths from 2020 to 2022, 9% higher than predicted based on trends from 2010 to 2019[2].

Sudden cardiac death (SCD) is a concern across all age groups, including young people. Although less common in individuals under 35, SCD in this population is clinically significant because causes such as arrhythmias and cardiomyopathies differ from the coronary artery disease typically seen in older adults[3]. Recent studies among undergraduate medical students have shown a CVD risk ratio of 14.3%, and studies conducted in the Chennai region have concluded that the student population in many parts of India is falling under cardiovascular risk.

**Author for Correspondence: arvindm@srmist.edu.in*

Physical activity, defined as coordinated body movement that increases energy expenditure, is essential for healthy aging and the prevention of chronic conditions, including heart disease. Conversely, physical inactivity increases the risk of obesity, diabetes mellitus, hypertension, cancer, and depression[4]. Current guidelines recommend at least 150 minutes of moderate-intensity exercise or 75 minutes of vigorous-intensity activity per week[5]. Despite these recommendations, sedentary behavior remains prevalent, particularly among college students who often combine prolonged sitting with minimal physical activity. The World Health Organization emphasizes reducing physical inactivity, especially in this age group, to mitigate CVD risk[6].

Stress is a state of mental or emotional tension arising from challenging situations. Among college students, common stressors include academic pressure, social challenges, and financial difficulties. Chronic stress can contribute to cardiovascular risk by promoting unhealthy behaviors, altering neuroendocrine function, and elevating blood pressure[7]. Work-related and lifestyle stressors influence physiological factors such as cholesterol levels, blood clotting, and heart rate, increasing the risk of hypertension, cerebrovascular events, and other cardiovascular complications[8].

Sleep is vital for regulating physiological processes, maintaining mental health, and supporting cognitive function. Poor sleep quality, including insomnia, is a growing public health concern, particularly among college students, and is associated with impaired academic performance, physical health, and cognitive function[9]. Both insufficient and excessive sleep have been linked to increased mortality risk from coronary heart disease and type 2 diabetes[10]. Adolescents and young adults (10–24 years) experience distinctive sleep patterns due to ongoing brain maturation, highlighting the importance of adequate sleep during this period[11].

Body Mass Index (BMI) is a simple anthropometric measure of body weight relative to height, commonly used to classify overweight and obesity. Higher BMI (>25 kg/m²) is associated with reduced life expectancy and increased morbidity and mortality, including elevated risk for diabetes, dyslipidaemia, and hypertension. Approximately 3.5% of adolescents have hypertension, defined as a systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg. Blood pressure is influenced by factors such as BMI, age, gender, and physical activity levels[12,13].

Each year, CVD accounts for 17.9 million deaths globally, with nearly 31% of fatalities over the past two decades attributed to high CVD risk factors such as obesity, physical inactivity, and poor diet, particularly in young people from industrialised nations. Heart attacks and strokes constitute approximately 85% of these deaths. Recent reports indicate a rising prevalence of cardiovascular risk factors among younger populations[13,14].

Given this context, the present study aims to investigate sleep quality, stress levels, and physical activity among college students and to analyse how these lifestyle factors influence selected cardiovascular risk factors, including BMI and blood pressure.

METHODOLOGY

An Observational, Correlational research design was conducted for the college students of physiotherapy department of SRM College Of Physiotherapy, SRM Institute of Science and Technology which is located 45 kms from the Chennai city centre. The SRM college comprises of 50,000 + students and the physiotherapy college with over 700 plus students studying and persuing internship over the tenure of time. This study happened from the period April 2024 to December 2024. The data collection happened during the college hours in between the classes and during the free hours. study got approved from Institutional Ethical Committee of SRM Medical College Hospital and Research Centre on 25.04.2024 (Ethical Clearance No: SRMIEC-ST0224-1124). The SRM college is mentioned to be one of the important academic institution around to the Chengalpet area. Due to the convenience to collect the datas this study setting was chosen. The students between 18-30 years, both men and women were included to this study. The students who are not willing to participate, any forms of existing cardiological conditions, hypertension are excluded from the study. The initial screening form was sent to all the students of college of physiotherapy through the forms. The screening form contains the demographic details, history taking questions to confirm pre existing conditions in a 'Yes' or 'No' format. The answers were evaluated and if anyone answered yes for any of the questions were excluded from the study. Among 700 plus students, only 500 students took up the screening process and from that only 384 students volunteered to participate in the study. The volunteered participants were called to specific lab area where the stations were arranged to collect the datas. The students were notified with a slot and they were called in batches for the assessment. The Stadiometer, weighing machine, BP cuffs and along with that questionnaires were taken in a hard copies and arranged in each station. The station 1 consists of measurement of height and weight followed by BMI calculation was done. The station 2 consists of Blood pressure measurement and further stations carried each of the questionnaires. The students were asked to come during their lunch hour and during their free hours of time without disturbing their academic schedules. After the students reach the lab they were asked to rest for 5 to 10 minutes of time in order to avoid the bias in the values to increase in blood pressure and to decrease any forms of the stress. Once the student got

relaxed physically and mentally, the data collection got started. The Blood pressure measurement was done by cardiovascular specialised faculty and the height, weight calculation is noted by students. The questionnaire were filled self reportedly by the students and collected back by the data collection team.

Blood Pressure Measurement

Blood pressure measurement followed American Heart Association guidelines. Participants rested for 5 minutes prior to measurement and were advised to avoid caffeine, smoking, and exercise for at least 30 minutes beforehand. They were seated comfortably with back supported, feet flat on the floor, and arms supported at heart level. A validated manual sphygmomanometer with an appropriate cuff size was used. The cuff was placed 2–3 cm above the antecubital fossa; the brachial artery was palpated and auscultated. Inflation was performed 20–30 mmHg above estimated systolic pressure and released at 2–3 mmHg per second. Two readings were recorded at 2-minute intervals and averaged.

Perceived Stress Scale (PSS)

The Perceived Stress Scale (PSS) is a widely used, well-validated 10-item self-report questionnaire assessing perceived stress over the past month, with test–retest reliability r = 0.70–0.80. Total scores range from 0 to 40: 0–13 = low stress, 14–26 = moderate stress, and 27–40 = high stress[15,16].

Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) is a highly reliable self-rated questionnaire (reliability r = 0.994) assessing sleep quality over one month. It generates seven component scores summed to a global score of 0–21: 0–4 = good sleep quality, 5–10 = poor sleep quality, and 11–21 = severe sleep difficulties[17,18].

International Physical Activity Questionnaire – Short Form (IPAQ-SF)

The IPAQ-SF is a standardised 7-item questionnaire assessing physical activity frequency, duration, and intensity in MET-min/week (ICC = 0.80). Levels are classified as: low (<600 MET-min/week), moderate (600–2999 MET-min/week), and high (≥3000 MET-min/week)[19,20].

Body Mass Index (BMI)

BMI is defined as body weight (kg) divided by height squared (m²). It demonstrates high diagnostic accuracy (sensitivity and specificity = 0.92) and classifies individuals as: underweight (<18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obese (≥30.0 kg/m²)[21,22].

STATISTICAL ANALYSIS

Data were analysed using IBM SPSS Statistics version 22. Descriptive statistics were computed with categorical variables expressed as frequency and percentage, and continuous variables as mean ± standard deviation. Spearman's rank correlation coefficient was used to assess associations between BMI, systolic and diastolic blood pressure, perceived stress (PSS), physical activity (IPAQ), and sleep quality (PSQI). Multiple linear regression was performed to determine whether these lifestyle variables predicted BMI and blood pressure. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1 - Demographic Data

DEMOGRAPHIC VARIABLE	N	RANGE	MEAN±SD
AGE	384	18–25	20.41±1.44
BMI (kg/m²)	384	18–30	23.20±3.50
SYSTOLIC BLOOD PRESSURE (mmHg)	384	90–140	116.59±11.21
DIASTOLIC BLOOD PRESSURE (mmHg)	384	60–92	73.93±7.23
PERCEIVED STRESS SCALE (PSS)	384	3–34	17.3±9.4
INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (IPAQ) (MET-min/week)	384	231–6400	1348.3±1197.3
PITTSBURGH SLEEP QUALITY INDEX (PSQI)	384	2–17	9.34±4.3
GENDER – MALE n (%)	221	—	58%
GENDER – FEMALE n (%)	163	—	42%

Table 1 shows that out of 384 college students, 58% were male and 42% were female. The participants' ages ranged from 18 to 25 years, with a mean age of 20.41 ± 1.44 years. BMI values ranged from 18 to 30 kg/m², with a mean of 23.20 ± 3.50 kg/m², reflecting a predominantly young adult population within the normal to overweight range. Systolic blood pressure ranged from 90 to 140 mmHg (mean: 116.59 ± 11.21 mmHg). Diastolic blood pressure ranged from 60 to 92 mmHg (mean: 73.93 ± 7.23 mmHg). Perceived stress scores ranged from 3 to 34 (mean: 17.3 ± 9.4). Physical activity levels ranged from 231 to 6400 MET-min/week (mean: 1348.3 ± 1197.3). Sleep quality scores ranged from 2 to 17 (mean: 9.34 ± 4.3).

Table 2 - Spearman's Rank Correlation

CORRELATION	N	r VALUE	p VALUE

BODY MASS INDEX AND PERCEIVED STRESS	384	0.057	0.261
BODY MASS INDEX AND PHYSICAL ACTIVITY	384	−0.052	0.305
BODY MASS INDEX AND SLEEP QUALITY	384	0.059	0.252
SYSTOLIC BP AND PERCEIVED STRESS	384	−0.026	0.617
SYSTOLIC BP AND PHYSICAL ACTIVITY	384	0.093	0.068
SYSTOLIC BP AND SLEEP QUALITY	384	−0.079	0.252
DIASTOLIC BP AND PERCEIVED STRESS	384	−0.089	0.081
DIASTOLIC BP AND PHYSICAL ACTIVITY	384	−0.063	0.216
DIASTOLIC BP AND SLEEP QUALITY	384	−0.031	0.543

Table 2 shows that BMI had a weak positive association with perceived stress (r = 0.057, p = 0.261) and a weak negative association with physical activity (r = −0.052, p = 0.305). A positive correlation was observed between BMI and sleep quality scores (r = 0.059, p = 0.252), suggesting higher BMI was associated with poorer sleep quality, although none of these relationships were statistically significant. Systolic blood pressure showed negligible negative correlations with perceived stress (r = −0.026, p = 0.617) and sleep quality (r = −0.079, p = 0.252), and a weak positive correlation with physical activity (r = 0.093, p = 0.068). Diastolic blood pressure demonstrated weak negative correlations with perceived stress (r = −0.089, p = 0.081) and physical activity (r = −0.063, p = 0.216), with no significant correlation with sleep quality (r = −0.031, p = 0.543).

Table 3 - Model Summary of Multiple Regression Analyses

Dependent Variable	R	R^2	Adjusted R^2	F (3,380)	p-value
BMI	0.082	0.007	−0.001	0.867	0.459
Systolic BP	0.137	0.019	0.011	2.425	0.065
Diastolic BP	0.106	0.011	0.003	1.444	0.230

Table 3 shows the Multiple linear regression analysis was performed to determine whether perceived stress, physical activity, and sleep quality predicted BMI, systolic blood pressure, and diastolic blood pressure. The model predicting BMI was not statistically significant, F(3, 380) = 0.867, p = 0.459, explaining only 0.7% of the variance (R^2 = 0.007; Adjusted R^2 = −0.001). The model for systolic blood pressure was not statistically significant overall, F(3, 380) = 2.425, p = 0.065, accounting for 1.9% of variance (R^2 = 0.019; Adjusted R^2 = 0.011). The model for diastolic blood pressure was also not statistically significant, F(3, 380) = 1.444, p = 0.230, explaining 1.1% of variance (R^2 = 0.011; Adjusted R^2 = 0.003).

Table 4 - Regression Coefficients for Bmi and Blood Pressure

Dependent Variable	Predictor	B	SE	β	t	p-value
BMI	**PSS**	0.023	0.019	0.061	1.183	0.237
	IPAQ	−0.000001	0.000	0.000	−0.007	0.994
	PSQI	0.040	0.042	0.050	0.963	0.336
Systolic BP	**PSS**	−0.043	0.061	−0.036	−0.702	0.483
	IPAQ	0.001	0.000	0.119	2.329	0.020*
	PSQI	−0.132	0.133	−0.051	−0.989	0.323
Diastolic BP	**PSS**	−0.074	0.039	−0.097	−1.882	0.061
	IPAQ	0.000	0.000	0.034	0.670	0.503
	PSQI	−0.036	0.086	−0.022	−0.422	0.673

Table 4 shows within the regression models, none of the predictors significantly influenced BMI. In the model predicting systolic blood pressure, physical activity emerged as the only significant predictor (β = 0.119, p = 0.020). For diastolic blood pressure, perceived stress showed a borderline association (β = −0.097, p = 0.061).

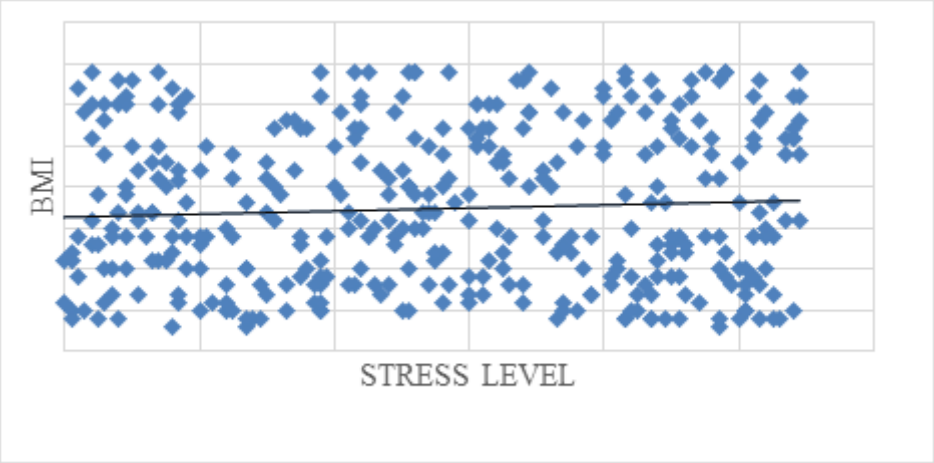

FIGURE 1 - Correlation of Body Mass Index and Perceived Stress

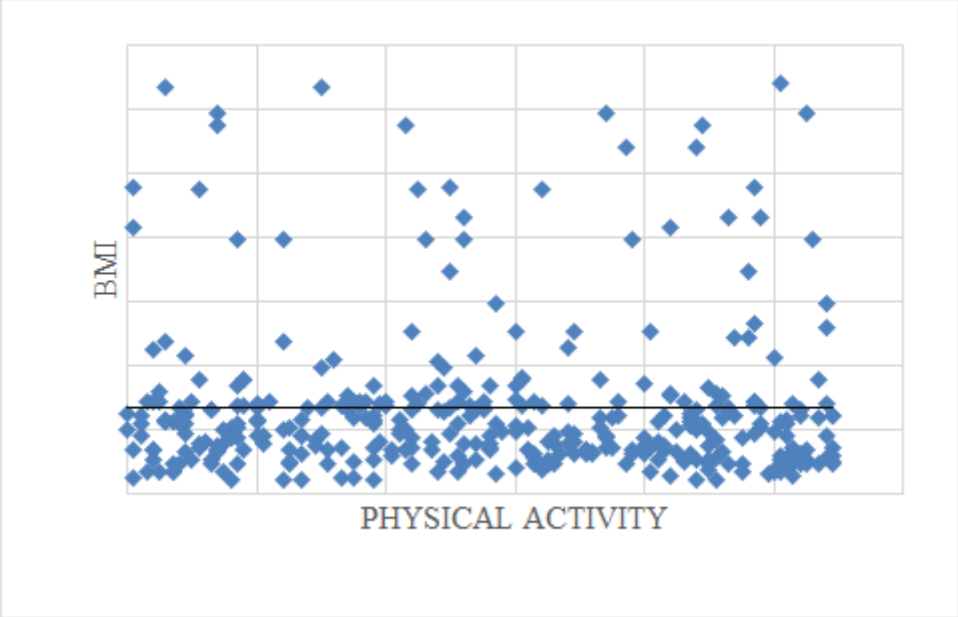

FIGURE 2 - Correlation between Body Mass Index and Physical Activity

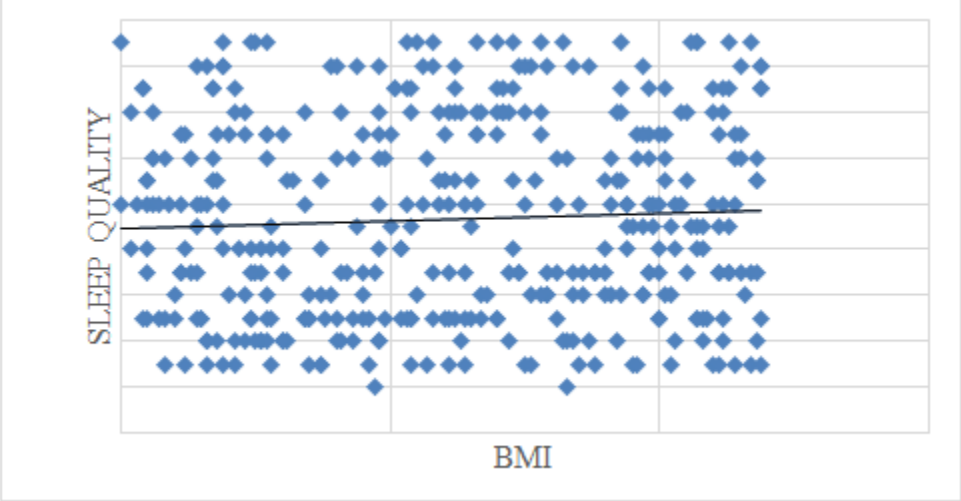

FIGURE 3 - Correlation between Body Mass Index and Sleep Quality

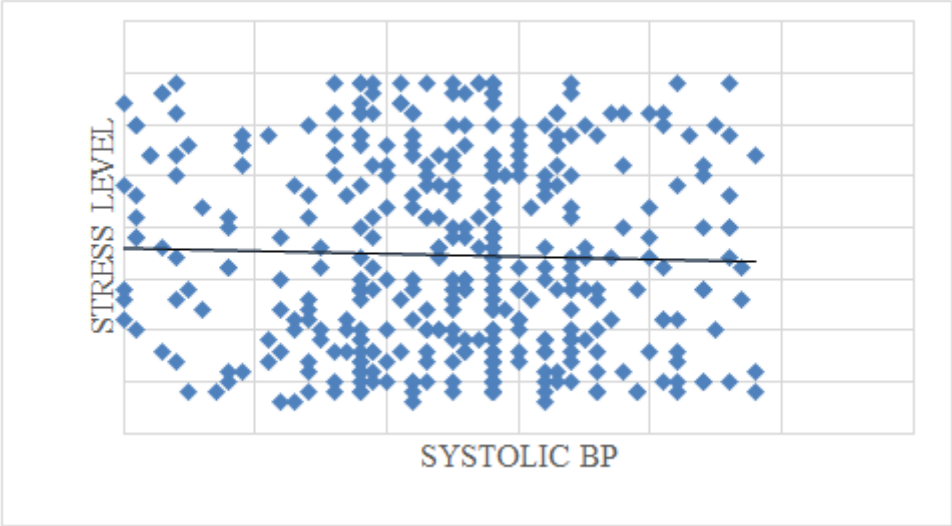

FIGURE 4 - Correlation between Systolic Blood Pressure and Perceived Stress

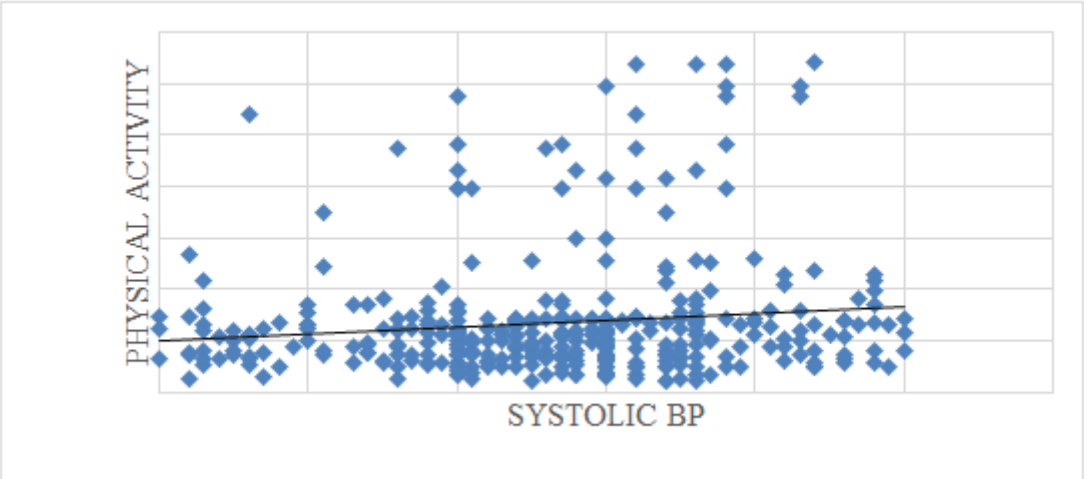

FIGURE 5 - Correlation between Systolic Blood Pressure and Physical Activity

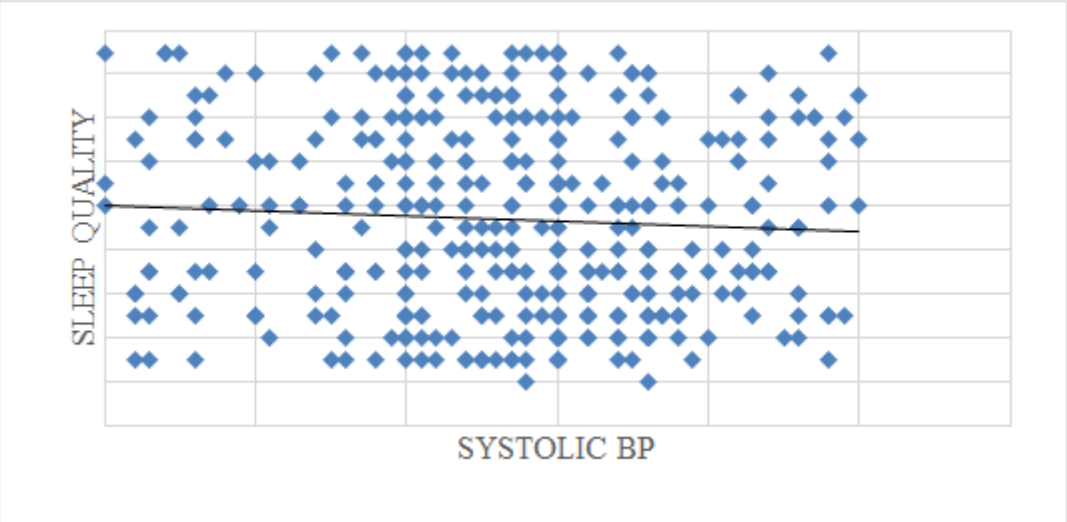

FIGURE 6 - Correlation between Systolic Blood Pressure and Sleep Quality

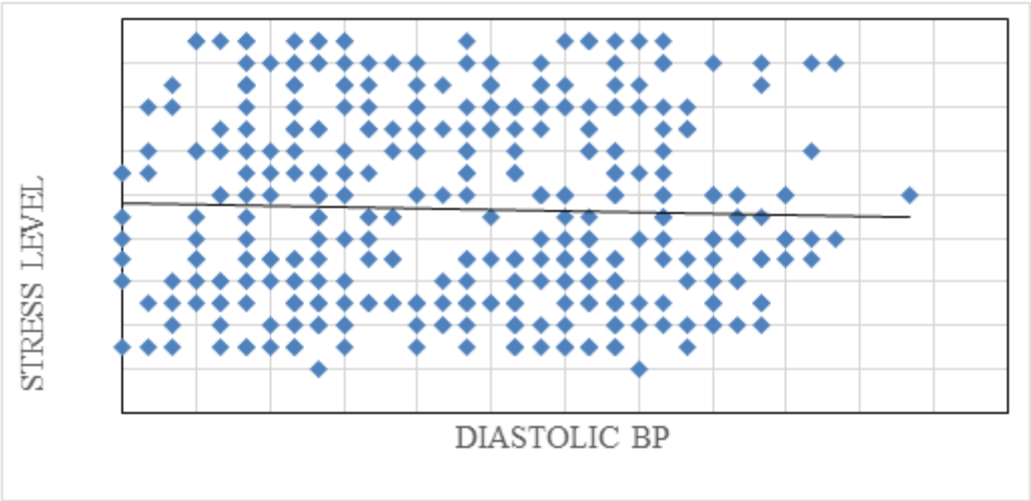

FIGURE 7 - Correlation between Diastolic Blood Pressure and Perceived Stress

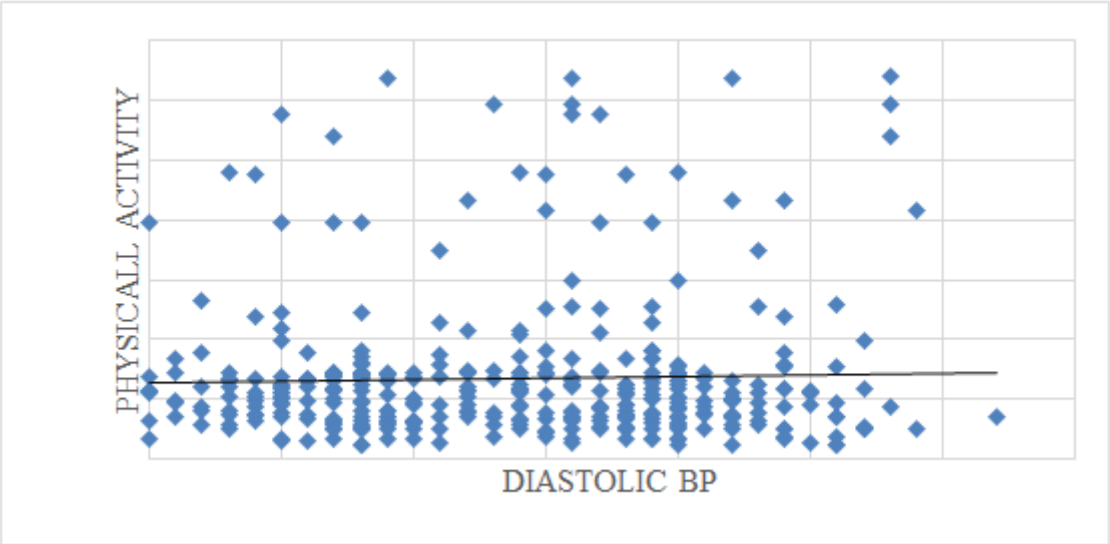

FIGURE 8 - Correlation between Diastolic Blood Pressure and Physical Activity

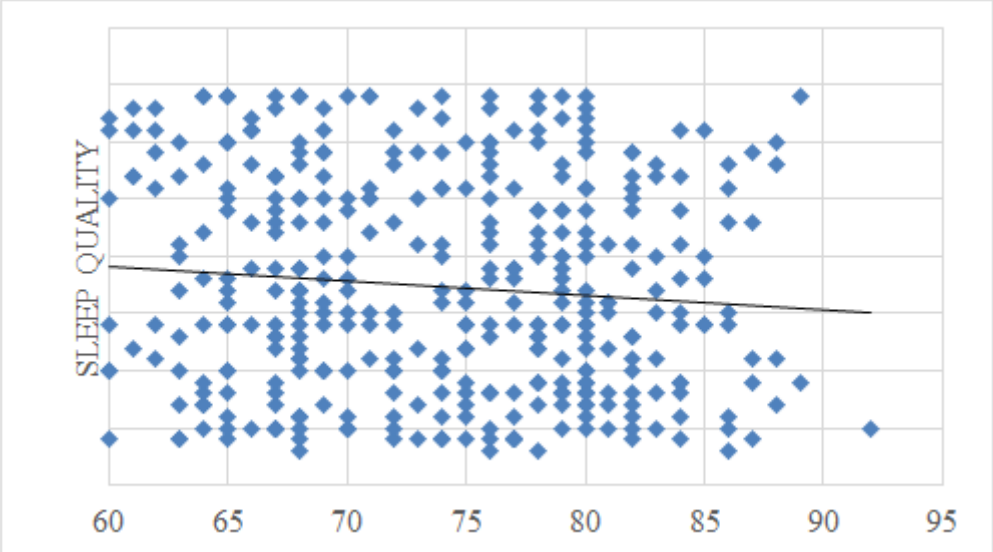

FIGURE 9: Correlation between Diastolic Blood Pressure and Sleep Quality

DISCUSSION

Physical inactivity, stress, and poor sleep quality are widely recognised modifiable risk factors for CVD, particularly among college students[1–3]. Despite WHO recommendations, sedentary behaviours remain common in this population. In the present study, most participants were moderately active, with 73% in the moderate physical activity category. However, students still reported an average of six hours of sedentary activity per day, consistent with findings by Dan et al.[24], who highlighted prolonged sitting as a common behaviour among university students.

Male students demonstrated higher physical activity levels than females, consistent with gender-based differences reported in prior literature[6]. Despite relatively favourable activity levels, physical activity showed only weak, non-significant associations with BMI and blood pressure. These findings contrast with studies reporting stronger protective effects of physical activity on cardiovascular parameters[5,23], suggesting that in young adults, short-term activity levels may not substantially influence BMI or blood pressure.

The regression model predicting BMI ($R^2 = 0.007$) was not statistically significant, indicating minimal combined influence of the three lifestyle variables on body composition in this population. This aligns with earlier studies showing that BMI in young adults is influenced by multiple factors, including dietary habits and genetic predisposition[12–14,21].

Similarly, the regression model for systolic blood pressure was not statistically significant overall ($R^2 = 0.019$), although physical activity emerged as a statistically significant predictor ($\beta = 0.119$, $p = 0.020$). This unexpected finding may be attributed to acute physiological responses to recent physical exertion. Given the low explanatory power of the model, this association should be interpreted with caution[5].

For diastolic blood pressure ($R^2 = 0.011$), none of the predictors were statistically significant; however, perceived stress showed a borderline negative association ($p = 0.061$). Similar findings have been reported in young populations where stress does not consistently translate into measurable changes in blood pressure[8].

Stress is known to contribute to cardiovascular risk through neuroendocrine activation, unhealthy coping behaviours, and elevated blood pressure[8]. Most participants reported mild to moderate stress, similar to observations by Ross et al.[25]. A weak positive association between perceived stress and BMI was observed, it was not statistically significant, and regression analysis confirmed no significant predictive role.

Poor sleep quality was highly prevalent, with more than 85% of participants reporting poor or very poor sleep, consistent with findings by Vargas et al.[26]. Sleep quality demonstrated weak, non-significant associations with BMI and blood pressure, and regression analysis showed no significant predictive role. The effects of sleep disturbances on cardiovascular health may become more evident over longer durations[9–11].

Overall, the weak and non-significant associations across correlation and regression analyses indicate that physical activity, perceived stress, and sleep quality have limited short-term impact on BMI and blood pressure in college students. Additional variables such as dietary habits, genetic predisposition, and long-term behavioural patterns should be considered in future research[1,5]. Longitudinal studies would be particularly valuable in capturing cumulative effects of these modifiable risk factors.

LIMITATIONS

The relatively small, single-institution sample limits generaliszability. Other important determinants of cardiovascular risk such as socioeconomic status, family history, dietary habits, substance use, and genetic factors were not assessed. Future longitudinal studies incorporating these variables are recommended to better understand causal relationships and long-term cardiovascular health outcomes.

CONCLUSION

The present study concludes that physical activity, perceived stress, and sleep quality have minimal and non-significant associations with BMI and blood pressure among college students. The low explanatory power of both correlation and regression analyses suggests limited short-term impact of these lifestyle factors in a young, healthy population. These findings indicate possible physiological resilience in early adulthood, with cardiovascular risk likely influenced by multiple long-term factors. However, maintaining healthy lifestyle behaviors remains important for preventing future cardiovascular risk.

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