

Evaluation of Blood Pressure Categories and Anthropometric Indices in Third-Year Students at Grsmu

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Abstract

The problem of overweight among young people has become quite acute in recent years. According to a UNICEF report for September 2025, for the first time in history, obesity among schoolchildren and adolescents aged 5-19 years has become more common than weight deficiency: the obesity rate in this group has reached 9.4%, which is equivalent to 188 million people

Keywords: waist circumference; hip circumference (HB); and waist-to-hip ratio

Introduction

The problem of overweight among young people has become quite acute in recent years. According to a UNICEF report for September 2025, for the first time in history, obesity among schoolchildren and adolescents aged 5-19 years has become more common than weight deficiency: the obesity rate in this group has reached 9.4%, which is equivalent to 188 million people [1]. Research published in *The Lancet* confirms that the prevalence of obesity among children and adolescents worldwide has quadrupled since 1990 [2,3]. Experts cite a sedentary lifestyle due to the use of gadgets and the consumption of cheap fast food as the main reasons. The World Federation against Obesity predicts that by 2030 the number of young people with obesity will exceed 250 million [4].

The prevalence of hypertension is significantly higher among obese people than among people of normal weight. Obesity is the main independent risk factor for hypertension; in particular, 78% of cases of primary hypertension in men and 65% in women are associated with overweight or obesity. Even a 5% increase in body weight is associated with a 20-30% increase in the incidence of primary hypertension [5]. Recent longitudinal studies emphasize that the transition from adolescence to young adulthood (18-25 years old) is a "critical window" when weight gain is most strongly correlated with a constant change in the hemodynamic equilibrium point, leading to an early onset of cardiovascular aging [6].

The mechanisms by which obesity leads to hypertension are complex and include overactivation of the sympathetic nervous system, stimulation of the renin-angiotensin-aldosterone system, increased cytokine production by adipose tissue, insulin resistance, as well as structural and functional changes in the kidneys [7]. In addition, modern research highlights the role of "metabolic inflammation" (meta-inflammation) and adipokine dysregulation in young adults, where even a moderate increase in hip or

waist circumference acts as endocrine triggers of vascular rigidity in those who are increasingly exposed to a sedentary lifestyle associated with the use of digital devices [8, 9].

In clinical practice, the assessment of overweight is traditionally based on body mass index (BMI). However, BMI does not always reflect the specific distribution of body fat, which has different levels of metabolic activity and has different effects on the cardiovascular system. Anthropometric indicators such as

waist circumference (WC), hip circumference (HB), and waist-to-hip ratio (WHR) provide a more accurate assessment of the localization of excess body fat and their contribution to changes in hemodynamic parameters.

The aim of the study

was to evaluate the prevalence of various blood pressure categories and the frequency of hypertensive/hypotensive episodes in the medical history of Grodno State Medical University students (academic year 2025-2026), in relation to their Body Mass Index and Waist-to-Hip Ratio.

Research methods.

The study involved 385 girls and 160 boys, third-year students of Grodno State Medical University in the 2025-2026 academic year. The students provided voluntary informed consent to participate in the study.

An anonymous survey of students was conducted on the presence of episodes of increased and decreased blood pressure at rest. Answers were offered: "yes," "no," "I don't know." After that, the individuals who answered "I don't know" were excluded from the analysis.

Blood pressure (BP) was measured according to WHO recommendations with a mechanical tonometer using the Korotkov method [10]. Further, students who smoked, drank tea, coffee, and energy drinks for 1 hour or less before the study were excluded from the study. BP levels were assigned a category according to the recommendations of the European Society of Cardiology in 2023: optimal BP (<120/80 mmHg), normal BP (120-129/80-84 mmHg), high-normal BP (130-139/85-89 mmHg), high BP (\geq 140/90 mmHg), low BP (<100/60 mmHg) [11].

Waist circumference (WC) was measured in accordance with WHO recommendations at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest. Hip circumference (HC) was measured at the widest part of the buttocks [12]. Anthropometric indices were calculated as follows: BMI = (body weight)/(height, m)² and WHR

= WC/HC. According to WHO criteria, WHR was considered elevated if it exceeded 0.85 for women and 0.90 for men [13].

Qualitative features were presented in the form of relative frequencies (%). The distributions were compared using the Pearson's chi-squared test and Fisher's exact test. The threshold value of the statistical significance level was assumed to be 0.05. Statistical data processing was carried out using the StatSoft STATISTICA 10.0 program.

Results and Discussion. The study revealed that among male students with an increased BMI, the combined frequency of optimal and normal BP was significantly lower compared to those with a normal BMI: 27.78% (n=5) versus 61.4% (n=35), respectively (Table 1). Conversely, the combined prevalence of high-normal BP and hypertension was significantly higher in the increased BMI group: 66.67% (n=12) compared to 38.6% (n=22) in the normal BMI group (p=0.011).

BMI	Low BP (n=1)	Optimal BP (n=10)	Normal BP (n=30)	High-normal BP (n=18)	High BP (n=16)
Normal BMI (n=57)	0% (0)	15.79% (9)	45.61% (26)	15.79% (9)	22.81% (13)
Increased BMI (n=18)	5.56% (1)	5.56% (1)	22.22% (4)	50.00% (9)	16.67% (3)

Table 1: Distribution of blood pressure categories among third-year male students of GrSMU (2025/2026) according to Body Mass Index, % (n)

Among male students with an increased BMI, a history of hypertensive episodes was significantly more frequent compared to those with normal or low BMI: 51.28% (n=20), 18.68% (n=17), and 0.0% (n=0), respectively (p<0.001; Table 2).

BMI	No history of elevated BP (n=99)	History of elevated BP (n=37)
Low BMI (n=6)	100.00% (6)	0% (0)
Normal BMI (n=91)	81.32% (74)	18.68% (17)
Increased BMI (n=39)	48.72% (19)	51.28% (20)

Table 2: Prevalence of hypertensive episodes among third-year male students of GrSMU (2025/2026) according to Body Mass Index, % (n)

Furthermore, among male students with a low BMI, a history of hypotensive episodes was significantly more frequent compared to those with normal or increased BMI: 66.67% (n=4), 15.22% (n=14), and 12.20% (n=5), respectively (p=0.003; Table 3).

BMI	No History of hypotension (n=23)	History of hypotension (n=139)
Low BMI (n=6)	33.33% (2)	66.67% (4)
Normal BMI (n=92)	84.78% (78)	15.22% (14)
Increased BMI (n=41)	87.80% (36)	12.20% (5)

Table 3: Prevalence of hypotensive episodes among third-year male students of GrSMU (2025/2026) according to Body Mass Index, % (n)

Although no significant differences were observed in current BP categories between female students with increased and normal BMI, a history of hypertensive episodes was significantly more frequent among those with an increased BMI: 39.53% (n=17), 22.97% (n=51), and 10.17% (n=6), respectively (p=0.002; Table 4).

BMI Category	No history of elevated BP (n = 250)	History of elevated BP (n = 74)
Low BMI (n=59)	89.83% (53)	10.17% (6)
Normal BMI (n=222)	77.03% (171)	22.97% (51)
Increased BMI (n=43)	60.47% (26)	39.53% (17)

Table 4: Prevalence of hypertensive episodes among third-year female students of GrSMU (2025/2026) according to Body Mass Index, % (n)

Furthermore, female students with an elevated WHR reported a significantly higher frequency of hypertensive episodes in their medical history compared to those with a normal WHR: 50.00% (n=16) versus 19.93% (n=58), respectively (p<0.001; Table 5).

Waist-to-Hip Ratio	No history of elevated BP (n = 249)	History of elevated BP (n = 74)
Normal WHR (n=291)	80.07% (233)	19.93% (58)
Elevated WHR (n=32)	50.00% (16)	50.00% (16)

Table 5: Prevalence of hypertensive episodes among third-year female students of GrSMU (2025/2026) according to Waist-to-Hip Ratio, % (n)

Furthermore, a history of hypotensive episodes was significantly more frequent among female students with a low BMI compared to those with normal or increased BMI: 59.32% (n=35), 55.22% (n=127), and 28.26% (n=13), respectively (p=0.002; Table 6).

BMI Category	No history of hypotension (n=160)	History of hypotension (n=175)
Low BMI (n=59)	40.68% (42)	59.32% (35)
Normal BMI (n=230)	44.78% (103)	55.22% (127)
Increased BMI (n = 46)	71.74% (33)	28.26% (13)

Table 6: Prevalence of hypotensive episodes among third-year female students of GrSMU (2025/2026) according to Body Mass Index, % (n)

Furthermore, a history of hypotensive episodes was significantly more frequent among female students with a normal WHR compared to those with a reduced WHR: 55.33% (n=166) versus 26.47% (n=9), respectively (p=0.001; Table 7).

Waist-to-Hip Ratio	No history of hypotension (n = 159)	History of hypotension (n = 175)
Normal WHR (n=300)	44.67% (134)	55.33% (166)
Elevated WHR (n=34)	73.53% (25)	26.47% (9)

Table 7: Prevalence of hypotensive episodes among third-year female students of GrSMU (2025/2026) according to Waist-to-Hip Ratio, % (n)

Conclusions.

Among third-year male students at Grodno State Medical University (2025-2026), an increased Body Mass Index is associated with a significant shift in blood pressure distribution. This is characterized by a higher prevalence of high-normal blood pressure and hypertension compared to students with a normal Body Mass Index.

Students of both sexes with an increased Body Mass Index or an elevated Waist-to-Hip Ratio demonstrate a higher frequency of hypertensive episodes and a lower frequency of hypotensive episodes in their medical history compared to those with normal or low anthropometric indices.

Identifying risk factors such as increased Body Mass Index and Waist-to-Hip Ratio in students – even those with currently normal blood pressure levels – is crucial for preventing the progression of transient pressure spikes into persistent hypertension. Early intervention focusing on lifestyle modification, including weight management, balanced nutrition, regular physical activity, and consistent blood pressure monitoring, is essential for the primary prevention of cardiovascular diseases among young people

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