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Impact of Body Weight on Blood Pressure Among University Students

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ABSTRACT

Body weight and blood pressure are two vital health indicators that are closely related. Excessive body weight or obesity, in particular, has been strongly associated with higher blood pressure, a key risk factor for cardiovascular diseases. Blood pressure, which measures the force of blood against the walls of blood vessels, is influenced by several factors, including body composition, physical activity, and diet. For young adults, maintaining a healthy weight is especially important, as early high blood pressure can result in long-term health issues. Recognizing the connection between body weight and blood pressure in this group is crucial for developing preventive measures against hypertension. This study examines the relationship between body weight and blood pressure among university students at the Universiti Teknologi MARA Pahang Branch Jengka Campus. A sample of 43 students, aged 18 to 22, from various faculties was selected for analysis. Descriptive statistics and Spearman rank correlation were used to investigate the association between body weight and blood pressure (systolic and diastolic). The results showed a statistically significant positive linear correlation, indicating that as body weight increases, both systolic and diastolic blood pressure also rise. These findings are consistent with previous research highlighting a strong linear correlation between body mass and blood pressure. The study underscores the importance of maintaining a healthy weight to reduce the risk of hypertension, particularly in young adults. Future research should explore additional factors affecting blood pressure and assess the effectiveness of weight management strategies in similar populations.

KEYWORDS

blood pressure; body weight; systolic; diastolic

INTRODUCTION

Body weight and blood pressure are closely linked, and their relationship is a major concern in both clinical practice and public health. For university students, the shift from adolescence to adulthood often involves lifestyle changes, such as alterations in diet, physical activity, and stress levels, all of which can impact body weight and blood pressure. Blood pressure is an important indicator of cardiovascular health, with readings categorized based on systolic and diastolic values (Whelton et al., 2018). Systolic blood pressure (SBP) reflects the pressure on artery walls during heart contraction, while diastolic blood pressure (DBP) measures the pressure when the heart is resting between beats (Muntner et al., 2020). Blood pressure is measured in millimeters of mercury (mmHg). Both the World Health Organization (WHO) and the American Heart Association (AHA) classify blood pressure

readings into four categories: normal, prehypertension, stage 1 hypertension, and stage 2 hypertension (Chobanian et al., 2003; WHO, 2023).

A normal blood pressure is defined as a systolic value below 120 mmHg and a diastolic value below 80 mmHg (Whelton et al., 2018). Elevated blood pressure, or prehypertension, occurs when systolic values range from 120 to 129 mmHg and diastolic values remain below 80 mmHg (Muntner et al., 2020). Hypertension stage 1 is identified when systolic values range from 130 to 139 mmHg and diastolic values are between 80 to 89 mmHg (Whelton et al., 2018), while hypertension stage 2 is diagnosed when systolic values reach 140 mmHg or higher and diastolic values are 90 mmHg or higher (Whelton et al., 2018). Early detection of hypertension is especially important in young adults, as sustained high blood pressure raises the risk of heart disease, stroke, and kidney issues (Kannel, 2000). Among university students, blood pressure may vary due to factors like stress, irregular sleep, diet, and physical activity, highlighting the importance of accurate monitoring and classification to avoid long-term health risks (Mullins et al., 2019; Ehmann et al., 2020).

Numerous studies have explored the connection between body weight and blood pressure in university populations, providing valuable insights into how these factors contribute to cardiovascular health risks at a young age. Several have demonstrated a positive correlation between body weight, particularly body mass index (BMI), and elevated blood pressure levels. Research by Hu et al. (2017) revealed that overweight and obese university students had significantly higher systolic and diastolic blood pressure compared to their normal-weight counterparts, emphasizing that higher BMI is a key predictor of hypertension in this group. Although the prevalence of high blood pressure in university students is generally lower than in older populations, it is increasing due to rising rates of obesity and sedentary lifestyles. Khan et al. (2022) similarly found that overweight and obese young adults were more likely to have elevated systolic and diastolic blood pressure than their normal-weight peers. Likewise, El-Ashker et al. (2021) reported an association between overweight, obesity, and hypertension risk in university students, reinforcing the link between body weight and blood pressure in this demographic.

In conclusion, the relationship between body weight and blood pressure among university students has been well-established in several countries, with numerous studies emphasizing the risks of being overweight or obese. Consequently, this study seeks to examine the impact of body weight on systolic and diastolic blood pressure, specifically focusing on university students at Universiti Teknologi MARA (UiTM) Pahang Branch, Jengka Campus. By concentrating on a younger and more homogeneous group, this research offers targeted insights into the connection between body weight and blood pressure, which can guide early intervention strategies. Additionally, this study contributes to the broader understanding of how managing weight in early adulthood can reduce future health risks.

RESEARCH METHODS

Data Collection

A preliminary descriptive study was carried out at Universiti Teknologi MARA (UiTM), Pahang Branch, Jengka Campus, involving a representative group of 43 diploma and degree students from eight different faculties and schools. Among the 43 respondents, 74.4% identified as female and 25.6% identified as male, with participants aged between 18 and 22 years. The data was obtained by using an online survey given through validated questionnaires. Data was collected through an online survey utilizing validated questionnaires, which covered three sections: demographic details, lifestyle habits, and blood pressure measurements (mmHg).

Statistical Methods

Descriptive Statistics

The present study utilizes descriptive statistics to elucidate and succinctly summarize the characteristics of the data. This methodological approach provides a comprehensive overview of the sample and its associated measurements, complemented by straightforward visual representations to facilitate quantitative analysis. In this context, descriptive analysis was employed to characterize the patterns of body weight and blood pressure readings among the students. For categorical data, a graphical method using percentages (%) will be applied, while numerical data will be assessed through statistical measures such as mean, standard deviation, minimum, and maximum values. Nevertheless, it is essential to acknowledge that descriptive statistics alone are insufficient for reaching definitive conclusions regarding the hypotheses under investigation in the study (Cox and Hinkley, 1979). As mentioned by Fisher and Marshall (2009), descriptive statistics are primarily employed to characterize the central tendency of a distribution of scores, commonly referred to as measures of central tendency, in addition to the dispersion or variance of the scores. Accordingly, the analysis proceeds with the implementation of a correlation analysis.

Correlation Analysis

Correlation analysis, often termed bivariate analysis, is widely employed across numerous academic fields. Researchers have developed various forms of correlation analysis to evaluate the strength of the relationship between two variables. In this research, the Spearman rank correlation is applied to examine the association between body weight and blood pressure readings among students. This technique is particularly suitable for non-normally distributed continuous data, ordinal data, or data containing significant outliers (Schober et al., 2018). According to Liebrau (1983), the Spearman's rank correlation coefficient, abbreviated as ρ, can be calculated as follows:

$$\rho = \frac{\sum_{i=1}^{n}\left[\left(r(x_i) - r(\bar{x})\right)\left(r(y_i) - r(\bar{y})\right)\right]}{\sqrt{\sum_{i=1}^{n}\left(r(x_i) - r(\bar{x})\right)^2 \sum_{i=1}^{n}\left(r(y_i) - r(\bar{y})\right)^2}}$$

Where $r(x_i)$ and $r(y_i)$ are the ranks of the observations in the sample. The $r(\bar{x})$ and $r(\bar{y})$ are represent as the average values of corresponding variables. In general, the range of values for a correlation coefficient is typically between -1 and $+1$. The monotonic relationship between two variables is weakened as ρ approaches 0 (Liebetrau, 1983). A correlation value of zero signifies no relationship between the variables. A positive correlation coefficient indicates a direct relationship, wherein an increase in one variable corresponds with an increase in the other. Conversely, a negative correlation coefficient reflects an inverse relationship, where an increase in one variable results in a decrease in the other (Gagne, 2014). Only correlations that are statistically significant, as determined by a *p*-value less than the established significance threshold, are considered. The analysis was performed using IBM SPSS Statistics 25, with statistical significance determined by *p*-values less than 0.05.

RESULTS AND DISCUSSION

Descriptive Statistics

Figure 1 shows the percentage distribution of blood types among students in this study. Blood type O is the most common, comprising 37.2% of the students. Blood type B follows with 23.3%, making it the second most prevalent. Blood type A is slightly less common, accounting for 20.9% of the students, while blood type AB is the least frequent, at 18.6%.

This indicates that blood types O and B are the dominant blood types among the students in this particular group.

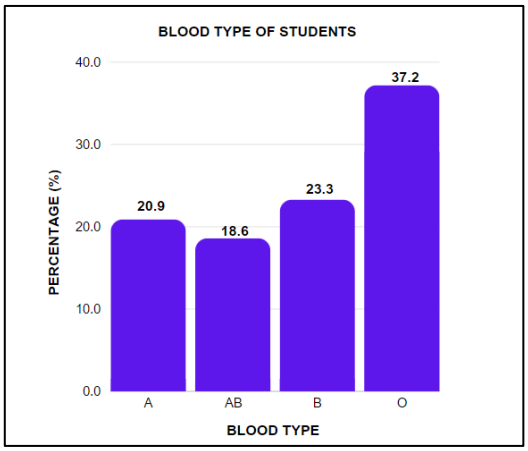

Figure 1. Blood type of students

Figure 2 illustrates the distribution of hours students exercise per day. A majority of the students, 72.1%, engage in 1 to 2 hours of exercise daily, represented by the large blue portion. 16.3% of individuals do not exercise at all (orange section), while a smaller group, 11.6%, exercise for 3 to 4 hours each day (purple section). The finding suggests that most of the students maintain a moderate level of physical activity, with a significant portion not engaging in exercise and a minority dedicating extended hours to it.

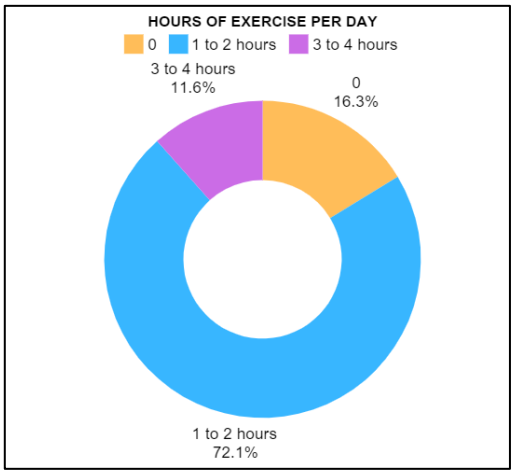

Figure 2. Hours of exercise per day

Figure 3 illustrates food preferences among students that consist of three categories: Malay food, fast food, and snacks. According to the data, the majority of students, 51.2%, prefer Malay food, followed by 39.5% who favor fast food. A smaller portion, 9.3%, expresses a preference for snacks. This indicates a significant leaning toward traditional Malay food, with fast food also quite popular, while snacks are the least preferred option among the choices presented.

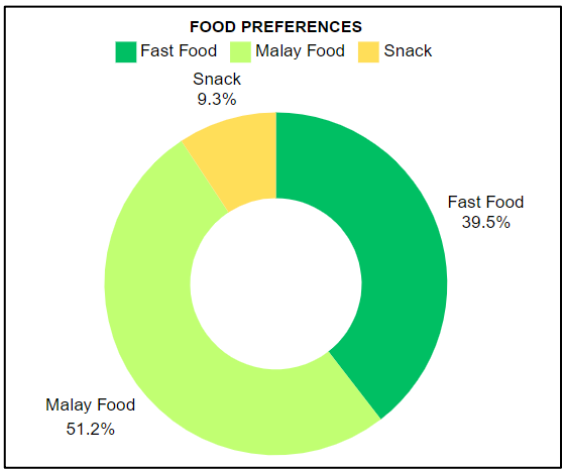

Figure 3. Food preferences

Figure 4 below shows the distribution of fast food intake per week based on the number of days spent by students in this study. The highest percentage of students, 62.8%, consume fast food 1 to 2 days a week, indicating that the majority prefer occasional fast food consumption. A smaller percentage, 20.9%, consume fast food 3 to 4 days a week, while only 4.7% eat fast food frequently, at 5 to 6 days a week. Additionally, 11.6% fall under the 'Others' category, which likely includes those with varying or unpredictable fast food intake patterns. This suggests that while occasional consumption is common, regular consumption of fast food is less prevalent.

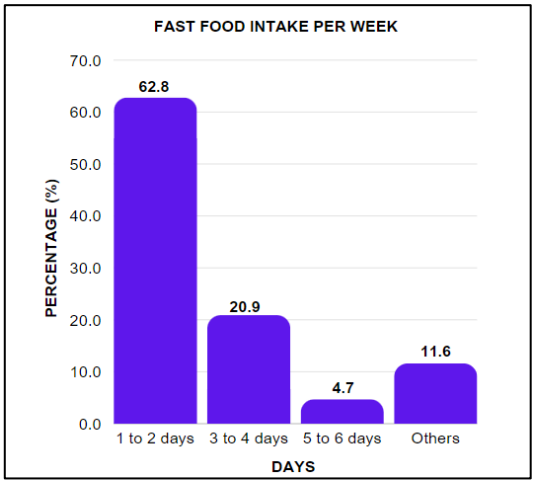

Figure 4. Fast food intake per week

Figure 5 shows the consumption of vitamins and supplements, with a breakdown of responses between students who take supplements and those who do not. According to the data, a significant majority, 76.7%, reported that they do not consume vitamins or supplements, while only 23.3% indicated that they do. This suggests that the majority of students surveyed either do not feel the need to take such products or may have other sources of necessary nutrients, with a smaller portion of the population actively engaging in vitamin or supplement intake.

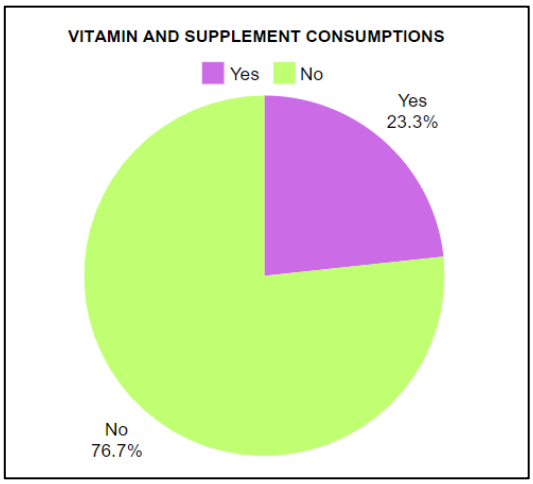

Figure 5. Vitamin and supplement consumption

On the other hand, Figure 6 shows data regarding students' efforts to monitor their calorie intake and diet. A large proportion, 79.1%, do not actively monitor their diet or calorie consumption, while only 20.9% of individuals reported that they do. This indicates that the majority of the students either do not find it necessary or lack the practice of keeping track of their dietary habits, while a smaller group takes active steps to manage their caloric intake and dietary choices.

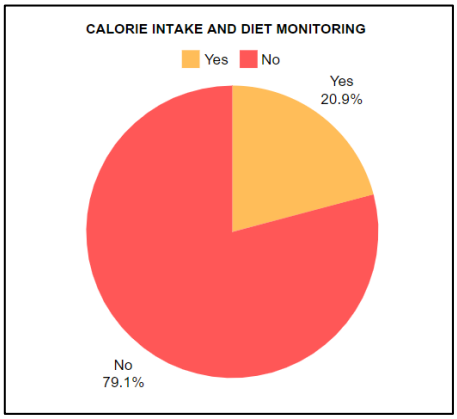

Figure 6. Calorie intake and diet monitoring

Figure 7 illustrates the perception of whether weight affects blood pressure readings among students. A majority of the students, 67.4%, believe that weight does indeed impact blood pressure, while 32.6% of the individuals surveyed do not think weight affects their blood pressure readings. This suggests that most students recognize a correlation between weight and blood pressure, indicating a general awareness of the health risks associated with weight in relation to blood pressure, though a significant portion does not share this belief.

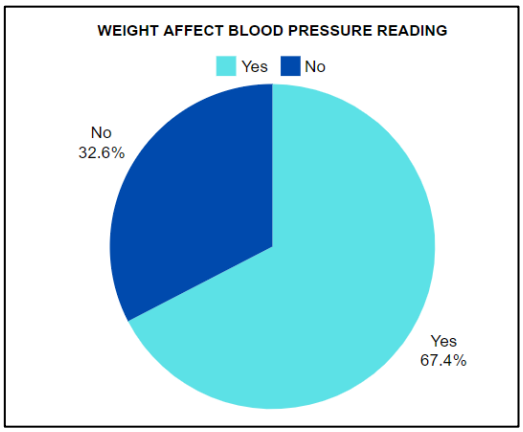

Figure 7. The perception of weight affects blood pressure reading

Table 1 presents the distribution of systolic blood pressure readings categorized by gender. Among males, 9.3% have systolic blood pressure readings of less than 120 mmHg, while 9.3% fall within the 120 to 139 mmHg range, and 7.0% have readings between 140 and 159 mmHg. In contrast, a significant portion of females, 55.8%, have systolic readings below 120 mmHg, 16.3% are in the 120 to 139 mmHg range, and only 2.3% have readings between 140 and 159 mmHg. This data suggests that a higher percentage of females have lower systolic blood pressure readings compared to males, with fewer females in the higher blood pressure categories.

Table 1. Distribution of the systolic blood pressure reading by gender

Gender	Systolic lood pressure reading (mmHg)		
	Less than 120	120 to 139	140 to 159
Male	9.3	9.3	7.0
Female	55.8	16.3	2.3

Table 2 displays the distribution of diastolic blood pressure readings by gender across various categories. For males, the majority have a blood pressure reading between 80 to 89 mmHg with 16.3%, while a small percentage of 4.7% fall in the less than 80 mmHg and 90 to 99 mmHg categories, with none having a reading of 100 mmHg or higher. In contrast, for females, the largest proportion falls in the less than 80 mmHg category, with 39.5%, followed by 23.3% in the 80 to 89 mmHg range. A smaller percentage of females have readings between 90 to 99 mmHg with 9.3%, and 2.3% have readings of 100 mmHg or above. This indicates that females have a greater proportion of lower diastolic blood pressure readings compared to males.

Table 2. Distribution of the diastolic blood pressure reading by gender

Gender	Diastolic blood pressure reading (mmHg)			
	Less than 80	80 to 89	90 to 99	100 and above
Male	4.7	16.3	4.7	0.0
Female	39.5	23.3	9.3	2.3

Table 3 presents the distribution of blood pressure categories (low, normal, and high) by gender. Among male students, none fall into the low blood pressure category, with 16.3% having normal blood pressure and 9.3% categorized as having high blood pressure. On the other hand, females show a more diverse distribution, with 18.6% falling into the low blood pressure category, a significant 41.9% having normal blood pressure, and 14.0% classified

with high blood pressure. Overall, the data suggests that females are more likely to have low and normal blood pressure, while males are more concentrated in the normal and high blood pressure categories.

Table 3. Distribution of the blood pressure reading catogeries by gender

Gender	Categories of blood pressure reading		
	Low	Normal	High
Male	0.0	16.3	9.3
Female	18.6	41.9	14.0

Table 4 shows the distribution of blood pressure readings categorized as low, normal, and high across different body weight ranges of students. Among students weighing less than 50 kg, 7.0% have low blood pressure, 11.6% have normal blood pressure, and 2.3% have high blood pressure. In the 50 to 69 kg weight group, 11.6% have low blood pressure, 32.6% have normal, and 14.0% have high blood pressure, indicating that this group has the highest percentage of normal and high readings. For students weighing 70 to 89 kg, none have low blood pressure, 11.6% have normal, and 7.0% have high blood pressure. Lastly, in the 90 kg and above group, 2.3% have normal blood pressure, and none have either low or high blood pressure. This finding suggests that students with higher body weight tend to have a higher percentage of normal and high blood pressure readings.

Table 4. Distribution of the blood pressure reading catogeries by student's body weight

Body weight (kg)	Categories of blood pressure reading		
	Low	Normal	High
less than 50	7.0	11.6	2.3
50 to 69	11.6	32.6	14.0
70 to 89	0.0	11.6	7.0
90 and above	0.0	2.3	0.0

Table 5 presents a summary of the students' body weight and blood pressure readings, showing the mean, standard deviation, minimum, and maximum values for each variable. The average body weight of the students is approximately 58.98 kg, with a standard deviation of 14.61 kg, ranging from a minimum of 39 kg to a maximum of 95 kg. For systolic blood pressure, the mean is 113.14 mmHg, with a standard deviation of 19.97 mmHg, and readings range from 53 mmHg to 157 mmHg. Diastolic blood pressure has a mean of 78.30 mmHg, a standard deviation of 13.69 mmHg, with values spanning from 41 mmHg to 109 mmHg. These statistics indicate variability in body weight and blood pressure measurements among the students.

Table 5. Summary of the students body weight and blood pressure reading

Variables	Mean	Standard Deviation	Minimum	Maximum
Body weight (kg)	58.9767	14.6116	39	95
Systolic blood pressure reading (mmHg)	113.1395	19.9673	53	157
Diastolic blood pressure reading (mmHg)	78.3023	13.6896	41	109

CORRELATION ANALYSIS

Association Between Students Body Weight And Blood Pressure Reading

The scatter diagrams in Figure 8 show the relationship between students' body weight and their systolic (a) and diastolic (b) blood pressure readings. In both diagrams, there appears to be a positive linear correlation between body weight and blood pressure. As body weight increases, both systolic and diastolic blood pressure readings tend to increase, though the scatter suggests some variability. This indicates that, generally, heavier students may have higher blood pressure readings, reflecting the potential influence of body weight on blood pressure. However, the scattered nature of the data points suggests that other factors could also be contributing to variations in blood pressure.

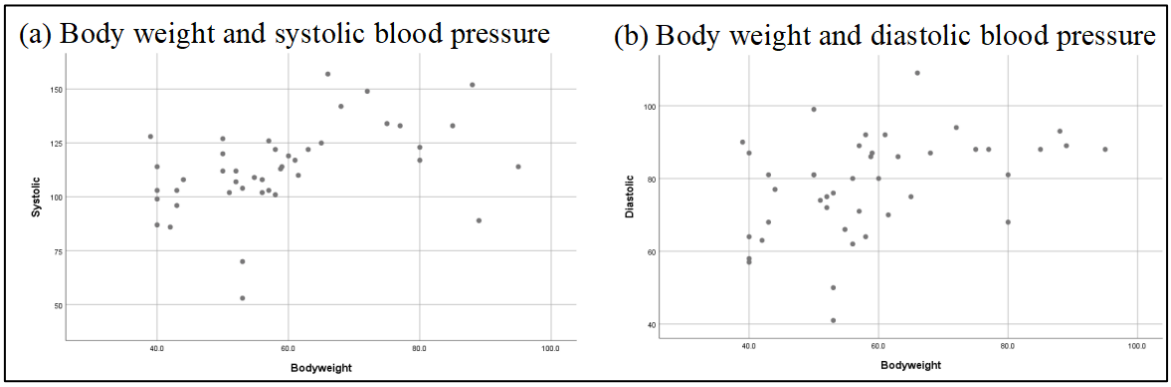

Figure 8. Scatter diagram of student's body weight and blood pressure reading

Table 6 presents the results of a Spearman rank correlation analysis between students' body weight (in kilograms) and systolic blood pressure readings (in mmHg). The correlation coefficient (ρ) between body weight and systolic blood pressure is 0.440, indicating a moderate positive linear correlation between the two variables. This suggests that as body weight increases, systolic blood pressure also tends to increase. The *p*-value associated with this correlation is 0.002, which is highly significant, as it is below the significance threshold of 0.05. This means the observed correlation is statistically significant. Thus, the analysis demonstrates a meaningful positive linear relationship between body weight and systolic blood pressure among the students.

Table 6. Spearman rank correlation analysis of students body weight and systolic blood pressure reading

Variables	Values	Body weight (kg)	Systolic blood pressure reading (mmHg)
Body weight (kg)	Correlation Coefficient, ρ	1	0.440
	p-value	-	0.002***
Systolic blood pressure reading (mmHg)	Correlation Coefficient, ρ	0.440	1
	p-value	0.002***	-

*Notes. Significant codes: 0.05 '***'*

Besides, table 7 presents the results of a Spearman rank correlation analysis between students' body weight (in kilograms) and diastolic blood pressure readings (in mmHg). The correlation coefficient (ρ) between body weight and diastolic blood pressure is 0.412,

indicating a moderate positive linear correlation between the two variables. This means that as body weight increases, there is a tendency for diastolic blood pressure to also increase. Moreover, the *p*-value for this correlation is 0.003, which is statistically significant at the 0.05 level, suggesting that there is a meaningful association between body weight and diastolic blood pressure among students.

Table 7. Spearman rank correlation analysis of student's body weight and diastolic blood pressure reading

Variables	Values	Body weight (kg)	Diastolic blood pressure reading (mmHg)
Body weight (kg)	Correlation Coefficient, ρ	1	0.412
	p-value	-	0.003***
Diastolic blood pressure reading (mmHg)	Correlation Coefficient, ρ	0.412	1
	p-value	0.003***	-
*Notes. Significant codes: 0.05 '***'*			

The current study demonstrates a statistically significant relationship between students' body weight (in kilograms) and their blood pressure readings (in mmHg). Moreover, the findings reveal a positive linear correlation between body weight and blood pressure among the students. Similar outcomes have been reported in other studies examining the link between body weight and blood pressure. For example, research involving 1.7 million Chinese adults identified a strong positive linear relationship between body mass index (BMI) and blood pressure, with increased body weight and BMI being significantly associated with higher systolic and diastolic blood pressure across various population subgroups (Linderman et al., 2018). Another study of young adults aged 18-22 found a significant positive linear correlation between body weight and systolic blood pressure, with a weaker yet still notable correlation for diastolic pressure. It further concluded that for each kilogram of weight gained, systolic blood pressure increased by about 0.725 mmHg and diastolic pressure by 0.318 mmHg (Yusni et al., 2024).

In addition, a study involving 843 medical students aged 21-24 found a statistically significant correlation between body mass index (BMI) and both systolic (SBP) and diastolic blood pressure (DBP). The analysis revealed that students classified as obese had significantly higher systolic and diastolic blood pressure compared to those in the underweight, normal weight, and overweight categories (Song et al., 2023). Furthermore, another study conducted on a large sample of Chinese adults confirmed a consistent and significant relationship between BMI, an indicator of body weight, and blood pressure. This correlation remained significant across various subgroups, reinforcing the positive association between increased body weight and elevated blood pressure (Vallée et al., 2019).

CONCLUSION

In light of the results obtained, it is apparent that body weight exerts a significant influence on blood pressure among university students. The analysis undertaken aimed to investigate the association between body weight and blood pressure, focusing particularly on systolic and diastolic measurements. Employing descriptive statistics and correlation analysis, this research has yielded valuable insights into the patterns and relationships between these variables. The study establishes a significant positive linear correlation between body weight

and both systolic and diastolic blood pressure, indicating that increases in body weight are associated with corresponding rises in blood pressure. This relationship was found to be statistically significant. These findings align with prior research, which has similarly documented a strong connection between elevated body mass and higher blood pressure across various populations and age groups. Given the potential health risks associated with elevated blood pressure, this study underscores the importance of maintaining a healthy body weight as a preventive strategy against hypertension. Future research should explore additional factors contributing to blood pressure variability and evaluate the effectiveness of lifestyle interventions in managing both body weight and blood pressure in similar populations.

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