Current Research in Health Sciences, 4(1):17–23, 2026. DOI: 10.58613/crhs414

Current Research in Health Sciences

ISSN (Online): 2584-1084

Journal homepage: https://gpub.org/journal-details.php?journal-id=47

Research Article

The Impact of Obesity on the Severity and Degree of Hypertension among Students of the Open Educational College

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Article Info

Keywords: *Obesity, Blood Pressure, Blood Glucose.*

Received: *30.04.2026;*
Accepted: *15.06.2026;*
Published: *24.06.2026*

Abstract

The purpose of this study was to determine the effect of obesity on blood pressure and blood glucose of open education students and to see whether this effect remained after accounting for several co-occurring factors. A descriptive-analytical study with cross-sectional design was used in this study with a random sample of 100 students male and female. Demographic, behavioral, and health data were collected, along with weight and height, and body mass index (BMI) was calculated, as well as systolic and diastolic blood pressure and blood glucose levels. The results showed that 66% of the sample were overweight or obese. There was also a statistically significant ($p<0.001$) difference in blood pressure and blood glucose levels between the various body mass index (BMI) groups, which was progressively positive from normal weight to obesity. Multiple regression models showed that obesity was an independent risk factor for blood pressure and blood glucose level, regardless of the sex, age, smoking, number of meals, medications taken, and thyroid hormone levels. The researchers found that obesity is an early health risk factor in open education students and advised to build the health awareness program and conduct regular health screenings in educational institutions to minimize the risk factors for chronic diseases.

1. Introduction

The prevalence of obesity is a significant problem of today that has rapidly increased worldwide, with direct and indirect consequences on human physical and functional abilities [1]. Obesity is not only excess weight, but is now recognized as a chronic medical condition associated with the development of many metabolic, hormonal and vascular disorders, particularly hypertension and blood sugar imbalance. These are some of the greatest risk factors contributing to the development of cardiovascular disease, diabetes and its complications. Medical research indicates that fat accumulation in the body contributes to increased vascular resistance and a higher burden on the heart. It also plays a role in increasing insulin resistance and disrupting the secretion of certain hormones that regulate metabolism, leading to a gradual imbalance in the body's internal systems [2, 3]. This negatively impacts key vital signs such as blood pressure and blood glucose levels. The danger of these changes increases when they occur at a young age, as they pave the way for the development of chronic diseases that are difficult to manage later in life [4].

An estimated one billion persons globally are overweight, with at least 300 million of them being classified as clinically obese [5]. This tendency has been linked to several variables, including changes in people's environments and their physical, social, and economic lifestyles [6].

One of the media that significantly affects people's views, social, economic, and psychological behaviours is education. Education and socioeconomic position (SES) are related, according to numerous research [7]. Numerous research have examined the connection between obesity and SES, despite the fact that education can be demonstrated to affect both SES and obesity. However, the same cannot be

true of education and obesity. The disparities in the prevalence of obesity and overweight among social groups, by educational attainment, socioeconomic status, and ethnic background, contribute to the growing worry about the rising rates of these conditions [8].

Therefore, this study aims to analyze the nature of the relationship between obesity and both blood pressure and blood sugar levels among open education students, and to reveal the extent to which this effect persists after controlling for associated factors, to contribute to providing a scientific basis that helps in developing awareness and prevention programs targeting this group, and reducing the development of risk factors at early ages.

2. Methods

In this study, the population consisted of students enrolled in open education programs, representing a diverse demographic and adult group with varying health and dietary habits. A simple random sample of 100 students (male and female) who consented to participate was selected to ensure adequate representation of the target population. Minimising confounding factors and ensuring the results were as accurate as possible, individuals with diagnosed chronic conditions that could directly influence weight, blood pressure, or blood sugar levels, including diagnosed diabetes and advanced heart disease, were excluded.

2.1. Anthropometric Measurements

Weight of the participants was measured on a calibrated medical scale and the height on a measuring tape without shoes on. Then the weight (in kg) was divided by the square of the height (in m) to obtain the Body Mass Index (BMI). The values were then reported as normal weight, overweight or obesity on the basis of the accepted weight classifications in health studies. BMI is among the most common measures used in field studies because it is easily applied and offers a general indication of how obese a population studied is.

2.2. Blood Pressure Measurement

After adequate rest to obtain stable readings, the participant's systolic and diastolic blood pressure were taken with an arm sphygmomanometer. For each participant, two readings were made and then the average of the two readings used in the statistical analysis in order to reduce the chance of the random error. This is a common method of blood pressure measurement that is accurate and reliable for epidemiological and health studies [9].

2.3. Blood glucose measurement

A portable blood glucose meter was used to measure blood glucose levels with a capillary blood sample. Values were obtained in mg/dL and taken as a blood glucose disturbance indicator in the sample. This practice is common in field studies because it is quick, easy to do, and gives good estimates of blood glucose levels, particularly in younger humans [9].

2.4. General data collection

To capture data on demographic factors and other covariates that may affect the results of the study, a special form was created, which included answers to questions regarding sex, age, smoking, number of meals, duration of hypertension, use of medication, and status of thyroid hormone secretion. Including these variables is essential for understanding the nature of the relationship between obesity and biomarkers and for controlling for the effects of confounding factors during statistical analysis [10].

2.5. Statistical processing

The data was processed using appropriate statistical software. Descriptive statistics were used to display frequencies, percentages, means, and standard deviations. Comparative tests were used to measure differences between BMI categories, and correlation coefficients were used to examine the direction and strength of the relationship between variables. To test the advanced hypotheses, a multiple linear regression model was applied to measure the effect of obesity on blood pressure and blood glucose levels after controlling for covariates. A significance level of $p \geq 0.05$ was used as the benchmark for determining the statistical significance of the results [11].

3. Results & Discussion

3.1. Sample characteristics and prevalence of obesity

Table 1: Demographic characteristics and lifestyle of the study sample (n = 100)

Variable	Category	Number	Percentage %
Sex	Male	48	48
	Female	52	52
Gender	33-40 years	34	34
	40-47 years	41	41
	More than 47 years	25	25
Smoke	Yes	29	29
	No	71	71
Number of meals	Less than 3 meals	27	27
	3 meals	46	46
	More than 3 meals	27	27
Duration of high blood pressure	No found	68	68
	Under 3 years	19	19
	More than 3 years	13	13
Medication intake	Yes	31	31
	No	69	69
Thyroid condition	Normal	88	88
	Disorder in secretion	12	12

Table 2: Arithmetic means and standard deviations of body mass index and biometric measurements

Variable	Arithmetic mean	Standard deviation	Minimum	Maximum
Weight (kg)	76.4	± 14.2	49	112
Height (m)	1.68	± 0.09	1.5	1.92
Body Mass index (kg/m²)	27.1	± 4.3	18.6	36.8
Systolic Blood Pressure (mmHg)	128.6	± 15.4	98	168
Diastolic Blood Pressure (mmHg)	82.3	± 9.1	60	104
Blood Glucose (mg/dL)	104.7	± 18.9	72	168

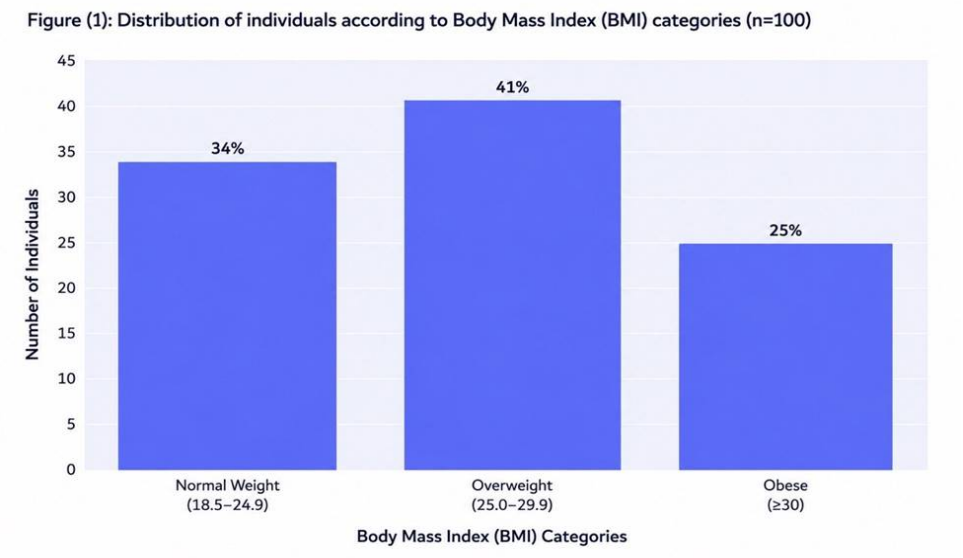

Figure 1: Distribution of Body Mass Index categories among the sample members

This figure shows the distribution of the sample members according to the Body Mass Index categories (normal weight, overweight, obesity), and shows the high percentage of overweight and obesity compared to normal weight.

The study results on sample characteristics indicate that the sample was very diverse in terms of the demographic characteristics and lifestyles of the open education students, which is a reflection of the diversified health and behaviors of the students in the open education. The sample consisted of an approximately equal number of females and males and a distribution across the adolescent and early college age years, when healthy lifestyle and dietary and physical behaviors become established that can later impact health.

Table 2 indicates that the mean body mass index (BMI) of the sample is in overweight category, which means that there is high risk of future health problems due to overweightness. This is evidenced by Figure 1 where about two thirds of the sample are overweight or obese with a smaller proportion being in the normal weight range. This pattern is consistent with that seen in previous studies conducted in the Arab world on the prevalence of overweight among the youth [12].

These results are indicative of the increasing obesity trend as a health issue among university students in educational settings where there is an increased workload, low physical activity and irregular eating habits. Multiple studies indicate that these behavioral and social factors directly contribute to weight gain and fat accumulation, even in young individuals [13].

The results also indicate that young adults are no longer immune to the problems of excess weight; rather, obesity has become an early risk factor that may pave the way for the emergence of later health disorders such as high blood pressure and blood sugar disorders, if the matter is not addressed through early preventive and awareness-raising interventions within educational institutions [14].

3.2. Obesity and Blood Pressure

Table 3: Comparison of blood pressure and blood sugar levels according to body mass index categories

BMI category	Systolic blood pressure (mean ± deviation)	Diastolic blood pressure (mean ± deviation)	Blood glucose (mean ± deviation)
Normal weight (n=34)	9.6 ± 118.4	6.8 ± 76.9	11.7 ± 94.2
Overweight (n=41)	11.3 ± 128.7	7.4 ± 82.1	14.9 ± 104.6
Obesity (n=25)	13.8 ± 141.9	8.1 ± 89.6	18.6 ± 121.8
P value	<0.001	<0.001	<0.001

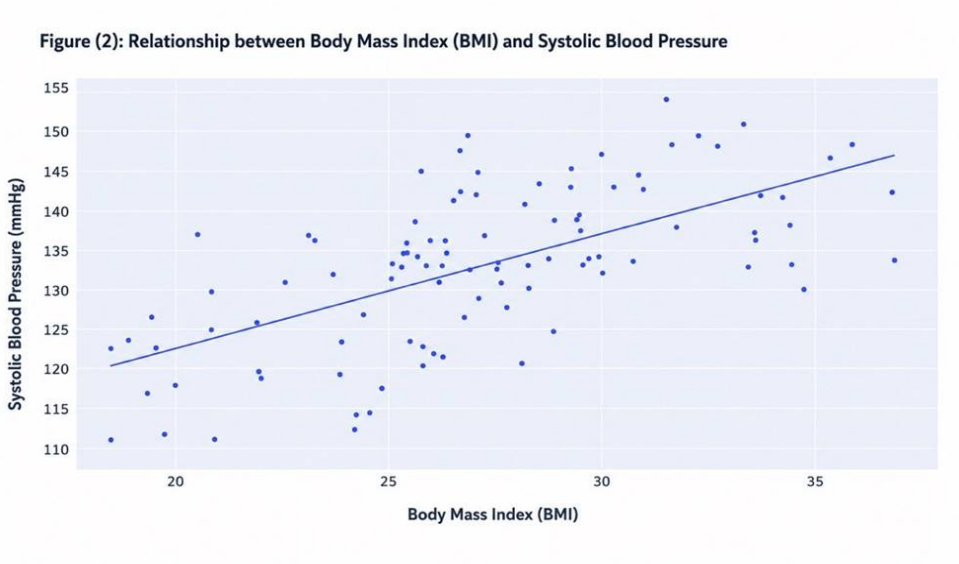

Figure 2: The relationship between body mass index and blood pressure

Systolic and diastolic blood pressure levels varied statistically significantly between BMI categories, according to the study's findings. As people transitioned from the normal weight category to the overweight and finally the obese categories, their blood pressure measurements progressively rose. Systolic blood pressure showed the biggest increase, which is indicative of the heart's increased strain when body mass increases [15].

Figure 2 demonstrates a strong positive correlation between blood pressure and body mass index, suggesting that rising obesity is linked to a slow increase in blood pressure. These findings support the study's initial premise, which holds that among open education students, obesity and high blood pressure are statistically significantly correlated. This is consistent with field research that looked at the connection between young people' obesity and cardiovascular markers [16].

The physiological processes linked to obesity can account for these findings. In addition to increasing peripheral vascular resistance and circulating blood volume, increased adipose tissue also activates the sympathetic nervous system and the renin-angiotensin-aldosterone pathway, which progressively raises blood pressure. Additionally, obesity reduces vascular flexibility, which explains why systolic blood pressure rises more than diastolic blood pressure [17].

These results show that high blood pressure is not a problem that only affects the elderly; it can also manifest at a younger age in the

presence of obesity, which raises the risk of cardiovascular diseases in the future if early preventive measures aimed at a healthy lifestyle are not implemented in educational institutions [18].

3.3. Obesity and Blood Sugar Levels

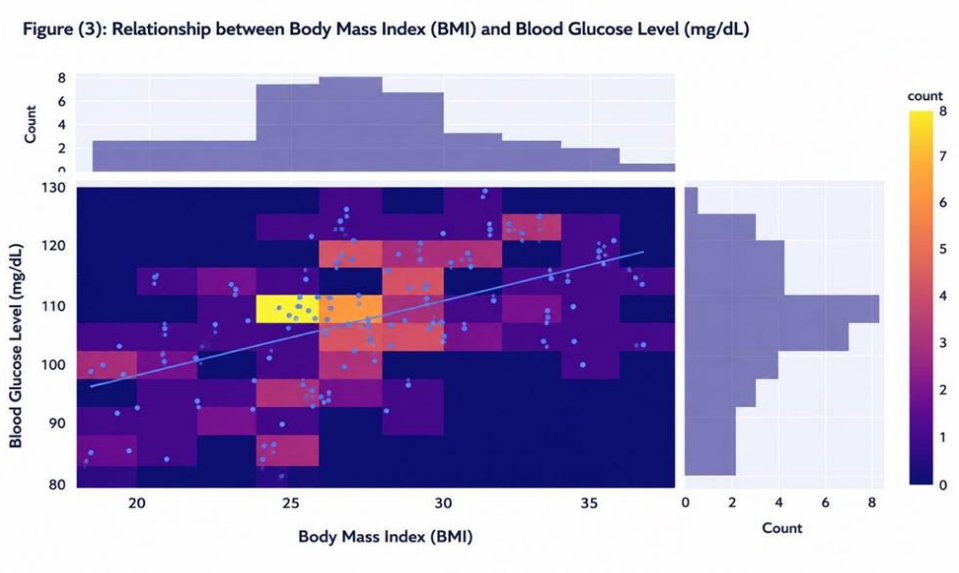

Figure 3: The relationship between body mass index and blood sugar level

The study results showed statistically significant differences in blood glucose levels between body mass index (BMI) categories, with average blood glucose levels increasing gradually from the normal weight category to the obese category. This trend is consistent with previous reports on the relationship between obesity and blood glucose regulation in youth [19], and the results clearly show a relationship between rising obesity and worsening blood glucose regulation from youth to adulthood.

This is supported by Figure 3 which shows that there was a positive relationship between body mass index (BMI) and blood glucose level, confirming that overweight and obesity are linked to higher blood glucose level. The findings are also in agreement with the second hypothesis of the study that high blood glucose has a statistically significant association with obesity. This is consistent with the regional reports and studies on prevalence of glucose disorders related to obesity [20].

This association is due to insulin resistance. Too much fat, especially around the belly, makes cells less responsive to insulin, making it more difficult for glucose to be taken up and leaving it in the bloodstream. Obesity also leads to higher production of inflammatory mediators that have detrimental effects on liver and muscle functions that regulate glucose. This causes a progressive disturbance in metabolic balance [21].

The results indicate that hyperglycemia may silently develop in young adulthood, with obesity as a risk factor, leading to the development of prediabetes and eventually type 2 diabetes unless preventive strategies are taken early for lifestyle changes, specifically in food intake and physical activity levels [22].

3.4. Multiple Regression Results and Interpretation of the Residual Effect of Obesity

Table 4: Results of the Multiple Regression Model for Interpreting Blood Pressure

Variable	Regression coefficient B	Standard error	t value	P value
Body Mass Index	1.48	0.21	7.04	0.001>
Age	0.62	0.25	2.48	0.015
Gender	3.71	1.42	2.61	0.011
Smoking	2.94	1.36	2.16	0.033
Number of Meals	0.88	0.41	2.14	0.035
Duration of Hypertension	4.16	1.08	3.85	0.001>
Medication Use	5.02-	1.47	3.41-	0.001
Thyroid Gland	2.57	1.29	1.99	0.049

Table 5: Results of the multiple regression model for interpreting blood sugar levels

Variable	Regression coefficient B	Standard error	t value	P value
Body Mass Index	1.63	0.28	5.82	0.001>
Age	0.71	0.31	2.29	0.024
Gender	2.11	1.76	1.19	0.238
Smoking	3.26	1.59	2.05	0.043
Number of Meals	1.09	0.46	2.37	0.02
Medication Use	6.18-	1.88	3.28-	0.002
Thyroid Gland	4.41	1.94	2.27	0.026

The multiple linear regression model results indicated that body mass index (BMI) was an independent variable for blood pressure, and had a positive regression coefficient with high statistical significance after accounting for the other variables. This means that the association of obesity with BP is independent of sex, age, and lifestyle; corroborating previous studies that showed that obesity is an independent risk factor for increased BP [23].

The results also revealed that some co-variables, including age, smoking, number of meals consumed and length of time of hypertension, accounted for the differences in blood pressure to a certain extent. This is in part a result of physiological and behavioral factors affecting this important measure. However, medication use was correlated with lower blood pressure readings, perhaps because some participants had been prescribed antihypertensive medications, which resulted in lower readings than did not receive the medication, normal blood pressure [24].

For blood glucose, the multiple regression model revealed that BMI was still a significant independent influence, even after the covariates were adjusted, meaning that BMI is a key factor in glucose dysregulation, even with other factors taken into account. The effects of age, smoking, number of meals and thyroid status were significant, and there was no statistically significant effect of sex. This indicates that in the sample obesity, together with behavioral and endocrine factors, is the most significant determinant of blood glucose level [25].

These findings support the third hypothesis of the study, and suggest that obesity is a risk factor for high BP, hyperglycemia, and continues to be a risk factor even after other demographic, behavioral and health factors are taken into account. This further emphasises the need to tackle obesity as a preventative issue with young people in educational settings [26].

4. Conclusions

1. Excess body weight was common among Open Educational College students, suggesting that being overweight is a health issue among this group.
2. Both blood pressure and blood glucose levels were significantly associated with Body Mass Index (BMI), where both levels increased with an increase in BMI.
3. After adjusting for the demographic and health-related factors, 3. BMI remained an independent predictor of BP and blood glucose level.
4. Cardiovascular and metabolic disturbances were found to be an important risk factor in young adults for obesity.
5. Early prevention and management of obesity has the potential to help decrease the future burden of chronic diseases in this population.

Recommendations

1. Foster regular health education programs to raise awareness about obesity, healthful nutrition and health risks associated with lifestyle among students.
2. Promote healthy nutrition and exercise habits to prevent overweight and obesity.
3. Regularly monitor and screen Body Mass Index (BMI), blood pressure and blood sugar levels to identify health risks at an early stage.
4. Design interventions to prevent obesity and obesity-related risk factors for young adults.
5. Conduct further research on larger and more diverse populations, including other factors including physical activity, sleep habits, and psychological stress.

Article Information

Disclaimer (Artificial Intelligence): The author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.), and text-to-image generators have been used during writing or editing of manuscripts.

Competing Interests: Authors have declared that no competing interests exist.

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