PHYSICAL EDUCATION OF STUDENTS

ORIGINAL ARTICLE

Trends regarding the living environment and body composition among university students

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Abstract

Background and Study Aim: The increasing reliance on technology for daily activities has led to a significant reduction in physical activity, especially among university students. This trend is driven by a desire to avoid perceived "stress" and to achieve goals more easily. As a result, there has been a rise in the number of overweight students. The sedentary lifestyle associated with excessive technology use poses a serious threat to students' health. It leads to unfavorable changes in body composition. The purpose of this research is to explore the relationship between body composition and the living environment among female students, specifically examining differences between those from rural and urban areas.

Material and Methods: A total of 144 first-year female students from non-sports faculties participated in this study, including 66 from rural areas and 78 from urban areas. The research logistics involved the use of the Tanita BC 1000 Body Composition Analyzer and GMON software. The following body composition parameters were measured: weight, BMI, fat level (expressed in % and kg), bone mass, body water (%), and metabolic age. Additionally, the height of the subjects was measured to calculate the body mass index.

Results: The analysis reveals that although urban students are, on average, older than their rural counterparts (22.6 years vs. 19.7 years, $z = 3.50$, $p < 0.001$), there are no significant differences between the groups in terms of height ($z = 0.47$, $p > 0.05$), weight ($z = 0.31$, $p > 0.05$), or BMI ($z = 0.35$, $p > 0.05$). The greatest consistency in measurements was observed in height among rural students, while the most variability was found in fat mass. The largest discrepancy between the groups was in weight, with rural students generally being heavier.

Conclusions: The results of this study show that the living environment does not have a significant impact on body composition dynamics. Both rural and urban groups displayed nearly identical average values for most indicators. This suggests that other factors may have a stronger influence on body composition.

Keywords: body analysis, female students, health, life quality.

Introduction

Modern society offers more opportunities for "smart" leisure time compared to the past. Many activities now have technological support, allowing for faster access to information and the ability to complete tasks with less effort and greater efficiency. However, this trend toward minimizing physical effort in daily activities has negative repercussions on human health and body composition. Frequently, the physical activity that was once necessary is now replaced by technology to avoid feeling "stressed" and to make it easier to achieve goals.

Obviously, the student population is among the most engaged in the technology trend, using it extensively for socialization and leisure. The negative effects of this trend are evident in the growing number of overweight students who have adopted lifestyles that negatively impact their body composition. This behavior reflects a superficial approach to health, where many students are content with having a place to stay and money for daily expenses [1].

An increase in the body mass index (BMI) among students has been reported [1]. This increase can be attributed to various factors related to the transition to a new living environment. These factors include leaving home to attend university [2], moving away

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from the family environment, starting work [3], and gaining increased autonomy in decision-making [4]. One of the most significant threats in daily living behavior is the combination of a technological, sedentary lifestyle with a high-fat diet. These behaviors are largely a result of industrial and urban changes in many countries [5]. Continuous economic changes in society are closely linked to shifts in nutritional habits, which, in turn, can impact body composition and serve as predictors for increased health risks [6, 7].

Previous studies have highlighted the close connection between body composition components (such as height, weight, fat level, bone mass, metabolic age, and body water) and nutritional status [8]. The relationship between body composition and bone mineral density has also been explored [9]. Body weight influences bone growth and density, making it a significant risk factor, alongside age, for vertebral and hip fractures [10]. High-energy diets and reduced energy expenditure due to a sedentary lifestyle are factors associated with obesity. Recently, weight gain and the increasing prevalence of overweight and obesity among university students have become a growing concern for the health system [11].

Researchers studying the relationship between body composition, particularly obesity, and environmental lifestyle influences have found a link between the physical environment and daily food habits [12]. It was observed that people living near supermarkets had greater fruit and vegetable consumption, while those in areas with many fast-food outlets and restaurants tended to have higher body weight [13, 14, 15,16]. Additionally, it was noted that individuals with more opportunities for walking, jogging, and physical activities are influenced by the availability of environmental facilities [17, 18, 19]. In a study relevant to our research, the authors highlighted how 6-week endurance and strength training programs led to changes in body circumferences and composition. The physical fitness of female students improved significantly. The experiment demonstrated that even a small amount of planned physical activity can lead to significant changes in young women's bodies. When combined with other elements of a healthy lifestyle, such as a proper diet, these benefits may be multiplied [20].

Purpose of the Study. The purpose of this study was to determine whether body composition is related to the living environment among female students by comparing subjects from rural and urban areas. It was hypothesized that due to higher levels of physical activity, the body composition of students from rural areas would reflect a more active profile in the analyzed parameters.

Materials and Methods

Participants

This study involved 144 female students, with 66 from rural areas and 78 from urban areas. The average age of the rural participants was 20 years (±2.26 years), while the urban participants had an average age of 23 years (±7.57 years). All participants were first-year students studying in various fields, excluding sports-related disciplines. Each participant was involved in the measurements only once. They were thoroughly informed about the purpose, nature, practical details, and potential risks of the experiment, as well as their right to withdraw at any time. Written consent was obtained voluntarily from all participants, in accordance with the Declaration of Helsinki and with the approval of the Ethics Committee of the Doctoral School of Sports Science and Physical Education at the University Center of Pitești, Romania (ID: 13/16.02.2024)

Research Design

The Tanita BC 1000 Body Composition Analyzer, which operates using bioelectrical impedance analysis (BIA) technology, and the GMON software were employed to assess body composition parameters. BIA has increasingly been used as a tool for investigating body composition across various fields, including medical, social, and sports contexts [21]. One of the key features of this technology is its sensitivity during body scanning, which allows for detailed distribution analysis of body composition components [22]. Additionally, BIA technology has proven effective in highlighting correlations between body fat, visceral fat, skeletal muscle, subcutaneous fat, and BMI among college students [23]. These tools facilitated the specific measurements and the systematic collection of data in a dedicated archive.

The following body composition parameters were measured: weight, BMI, fat level (expressed in % and kg), bone mass, body water (%), and metabolic age. Additionally, the height of the subjects was measured to calculate the body mass index. For the BIA measurements, subjects stood barefoot on the platform without any metal objects or wristwatches. Height was measured using a wall-mounted stadiometer, with subjects standing upright and barefoot.

Statistical Analysis

Statistical indicators, including mean and standard deviation, were calculated using the KyPlot 6.0 program (©1997-2020, KyensLab Inc). The nonparametric Kruskal-Wallis test was applied to determine differences in means between several irregular samples. Statistical significance was set at $p < 0.05$.

Results

The GMON software enabled the direct transfer of data to a PC, where a database was created to store all the measurement results. The data were then exported to an Excel workbook, where the values from the two living areas were consolidated and compared (Table 1).

From the data presented in the table above, it can be observed that most parameters exhibit a linear trend in their averages. The average age is significantly higher in the urban environment (22.6 years) compared to the rural environment (19.7 years, $z = 3.50$, $p < 0.001$). The height averages are very close between the two groups (163.9 cm in rural areas vs. 164.5 cm in urban areas), with no significant difference ($z = 0.47$, $p > 0.05$). The average weight is also similar between the groups (58.3 kg in rural areas vs. 57.9 kg in urban areas), with no significant difference ($z = 0.31$, $p > 0.05$). Body fat percentage (24.1% in rural areas vs. 24.4% in urban areas) and fat mass (15.1 kg in rural areas vs. 14.9 kg in urban areas) are likewise similar, with no significant differences ($z = 0.12$, $p > 0.05$; $z = 0.03$, $p > 0.05$). The Body Mass Index (21.4 kg/m²) shows no significant difference between the groups ($z = 0.35$, $p > 0.05$). Bone mass (2.21 kg in rural areas vs. 2.17 kg in urban areas) and metabolic age (19.2 years in rural areas vs. 20.3 years in urban areas) also show no significant differences ($z = 1.16$, $p > 0.05$; $z = 0.76$, $p > 0.05$). Finally, the percentage of body water is similar between the groups (51.6% in rural areas vs. 44.8% in urban areas), with no significant difference ($z = 0.41$, $p > 0.05$).

Regarding the homogeneity of the dynamics of each parameter (Figure 1), it was observed that the best coefficient of variability was recorded for height among rural students compared to those from urban areas (3.86% vs. 4.23%). Conversely, the worst homogeneity was noted in the fat mass level, with both groups showing significant variability, particularly among rural students (58% vs. 53.04%).

Concerning the differences between the minimum and maximum values of the parameters (Figure 2), the largest gap was observed in weight for both groups (57 kg in rural areas vs. 51 kg in urban areas). The smallest difference was recorded in bone

Table 1. The results of the measurements in students of rural living environment

Parameters	Mean ±SD		Cv (%)		Min.		Max.		z	P
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban		
Age (years)	19.7 ±2.26	22.6 ±7.57	11.42	33.49	18	19	35	51	3.50	<0.001
Height (cm)	163.9 ±6.32	164.5 ±6.96	3.86	4.23	150	143	178	184	0.47	>0.05
Weight (kg)	58.3 ±12.04	57.9 ±11.07	20.61	19.13	39	42	96	93	0.31	>0.05
FATP (%)	24.1 ±9.22	24.4 ±8.2	38.17	33.58	5	10	46	44	0.12	>0.05
FATM (kg)	15.1 ±8.78	14.9 ±7.94	58.00	53.04	2	4	44	41	0.03	>0.05
BMI (kg/m²)	21.4 ±4.19	21.4 ±3.89	19.26	18.19	12	15	43	38	0.35	>0.05
BONEM (kg)	2.21 ±0.18	2.17 ±0.22	8.19	10.08	2	1	3	3	1.16	>0.05
METAAGE (years)	19.2 ±9.56	20.3 ±11.36	49.88	55.82	12	12	62	62	0.76	>0.05
WATERP (%)	51.6 ±5.92	44.8 ±5.23	11.14	9.9	39	40	67	61	0.41	>0.05

Note. FATP (%) / FATM (Kg) - level of fat; BMI (kg/m²) - body mass index; BONEM (kg) – bone mass; METAAGE (years) – metabolic age; WATERP (%) – body water; z - Wilcoxon Rank Sum Test (Mann-Whitney U Test) for Unpaired Data.

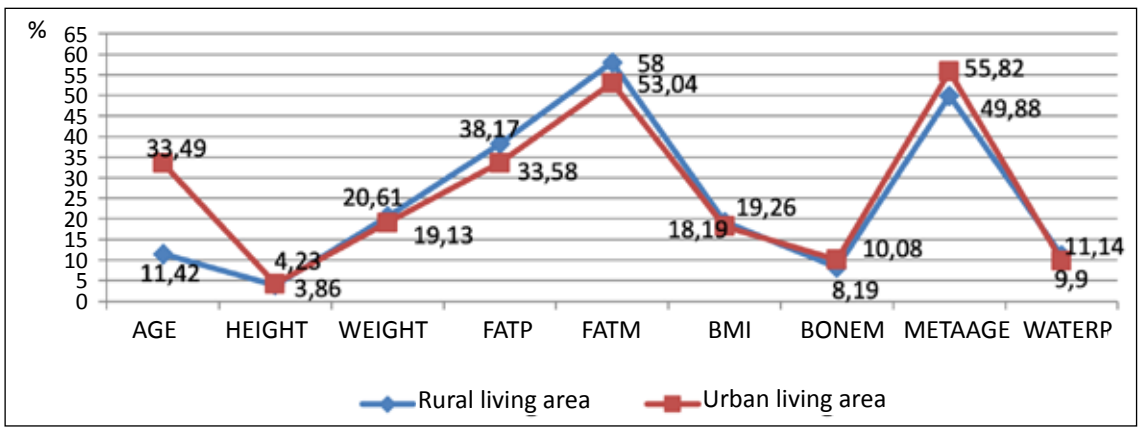

Figure 1. Dynamics of the homogeneity of parameters

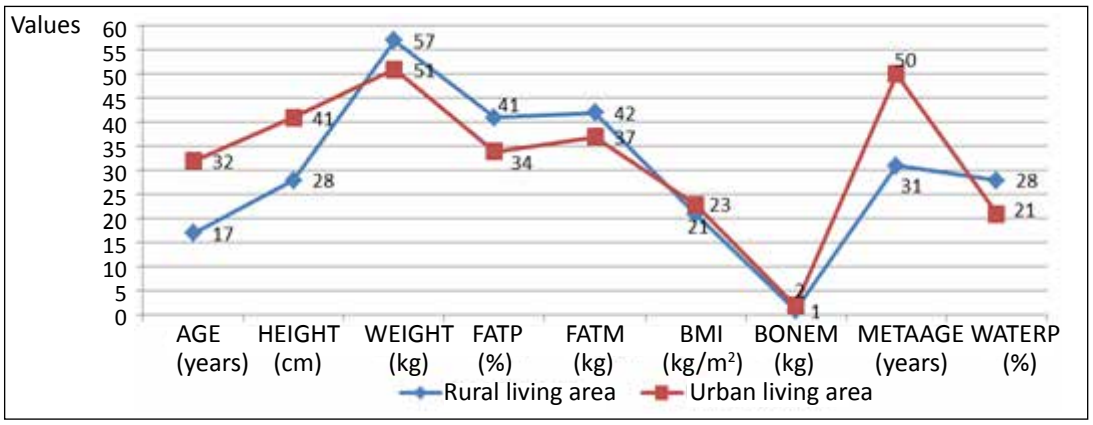

Figure 2. Dynamics of the minimum and maximum of parameters

mass (1 kg in rural areas vs. 2 kg in urban areas).

It is challenging to determine an ideal pattern of body composition parameters, especially among females from different living areas with varied lifestyles. However, based on the conducted measurements and expert findings over the years, it was observed that both groups had average body fat values within the healthy adult range (according to the age limits of 18-39 years). Regarding BMI, both groups recorded average results within the normal weight range (18.5 kg/m² - 24.9 kg/m²). As for metabolic age, the results showed that both groups had a younger metabolic age compared to their chronological age, as indicated by the averages. The body water data revealed that students in both living areas had values within the normal range (45% - 60%). However, the bone mass averages for all students were below the reference limits (2 kg compared to the reference value of 2.4 kg) for their body weight range (50 kg - 75 kg).

Discussions

The study aimed to identify the relationship between body composition and the origin of students from rural and urban areas. It was hypothesized that higher activity levels in rural areas would result in a more active body profile. This discussion compares the study's findings with previous research and explores possible explanations for the results. The hypothesis that rural students would have a more active body profile due to higher physical activity was not fully confirmed. Although the urban subjects were significantly older than the rural ones, other parameters, including BMI, body fat percentage, fat mass, and bone mass, showed no significant differences between the groups.

The results indicate that, despite a significant age difference of 2.9 years between rural and urban students ($p < 0.001$), other body composition parameters do not differ significantly between the two groups ($p > 0.05$), except for fat mass homogeneity, which showed greater variability in the rural group. The study suggests that, although identifying an ideal body composition model is challenging, the data show that the average body fat and BMI values are within healthy limits for both groups, and the metabolic age is lower than the chronological age. However, the average bone mass is below reference values, highlighting the need for increased attention to bone density, as emphasized in the specialized literature [24, 25].

Our study underscores the significance of the first university semester as a critical period for weight changes and fat accumulation among students, highlighting the influence of behavioral and environmental factors such as gender, dietary habits, and place of residence. Previous research has identified this period as crucial for evaluating and addressing obesity risks. Deliens et al. [26] noted that the early university years are associated with significant changes in body composition, driven by dietary habits, lifestyle, and students' living environments. Our findings support this, indicating that living on campus may particularly contribute to greater weight gain [26]. Dong et al. [27] reported a general decline in physical fitness in China between 1985 and 2014, with a more pronounced trend among boys and obese individuals. This emphasizes the need for integrated health policies that address both malnutrition and obesity and promote physical activity and a varied diet, especially in the context of urbanization [27].

Another study notes that a sedentary lifestyle among university students contributes to weight gain [28]. The authors observed that students who frequently use computers, whether for the Internet or computer games, spend more than 4 hours a day on these activities. Among first-year students, 33% of boys and 16% of girls spend more than 2 hours a day playing computer games. The study by Marchenko et al. [29] focused on the characteristics of body composition among students. The authors concluded that the internal proportions of body composition in students pursuing different sports specializations show significant variation. For example, those involved in swimming displayed a very low contribution

of the adiposity factor. Bodybuilders exhibited an extremely low contribution of the length factor. Students practicing soccer and volleyball showed a low importance of both the length factor and the adiposity factor. Other studies also confirm the relationship between students' body parameters and their level of physical activity [30, 31, 32, 33].

These findings align with our results, which also highlighted the complexity of body composition and its relation to lifestyle factors. While our study did not show significant differences in body composition between rural and urban students, the influence of physical activity and lifestyle habits, such as sedentary behavior, clearly plays a crucial role in shaping these parameters.

Beaudry et al. [34] highlighted that during the first year of university, both men and women experience unfavorable changes in diet and body composition, with men showing more pronounced changes, including significant increases in weight and fat mass. This finding suggests the need for gender-specific interventions to improve dietary habits and health during this transitional period [34]. Kalka et al. [35] observed that over the past 50 years, university students have become taller and heavier, with a notable increase in body fat percentage. This trend was particularly evident among students of technical universities, indicating that while economic and systemic changes have positively influenced physical development, they have also been accompanied by increases in body fat [35].

Other studies [36, 37] have emphasized the importance of developing explosive strength in the trunk and arm muscles to improve sports performance. Their results suggest that incorporating specific exercises into physical education programs could enhance students' athletic performance.

Kyrkou et al. [38] revealed improvements in the dietary habits of university students, particularly with increased consumption of plant-based foods, and noted significant gender effects on BMI and dietary attitudes. These changes are likely influenced by economic constraints and greater nutritional awareness, highlighting the need for targeted nutritional education strategies [38]. This approach and its results have also been observed in other studies [39, 49, 41, 42].

Lotrean et al. [43] found that between 2003 and 2016, dietary patterns and weight-related behaviors among Romanian students remained stable, with some behaviors either protecting against overweight and promoting physical activity or being linked to frequent fast-food consumption and higher BMI [43]. Kriaucioniene et al. [44] reported a significant increase in the prevalence of self-reported overweight between 2000 and 2017, particularly among men. Although dietary habits improved, with increases in fruit and vegetable consumption and decreases in red meat intake, gender differences in weight perception and management were observed [44].

Warwick and Reid [45] showed that between 1988 and 2003, the prevalence of overweight increased, accompanied by significant rises in body mass and protein and carbohydrate consumption, without notable changes in physical activity. Müller et al. [46] found that fitness test performance among 14-18 year-old boys is influenced by body composition, with disadvantages for those who are overweight and advantages for those with lower weight in certain tests. This finding underscores the importance of maintaining an optimal BMI for improving physical performance. Data analysis from Wesley College revealed that 29.5% of students were overweight and 19.8% were obese, with significantly higher average BMIs among men and those living on campus. Observance of USDA recommendations on fruit and dairy intake was identified as an important factor in reducing obesity risk, highlighting the importance of a balanced diet in weight management [47]. Although it was anticipated that the rural environment would favor a more active body profile, the results did not significantly confirm this hypothesis. Instead, they highlighted the complexity of the relationship between living environment and body composition, underscoring the need for further research to clarify the determining factors.

Conclusions

In conclusion, the data obtained in the current research provided information showing that, in this case, the living environment did not have any significant influence on the body composition dynamics, as both groups had almost the same averages in most of the parameters. Therefore, the hypothesis of this paper was not confirmed, the body composition profile of the rural students being similar to the urban ones. Two main reasons could explain such results. First, however, most of the students in the rural areas admitted that they have everyday house or yard activities which are moderate activities. Second, some urban students declared that they practice different types of sports as leisure activities or they keep different kinds of diet which may represent the cause of the values that were recorded.

So, it is possible to say that the similarities between the students of the two living environments are influenced by the lifestyle of each group. It should be noticed that, being first-year students, they still have good habits learned from their families. Future studies with this kind of approach are needed to determine if these students will maintain the dynamics of body composition in a similar trend or if they will be affected by the particularities of the student life. Further studies are also needed to verify if the practice of lower intensity activities in

rural subjects and leisure activities in urban subjects are responsible for the lack of results on body composition parameters.

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Conflict of interest

There are no conflicts of interest to declare.

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