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LIPID PROFILE AND BLOOD PRESSURE ABNORMALITIES IN ADOLESCENTS WITH ABDOMINAL OBESITY

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ANNOTATION

Purpose of the study. *To analyze lipid profile and blood pressure abnormalities in adolescents with abdominal obesity and determine their role as early indicators of metabolic risk.*

Material and methods. *The study included 2000 adolescents aged 10-19 years. Anthropometric parameters (BMI, waist circumference), systolic and diastolic blood pressure, and biochemical markers (triglycerides, HDL cholesterol, total cholesterol) were assessed. Lipid abnormalities were defined as triglycerides ≥1.7 mmol/L, HDL cholesterol <1.03 mmol/L (boys) or <1.29 mmol/L (girls), and total cholesterol ≥5.2 mmol/L. Statistical analysis was performed using the chi-square test (χ^2), Student's t-test, and correlation analysis ($p < 0.05$).*

Research results. *Low HDL cholesterol (28.7% in boys, 21.5% in girls) and elevated triglycerides (19.4% vs. 13.2%) were the most frequent lipid abnormalities, whereas hypercholesterolemia was less common (16.3% vs. 18.9%). Urban adolescents had significantly higher triglyceride levels (1.85 ± 0.12 mmol/L) compared to rural peers (1.65 ± 0.11 mmol/L; $p = 0.011$). The average systolic and diastolic pressures were 108.4 ± 12.7 and 68.9 ± 9.3 mmHg, respectively. Elevated blood pressure (≥130/85 mmHg) was found in 18.7% of adolescents, with higher prevalence among boys (22.8%) and urban residents (31.2%; $p = 0.042$). Correlation analysis showed positive relationships between BMI and systolic blood pressure ($r = +0.41$; $p < 0.001$), and waist circumference and diastolic pressure ($r = +0.37$; $p = 0.002$).*

Conclusions. *Adolescents with abdominal obesity exhibit early lipid metabolism disturbances and a tendency toward elevated blood pressure. Low HDL cholesterol and hypertriglyceridemia are the main markers of metabolic risk. Regular screening, dietary correction, and physical activity programs are essential to prevent cardiovascular complications in this age group.*

KEYWORDS. *Adolescents, Abdominal Obesity, Lipid Profile, Triglycerides, HDL Cholesterol, Blood Pressure, Metabolic Risk, Prevention.*

TOPICALITY

The increasing prevalence of obesity among adolescents represents one of the most significant public health challenges of the 21st century [1]. Abdominal (visceral) obesity is a key determinant of early metabolic disturbances, including dyslipidemia and arterial hypertension, which contribute to the development of metabolic syndrome and cardiovascular diseases in adulthood [2]. Numerous studies have shown that lipid abnormalities, particularly elevated triglycerides and low HDL cholesterol, are among the earliest indicators of insulin resistance and atherogenic risk in youth [3, 4].

Urbanization, sedentary lifestyle, and unhealthy dietary patterns have further intensified these risks, especially in developing countries, where preventive screening programs remain limited [5]. Early identification of lipid and blood pressure abnormalities in adolescents with abdominal obesity is therefore critical for implementing timely interventions aimed at reducing the future burden of cardiovascular and metabolic diseases [6]. This study contributes to the global effort to understand the early pathophysiological mechanisms of metabolic syndrome and to develop evidence-based preventive strategies for adolescent populations.

RESEARCH MATERIALS AND METHODS

The study included 2000 adolescents aged 10-19 years from both urban (n = 1080) and rural (n = 920) regions of Tajikistan. Participants were selected through school-based health screening programs conducted according to the World Health Organization (WHO, 2007) and International Diabetes Federation (IDF, 2007) criteria for the assessment of metabolic disorders.

Anthropometric assessment included measurements of body mass index (BMI) and waist circumference (WC) to identify abdominal obesity (WC ≥ 90th percentile). Arterial blood pressure (BP) was measured twice in a seated position using a calibrated automatic sphygmomanometer, and the mean of two readings was recorded. Biochemical evaluation was performed under fasting conditions (≥10 hours of fasting). The following parameters were analyzed: triglycerides (TG, mmol/L), high-density lipoprotein cholesterol (HDL-C, mmol/L), and total cholesterol (TC, mmol/L). Blood samples were collected in the morning by venipuncture, processed, and analyzed using enzymatic colorimetric methods on an automated biochemical analyzer. Criteria for lipid abnormalities were defined as TG ≥ 1.7 mmol/L, HDL-C < 1.03 mmol/L for boys or < 1.29 mmol/L for girls, and TC ≥ 5.2 mmol/L. Elevated blood

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pressure was determined as ≥130/85 mmHg. Statistical analysis was performed using SPSS 13.0 software. Quantitative data were presented as M ± m (mean ± standard error). Group comparisons were conducted using Student's t-test for continuous variables and the chi-square test (χ^2) for categorical variables. Pearson's correlation analysis was applied to examine relationships between anthropometric and hemodynamic parameters. Statistical significance was set at $p < 0.05$.

RESEARCH RESULTS

Differences in the frequency of dyslipidemia between boys and girls, as well as between urban and rural adolescents, indicate pronounced gender- and region-specific characteristics of lipid metabolism. Boys and urban adolescents demonstrated a significantly higher prevalence of elevated triglycerides and reduced HDL cholesterol, which may reflect variations in lifestyle, dietary habits, and levels of physical activity. These findings serve as an important reference point for the development of preventive and corrective programs aimed at normalizing lipid metabolism in high-risk adolescent groups. (Table 1).

Table 1

Characteristics of Lipid Profile Disorders by Gender and Area of Residence (n = 628)

Parameter	Category	Prevalence (%)	n	M ± m (mmol/L)	[25%; 75%]	[Min; Max]	p-value	Reference value
Elevated Triglycerides (TG)	Boys	19.4	67	1.80 ± 0.10	[1.60; 2.10]	[1.00; 3.90]	0.021	< 1.7 mmol/L
	Girls	13.2	21	1.50 ± 0.08	[1.30; 1.80]	[0.90; 3.10]	–	
	Urban	20.8	89	1.85 ± 0.12	[1.60; 2.20]	[1.00; 3.90]	0.011	
	Rural	14.2	28	1.65 ± 0.11	[1.40; 1.90]	[1.00; 2.90]	–	
Reduced HDL Cholesterol (HDL-C)	Boys	28.7	98	0.85 ± 0.05	[0.70; 1.00]	[0.45; 1.30]	0.018	≥ 1.03 (boys) / ≥ 1.29 (girls) mmol/L
	Girls	21.5	65	0.95 ± 0.06	[0.80; 1.10]	[0.60; 1.30]	–	
	Urban	30.1	129	0.88 ± 0.05	[0.75; 1.05]	[0.45; 1.30]	0.002	
	Rural	19.2	56	0.92 ± 0.07	[0.78; 1.10]	[0.50; 1.30]	–	
Elevated Total Cholesterol (TC)	Boys	16.3	56	4.60 ± 0.12	[4.20; 5.00]	[3.20; 6.20]	ns / 0.17	< 5.2 mmol/L
	Girls	18.9	57	4.75 ± 0.10	[4.30; 5.10]	[3.40; 6.30]	–	

Note: TG - triglycerides; HDL-C - high-density lipoprotein cholesterol; TC - total cholesterol; ns - non-significant ($p > 0.05$).

In our population, a significantly higher prevalence of reduced HDL cholesterol and elevated triglycerides was observed compared to elevated total cholesterol (Table 1). Reduced HDL-C was recorded in 28.7% of boys and 21.5% of girls ($\chi^2 = 5.56$; $p = 0.018$). The mean HDL-C level among boys was 0.85 ± 0.05 mmol/L, while in girls it was 0.95 ± 0.06 mmol/L, indicating a more pronounced atherogenic dyslipidemia in males. Elevated triglycerides were found in 19.4% of boys and 13.2% of girls ($\chi^2 = 5.39$; $p = 0.021$). The mean TG level among urban adolescents (1.85 ± 0.12 mmol/L) was significantly higher than among rural adolescents (1.65 ± 0.11 mmol/L; $\chi^2 = 6.47$; $p = 0.011$), which may be attributed to higher-calorie diets and lower physical activity.

Elevated total cholesterol was less common, observed in 16.3% of boys and 18.9% of girls ($p = 0.17$), with no significant differences between groups. The mean total cholesterol level remained within the normal range, suggesting that elevated triglycerides and reduced HDL-C are the primary markers of dyslipidemia in this adolescent population. These findings highlight that hypertriglyceridemia and low HDL-C should be considered key targets for early prevention of metabolic risk during adolescence.

Characteristics of Arterial Blood Pressure

Table 2.

Characteristics of Arterial Blood Pressure (n = 2000)

Indicator	Mean ± SE	[25%; 75% Percentile]	[Min; Max]
SBP, mmHg	108.4 ± 12.7	[99; 117]	[78; 148]
DBP, mmHg	68.9 ± 9.3	[61; 76]	[50; 98]

SBP - systolic blood pressure; DBP - diastolic blood pressure.

In the total sample of adolescents (n = 2000), the mean systolic and diastolic blood pressures (Table 2.) were 108.4 ± 12.7 mmHg and 68.9 ± 9.3 mmHg, respectively. Normal BP was observed in 72.3%, prehypertension in 18.7%, and grade 1 hypertension in

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9.0% of participants. Boys had a significantly higher prevalence of elevated BP than girls (22.8% vs. 14.2%; $\chi^2 = 5.83$; $p = 0.016$). Among adolescents with abdominal obesity, hypertension occurred in 28.4%, markedly exceeding rates in peers without obesity ($\chi^2 = 38.2$; $p < 0.001$). Urban adolescents demonstrated higher combined rates of elevated BP and hypertension compared to rural ones (31.2% vs. 23.0%; $\chi^2 = 4.12$; $p = 0.042$). These results highlight that elevated blood pressure is more common among boys, urban residents, and those with abdominal obesity, confirming the influence of lifestyle and environmental factors on adolescent cardiovascular risk.

Table 3.
Distribution by Categories of Arterial Blood Pressure

Blood Pressure Category	Frequency (%)	n	χ^2 / p-value
Normal (<90th percentile)	72.3	1446	-
Prehypertension (90th–95th percentile)	18.7	374	5.83/0.016*
Hypertension, Grade 1 (≥95th percentile)	9.0	180	38.2/0.001*
Combined Elevated BP and Hypertension	-	-	4.12/0.042*

Note: Statistically significant differences were found for combined elevated BP and hypertension when comparing urban (31.2%) and rural (23.0%) adolescents.

The prevalence (Table 3) of prehypertension (18.7%) and grade 1 hypertension (9.0%) is typical for adolescent groups and aligns with previous findings (ESH, 2016; CDC, 2017). A significantly higher frequency of elevated BP was observed among boys ($p = 0.016$) and urban adolescents ($p = 0.042$), reflecting the influence of lifestyle factors such as excessive salt intake, stress, and low physical activity in urban environments. The 28.4% prevalence of hypertension among adolescents with abdominal obesity confirms a strong association between visceral fat accumulation and impaired vascular regulation (IDF, 2007). These results emphasize the importance of regular blood pressure monitoring in adolescents-particularly in those with abdominal obesity-and the need for preventive programs aimed at reducing salt consumption and promoting physical activity to mitigate future cardiovascular risks.

Correlation Analysis

To assess the relationships between anthropometric indicators and blood pressure levels, a correlation analysis was conducted, as presented in Table 4.

Table 4.
Correlation Analysis

Pair	Correlation Coefficient (r)	p-value	Interpretation
BMI and SBP	+0.41	< 0.001	Moderate positive correlation: as BMI increases, systolic blood pressure rises, indicating a strong association between body mass and hypertension risk.
Waist Circumference and DBP	+0.37	0.002	Moderate positive correlation: larger waist circumference is associated with higher diastolic pressure, reflecting the effect of visceral obesity on vascular function.

Note:
BMI - *Body Mass Index*; SBP - *Systolic Blood Pressure*; DBP - *Diastolic Blood Pressure*.

The correlation between BMI and SBP (Table 4.) ($r = +0.41$; $p < 0.001$) indicates that each increase in BMI is associated with a noticeable rise in systolic blood pressure, which aligns with findings from numerous epidemiological studies. Similarly, the correlation between waist circumference and DBP ($r = +0.37$; $p = 0.002$) confirms the relationship between abdominal obesity and diastolic hypertension. These statistically significant associations emphasize the importance of monitoring both general obesity and visceral fat distribution when assessing the risk of arterial hypertension in adolescents. The obtained mean values of SBP (108.4 ± 12.7 mmHg) and DBP (68.9 ± 9.3 mmHg) correspond to normal ranges for adolescents; however, the wide interquartile range suggests considerable variability within the population. The prevalence of prehypertension (18.7%) and stage 1 hypertension (9.0%) is typical for adolescent groups and is consistent with data from other studies (ESH, 2016; CDC, 2017). The significantly higher frequency of elevated blood pressure in boys ($p = 0.016$) and in urban areas ($p = 0.042$) reflects the influence of lifestyle factors such as high salt intake, stress, and low physical activity associated with urban environments. The prevalence of hypertension among adolescents with abdominal obesity (28.4%) confirms the strong link between visceral fat accumulation and vascular dysregulation (IDF, 2007). These results highlight the need for regular blood pressure monitoring in adolescents, particularly those with abdominal obesity, and underscore the importance of preventive programs aimed at reducing salt consumption and increasing physical activity.

DISCUSSION

The results of the present study demonstrate a clear association between abdominal obesity and both lipid and hemodynamic abnormalities in adolescents. The high prevalence of decreased HDL cholesterol (28.7%) and elevated triglycerides (19.4%) compared with total cholesterol disturbances indicates that dyslipidemia in adolescence primarily manifests as an atherogenic profile

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characterized by low HDL-C and hypertriglyceridemia. This pattern reflects early metabolic alterations linked to insulin resistance and endothelial dysfunction, consistent with findings from international studies by Weiss et al. (2019), Lopez-Bermejo et al. (2021), and Ford et al. (2020), which identified HDL-C and TG abnormalities as early markers of metabolic risk in obese youth.

Gender and regional differences further emphasize the role of lifestyle and environmental factors. Boys and urban adolescents demonstrated significantly higher triglyceride levels and lower HDL-C concentrations ($p < 0.05$), likely due to dietary habits rich in saturated fats, reduced physical activity, and increased psychosocial stress associated with urbanization. Similar associations have been described by González-Gross et al. (2022) and Yin et al. (2021), supporting the concept that urban lifestyle patterns exacerbate metabolic risk profiles in developing populations.

Blood pressure indicators also showed substantial variability within the studied population. Mean SBP and DBP values (108.4 ± 12.7 and 68.9 ± 9.3 mmHg, respectively) were within normal ranges for adolescents; however, the prevalence of prehypertension (18.7%) and stage 1 hypertension (9.0%) reflects an increasing trend of early hemodynamic stress. The frequency of elevated BP was significantly higher among boys ($p = 0.016$) and urban adolescents ($p = 0.042$), consistent with data from the European Society of Hypertension (ESH, 2016) and the Centers for Disease Control and Prevention (CDC, 2017), which identify sex and urbanization as key determinants of hypertension risk in youth.

Correlation analysis revealed moderate positive relationships between BMI and systolic BP ($r = +0.41$; $p < 0.001$) and between waist circumference and diastolic BP ($r = +0.37$; $p = 0.002$), confirming the impact of both general and visceral obesity on blood pressure regulation. These findings align with those of Kelishadi et al. (2019) and Nguyen et al. (2022), who demonstrated that even modest increases in BMI and waist circumference are associated with elevated cardiovascular load and sympathetic activation in adolescents.

Taken together, the study results confirm that abdominal obesity represents a central factor linking dyslipidemia and hypertension in adolescence. The observed associations underscore the urgent need for integrated preventive programs focused on lifestyle modification-particularly dietary correction, regular physical activity, and psychosocial support-to reduce future cardiovascular and metabolic disease risk. Early screening for lipid profile and blood pressure abnormalities in school-age populations should be considered a strategic priority, as recommended by the World Health Organization (WHO, 2022) and the International Diabetes Federation (IDF, 2023).

CONCLUSION

Abdominal obesity in adolescents is closely associated with early manifestations of metabolic and hemodynamic dysfunction. The most frequent abnormalities included decreased HDL cholesterol and elevated triglycerides, indicating the predominance of an atherogenic lipid profile. Elevated blood pressure was observed significantly more often in boys ($p = 0.016$) and in urban adolescents ($p = 0.042$), reflecting the influence of lifestyle factors such as high salt intake, stress, and low physical activity. The correlation between BMI and systolic blood pressure ($r = +0.41$; $p < 0.001$) and between waist circumference and diastolic blood pressure ($r = +0.37$; $p = 0.002$) confirms the contribution of both general and visceral obesity to the development of hypertension. These findings highlight the need for early detection and correction of metabolic risk factors through regular screening, nutritional education, and promotion of physical activity, particularly in urban adolescent populations. Preventive strategies targeting weight management, lipid normalization, and blood pressure control are essential for reducing long-term cardiovascular and metabolic disease risks.

LITERATURE

1. *Elmaoğulları, S. (2015). Prevalence of dyslipidemia and associated factors in obese children and adolescents. Journal of Clinical Research in Pediatric Endocrinology, 7(3), 147-153. https://doi.org/10.4274/jcrpe.1867*
2. *Zeljkovic, A. (2024). Obesity and dyslipidemia in early life: Impact on long-term cardiometabolic health. Metabolism, S0026-0495(24)00146-X. https://doi.org/10.1016/j.metabol.2024.00146-X*
3. *Kim, E. Y. (2022). Clinical and diagnostic importance of dyslipidemia in children and adolescents. Clinical and Experimental Pediatrics, 65(6), 254-262. https://doi.org/10.3345/cep.2021.01851*
4. *Baran, R., et al. (2025). Lipid profile, obesity indicators and cardiometabolic risk factors in school-aged children and adolescents: Sex-specific associations. Journal of Clinical Medicine, 14(18), 6677. https://doi.org/10.3390/jcm14186677*
5. *Rahman, S. A., Hossain, M., & Begum, S. (2018). Dyslipidemia in childhood obesity: A review. Bangladesh Journal of Child Health, 42(3), 148-154. https://doi.org/10.3329/bjch.v42i3.39270*
6. *Jeong, S. I., & Kim, S. H. (2024). Obesity and hypertension in children and adolescents. Clinical Hypertension, 30, Article 23. https://doi.org/10.1186/s40885-024-00278-5*