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Monitoring of anthropometric parameters of 16-18 Year Olds

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Abstract: The development of health and performance-related physical fitness components during the early stages of life has an important impact on maintaining a sustainable level of physical fitness and improving health outcomes in the future, according to many studies. This study aims to analyze anthropometric parameters and physical activity levels in Albanian adolescents aged 16-18 years, making a comparison between urban and rural areas. Physical activity during this period of life is essential for physical and psychological well-being, as well as for the development of executive and cognitive functions. The study included 1,147 students from different schools in Albania and relied on mixed research methods, combining quantitative and qualitative analyses. Anthropometric measurements were performed according to international standards, including height, weight, and body mass index (BMI). The results show that 68.2% of the participants had a normal BMI, while the prevalence of underweight was higher in rural areas (20.6%) than in urban areas (16.8%). Meanwhile, overweight and obesity were more prevalent in urban areas. The findings suggest the need for policies focused on promoting physical activity and health education in both areas to ensure healthy youth development.

Keywords: *BMI, Rural Areas, Urban areas, Youth.*

1. Introduction

The development of health- and performance-related components of physical fitness during early life has a significant impact on maintaining a sustainable level of physical fitness and improving health outcomes in the future according to Ried-Larsen, et al. [1]. This is particularly important during adolescence, a critical period for body and behavioral development. During this period, individuals undergo major physiological changes, such as changes in body composition, as well as transformations in attitudes towards fitness, physical activity, and eating habits. Adolescence is also associated with changes in physical activity levels and sedentary behavior, which can have a major impact on the overall health and physical capabilities of individuals throughout life [2]. These periods of change are key opportunities to improve healthy habits and create a sustainable foundation for a healthy and active life. Physical activity in youth favors brain development and cognitive functioning according to Donnelly, et al. [3] and Tomporowski, et al. [4] especially executive functions [5, 6]. In children and adolescents, moderate-to-vigorous intensity physical activity is positively associated with task-related memory and reaction time, executive attention, cognitive flexibility and planning [7-11]. Furthermore, healthier body mass and body mass index are associated with improved general cognitive performance, and executive and cognitive functions in young adults of this age according to Li, et al. [12]. Studies and

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data on the prevalence of overweight and underweight, body composition and health-related fitness components in adolescents are essential for the creation of effective public health strategies and the development of appropriate physical activity programs. Socio-economic factors within a country account for the differences between rural and urban areas, as living in areas with different population densities can influence eating habits according to Mayen, et al. [13] access to sports facilities [14, 15] opportunities for physical activity, and consequently physical fitness and body composition. However, research focusing on physical fitness and physical activity comparing young people in urban and rural areas led to inconsistent results in the study by Chillon, et al. [16]. Health-related physical activity is strongly influenced by anthropometric characteristics such as BMI and body composition. Studies by Hyska, et al. [17] and Martinovic, et al. [18] show that the prevalence of overweight and obesity in the neighboring countries in the Western Balkans is increasing with negative consequences on health-related fitness parameters, but these data are lacking for Albanian young people aged 16-18. Therefore, the current study aimed to provide the first data on the components of anthropometric parameters, obesity and the involvement of young people aged 16-18 in sports and recreational activities. Data on young people in rural versus urban residential areas were also analyzed to have a clearer picture of the current situation in the country. In this way, the study aims to contribute to the further understanding of the factors that influence the health and physical performance of young people, as well as to provide recommendations for strategies that can improve their physical and psychological well-being.

2. Research Methodology

The research method will be mixed, including quantitative and qualitative methods to provide a comprehensive understanding of the topic. For this study, several schools from different cities in Albania were selected, including all four Regional Educational Directorates. The experimental results will aim to build a "framework" for analyzing data for young people, which will provide understandable and logical projection and "feedback" from the databases. The target group of this study is 1147 students aged 16-18 years,

Data analysis through techniques based on regression analysis by examining the correlation between physical activity variables and indicators for the well-being of young people in developed countries. Anthropometric and physical fitness parameters were determined from a total of 1147 adolescents (967 urban area, and 180 rural area) who volunteered to participate in this study.

The study was approved by the Ethics Committee of the University of Sports of Tirana and all procedures were carried out in accordance with the ethical standards of the Declaration of Helsinki revised in 2013 [19]. Permission for the use and publication of these data was obtained from the Commissioner for the Right to Information and Protection of Personal Data in the Republic of Albania, and for the measurements to be carried out in school sports facilities, permission was also obtained from the Ministry of Education and Sports, which authorized school directors/administrators to join the study group. Written informed consent was obtained from students and parents after a detailed explanation of the testing procedures.

The data collection structure was organized in several schools in different cities of the country, focusing on urban and rural areas, and all measurements were performed uniformly with respect to the testing order by the same research group throughout the data collection period in September-October 2024. Anthropometric measurements were carried out according to the International Standards for Anthropometric Assessment [20]. Participant height was measured to the nearest 0.5 cm using the standing-length method with a portable stadiometer and body mass was measured to the nearest 0.1 kg using a digital scale with participants wearing light sports clothing, without shoes.

Body mass index (BMI) was determined from height and weight measurements using the accepted method (BMI = body mass divided by the square of height expressed in $kg.m^{-2}$), and participants were classified as underweight, normal weight, overweight, and obese using age- and sex-specific cutoff points presented by Cole, et al. [21]. Overweight, obese, underweight, and normal weight students were combined in the final analyses.

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3. Results

In this section, the main results of the study are presented, focusing on the statistical analysis of the collected data. The results are presented through tables and graphs, which illustrate the relationships and distributions between the main study variables. The analysis aims to provide a clear and understandable overview of the main trends and differences, supporting the interpretation of the findings and reaching final conclusions.

Table 1 presents a cross-sectional analysis of the distribution of individuals by gender (female and male) and their location (urban or rural area). It includes the total number of individuals, the percentages within each gender category and area, as well as the percentages in relation to the total. This provides an overview of the gender and geographical composition of the population.

Table 1.
Distribution by gender and urban/Rural area.

Gender* urban/Rural area crosstabulation					
			Area urban/Rural		
			Rural	**Urban**	**Total**
Gender	Female	Count	87	492	579
		% within gender	15.0%	85.0%	100.0%
		% within area urban/rural	48.3%	50.9%	50.5%
		% of Total	7.6%	42.9%	50.5%
	Male	Count	93	475	568
		% within gender	16.4%	83.6%	100.0%
		% within area urban/rural	51.7%	49.1%	49.5%
		% of Total	8.1%	41.4%	49.5%
Total		Count	180	967	1147
		% within gender	15.7%	84.3%	100.0%
		% within Area urban/rural	100.0%	100.0%	100.0%
		% of Total	15.7%	84.3%	100.0%

The following Descriptive Statistics table presents key information on the demographic and anthropometric characteristics of the sample of 1147 individuals, including age, height, weight, and body mass index (BMI). For each variable, the minimum and maximum values, mean, and standard deviation are shown, providing a summary of the data distribution. The mean age is 16.38 years, the mean height is 170.69 cm, the mean weight is 62.89 kg, and the mean BMI is 21.5, reflecting a relatively homogeneous group with respect to these parameters.

Table 2.
Sample descriptive statistics of demographic and anthropometric characteristics.

Descriptive statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. deviation**
Gender	1147	13	19	16.38	.842
Height	1147	122	203	170.69	9.072
Weight	1147	36.0	112.0	62.892	12.545
BMI	1147	14.60	38.200	21.500	3.480
Valid N (Listwise)	1147				

Figure 1 presents the distribution of individuals by body mass index (BMI) categories. The categories include: normal (blue, 68.27%), overweight (green, 11.94%), underweight (orange, 17.35%), and obese (red, 2.44%). This visualization helps identify the percentage of each category within the studied sample, indicating that the majority of individuals have a normal BMI, while a smaller proportion are overweight, underweight, or obese.

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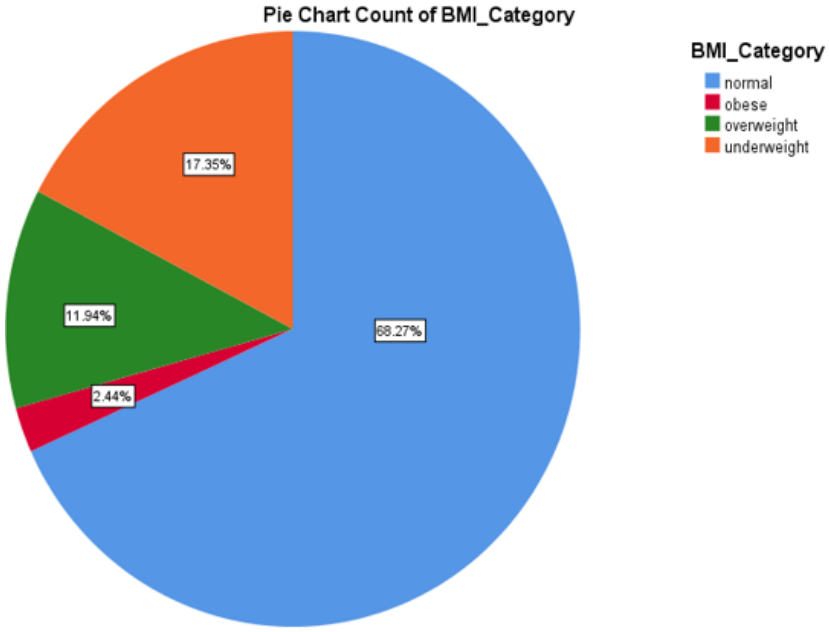

Figure 1.
Distribution of youth by body mass index (BMI) categories.

Table three presents the distribution of individuals by body mass index (BMI) categories in urban and rural areas. It shows the number of cases and percentages for each BMI category (normal, obese, overweight and underweight) within each area. From the data, it is observed that most individuals have a normal BMI in both areas, but the percentage of underweight individuals is higher in rural areas (20.6%) compared to urban areas (16.8%). Also, obesity is more prevalent in urban areas (2.6%) than in rural areas (1.7%). This analysis helps in understanding the differences between geographical areas regarding the body composition of individuals.

Table 3.
Distribution of BMI categories by urban and rural areas.

Area urban/Rural * BMI_category crosstabulation

			Bmi_category				
			Normal	**Obese**	**Overweight**	**Underweight**	**Total**
	Rural	Count	125	3	15	37	180
		% within area urban/Rural	69.4%	1.7%	8.3%	20.6%	100.0%
		% within BMI_category	16.0%	10.7%	10.9%	18.6%	15.7%
		% of Total	10.9%	0.3%	1.3%	3.2%	15.7%
	Urban	Count	651	25	122	162	967
		% within area urbane/Rural	68.0%	2.6%	12.6%	16.8%	100.0%
		% within BMI_category	84.0%	89.3%	89.1%	81.4%	84.2%
		% of Total	57.3%	2.2%	10.6%	14.1%	84.2%
Total		Count	781	28	137	199	1148
		% within area urban/Rural	68.2%	2.4%	11.9%	17.3%	100.0%
		% within BMI_category	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	67.2%	2.4%	11.9%	17.3%	100.0%

The boxplot below shows the distribution of BMI values in the sample studied. The blue box represents the interquartile range (IQR), which includes 50% of the BMI data, while the horizontal lines inside the box indicate the median. The vertical lines ("whiskers") extend to the lowest and highest

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values that are not considered extreme values. The points scattered above the upper limit represent extreme or exceptionally high values (outliers), which are individuals with BMIs much higher than the rest of the sample. This plot helps identify the distribution, variation, and anomalies in BMI data.

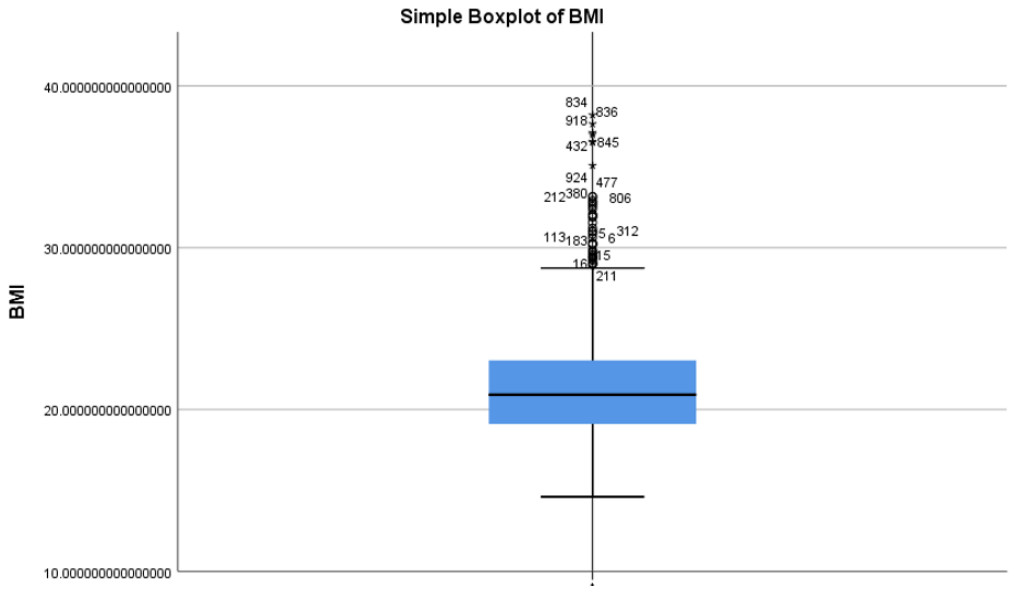

Figure 2.
Body mass index (BMI) boxplot.

4. Discussion

The main results of the study conducted on a sample of 1147 individuals provide a clear and detailed overview of the demographic, anthropometric and body mass index (BMI) distribution, through tables, graphs and comparisons. In the detailed analysis of the distribution of young people by gender and urban/rural area, we can observe some important trends and characteristics for the studied group. The total percentage of young people in rural areas is 15.7% of the population, while in urban areas it is 84.3%. This large differentiation in distribution reflects a common phenomenon, where the urban population is significantly larger than the rural one. This trend is evident in many Balkan countries and the European Union, where urbanization has marked rapid growth and has attracted a large number of individuals from rural areas to cities.

In the graph of the distribution of individuals by Body Mass Index (BMI) categories, the largest category is that of "Normal" with 68.27%, indicating that the majority of the young people studied are within the healthy BMI range. This is a positive sign, as it suggests that the majority of the population has a balanced and healthy body composition, which is essential for maintaining good health and preventing weight-related diseases. However, it is important to note that 17.35% of young people are classified as underweight, a group that is quite large and that may constitute a health concern. Underweight can be associated with a number of health problems, such as muscle weakness, poor immunity, and chronic fatigue. This is an area where emphasis should be placed, as young people who are underweight may need help to gain weight and prevent potential health consequences. Also, 11.94% of young people are classified as overweight. This percentage is significant and indicates that a significant number of these young people may be at risk of developing weight-related diseases, such as cardiovascular disease and type 2 diabetes. This group should receive the necessary attention, promoting healthy interventions to manage weight, such as a balanced lifestyle and physical activity.

In all four of these categories, the percentage of young people who are obese is 2.44%, which is a relatively low percentage. This can be considered positive, as obesity is a significant risk factor for a

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number of serious diseases, including heart problems, hypertension and metabolic disorders. However, despite the low percentage of obesity, it should not be ignored, as the long-term impacts of obesity can have serious health consequences. This BMI distribution shows that the majority of young student are in a healthy state, but there is also a significant number of young people who are either underweight or overweight, who may need support to maintain or achieve a healthy weight. Raising awareness and promoting a healthy lifestyle that includes a balanced diet and physical activity is key to preventing weight-related problems in the future.

5. Conclusion and Recommendation

This study provides a clear picture of the physical characteristics and distribution of body mass index in young people, highlighting differences between genders and different areas of residence. The data show that the majority of young people are within the limits of a healthy weight, but some of them face challenges such as being underweight or overweight, which can have long-term impacts on their health. These findings highlight the importance of raising awareness and promoting a healthy lifestyle to prevent weight-related problems and ensure the overall well-being of young people. One of the most important steps is their involvement in physical activities in schools and the organization of sports programs that encourage students to have an active lifestyle, also within the framework of the School Sports movement, funded by the Albanian Government. In addition, schools should provide education on healthy nutrition through specific modules, making young people more aware of the impact that diet has on their health. Also, organizing awareness campaigns in collaboration with health specialists would help inform students about the importance of maintaining a healthy weight and preventing related problems. On the other hand, young people should be aware of the importance of an active lifestyle. Engaging in sports or regular physical activities is one of the best ways to maintain health and build good habits that will accompany them throughout their lives.

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Institutional Review Board Statement:

This study has obtained approval from the Ethical Committee of the Sports University of Tirana (Ref. No. 1786, dated 08.07.24), the Ministry of Education and Sports (Ref. No. 5004/1, dated 18.09.24), and the Commissioner for the Right to Information and Protection of Personal Data (Ref. No. 1747/1, dated 23.07.24, have given their approval for the conduct of this study.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no essential features of the study have been omitted; and that any deviations from the study as planned have been explained. This study followed all ethical practices during its writing.

Competing Interests:

The authors declare that they have no competing interests.

Authors' Contributions:

All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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