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Research article

A Cross-Sectional Study of Body Composition and Cardiorespiratory Fitness: Insights from Romanian Physical Education Male Students and Non-Professionals

Mădălina-Gabriela Coman [1,2], Alina Maria Stan[1,2,†], Andreea Maria Adam [1,2,†], Carmen Gheorghe [2,†], Carmen Pârvu [1,2,†], Corneliu Mircea Codreanu[1,2,†], Liviu Moraru[3,*], Daniel-Andrei Iordan [1,2,*] and Ilie Onu [2,4]

1 Faculty of Physical Education and Sport, "Dunarea de Jos" University of Galati, Romania;
2 Research Centre for Physical Therapy and Rehabilitation, "Dunărea de Jos" University of Galati, 800008 Galati, Romania;
3 UMFST "G.E. Palade" Tâ̆rgu-Mureș, Romania;
4 Department of Biomedical Sciences, Faculty of Medical Bioengineering, University of Medicine and Pharmacy "Grigore T. Popa" Iasi, 700454 Iasi, Romania.
† These authors contributed equally to this work.

* Correspondence: liviu.moraru@umfst.ro; daniel.iordan@ugal.ro;

Abstract: Obesity is a growing global public health issue linked to reduced life expectancy. While genetic predisposition, physical activity, demographic factors, and energy intake are recognized as key contributors, the specific determinants of overweight remain de-bated. This study examines body composition and cardiovascular capacity differences among university students at "Dunărea de Jos" University of Galați, comparing students from the Faculty of Non-Professional Studies (MSNP, n=116) and the Faculty of Physical Education and Sport (MSPE, n=51). Body composition was assessed using the InBody 720 (Biospace, Ko-rea), analyzing total body water, intracellular and extracellular water, protein, minerals, body fat mass (BFM), skeletal muscle mass, body fat percentage (PBF), BMI, waist-hip ratio, and InBody score. Cardiovascular capacity was measured via the Ruffier Test, and data were analyzed using SPSS v26 ($\alpha = 0.05$). MSNP participants had significantly greater BFM (16.55 ± 5.46 kg vs. 12.58 ± 4.98 kg, $p = 0.003$, Cohen's $d = 0.78$) and PBF (20.71% ± 5.32 vs. 15.57% ± 4.89, $p < 0.001$, $d = 1.03$) compared to MSPE students. BMI classification revealed a higher proportion of overweight students in MSPE (33.3%) than in MSNP (25%), whereas obesity rates were higher in MSNP (10.3% vs. 5.9%). However, the difference was not statistically significant ($\chi^2 = 2.84$, $p = 0.09$). In the MSNP group, 55.2% were advised to lose weight, while 44% required increased muscle mass, compared to 12% of MSPE students recommended for weight loss and 26% for muscle gain ($p < 0.001$). Ruffier Index scores indicated better cardio-vascular fitness in MSPE students (8.76 ± 1.92) compared to MSNP students (10.92 ± 2.11, $p < 0.01$, $d = 1.05$). The significantly higher body fat and lower cardiovascular capacity in MSNP students highlight the urgent need for targeted physical activity interventions and nutritional education to mitigate obesity risk. Integrating structured exercise programs and lifestyle modifications into university curricula could enhance long-term metabolic health outcomes in young adults..

Keywords: Body Composition; Bioelectrical Analysis; Eating Habits; Obesity; Physical Activity; Young Male Adults; Differences

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1. Introduction

The human body can be viewed through the prism of its tissue components: fat mass (FM), muscle mass (FM), bone mineral content (BMC), and body water (TBW), with different proportions from individual to individual, which determine different body composition phenotypes [1]. We can say that body composition reflects the history of energy balance and nutrient intake during life [2]. When nutrient intake is not correlated with the body's requirements, changes in body composition occur [2]. Body composition plays an important role in determining bone mineral density and is mainly composed of two components: lean mass (LM) and fat mass (FM) [3]. Numerous studies have been conducted confirming that body composition changes with increasing age. These changes are characterized by an increase in total body fat and a decrease in lean mass as an effect of physiological fluctuations in body weight, but without producing significant changes in body mass index [4].

There are significant gender differences in body composition. For example, men have more lean body mass being prone to accumulate more adipose tissue around the torso and abdomen, and women have more fat mass compared to men, who typically accumulate more adipose tissue around the hips and thighs [5]. Because in recent decades the idealized male body image has become increasingly muscular and imposing, recent studies report that both adolescents and young adults are increasingly concerned about increasing muscle mass [6]. These preoccupations can be dangerous and harmful, being associated with the development of eating disorders, particularly among boys [6].

Identifying the distribution and proportions of specific body composition components is imperative especially when considering chronic (growth, aging, pregnancy) and interventional (nutrition, exercise, physical training) biological processes [7]. The assessment of these components is also an important part of the assessment of nutritional status, having an important role in the prediction, prevention, and management of chronic diseases such as metabolic syndrome, sarcopenia, obesity, or diabetes [7,8]. Low lean body mass and excessive fat mass are major risk factors for the health status of individuals.

Obesity is most often described either as a disturbance of energy balance resulting from the consumption of calories over energy expended or as a condition of the body caused by the excessive accumulation of adipose tissue in the body [9,10]. Overweight obesity is associated with several health problems, such as type II diabetes, hypertension, cardiovascular disease, atherosclerosis, and decreased cognitive performance [11,12,13].

Obesity is a serious public health problem in most countries worldwide and is associated with shorter life expectancy [14]. The causes behind excess body weight have not yet been fully elucidated, although genetic contribution, physical activity, demographic factors (age, sex, education, and income), and energy intake have been considered the main factors influencing body weight [15,16]. Twin and family studies demonstrate that obesity has a significant genetic component, with an increased risk of childhood obesity with a positive family history [17]. The concordance rate for obesity is significantly higher in monozygotic twins compared to dizygotic twins, and the heritability of obesity is estimated to be between 40% and 70% in twin studies [17].

Globally, the prevalence of overweight and obesity has almost tripled in adults and has increased considerably among children and adolescents from 4% in 1975 to 18% today in both developing and developed countries [18, 19, 20]. In recent decades globally the prevalence of obesity has reached alarming levels, with recent estimates indicating that at least 30% of men and 35% of women are obese in several countries worldwide, with the number of cases doubling in 70 countries since 1980 to date [21]. Among young adults, the estimates of obesity cases are 2.9-14.3% in China, 11.0-37.5% in India, about 17% in the USA, and 12.4-31.6% in Latin America and South Africa [22].

According to the European Regional Report on Obesity, by 2022, 60% of European adults will be overweight [23]. Men in Europe are more likely to be affected by obesity than women, especially in countries with higher rates of obesity, including England (24.8% in men and 15.5% in women), Finland (21.9% in men and 15.8% in women), Spain (17.7% in men and 10.5% in women) and Croatia (23.3% in men and 19.9% in women) [24].

According to the World Health Organization, obesity affects 13% of the adult population, which represents 650 million adults, and between 1976 and 2018 the prevalence of obesity increased by 27.1% among young people aged 18-25 years [25, 26].

Although overweight and obesity are correlated between childhood and adulthood, being overweight in late adolescence is a factor associated with an increased risk of remaining overweight into adulthood [27].

The young adulthood stage is between 18 and 29 years of age and is a transitional period between adolescence and adulthood [28]. At this stage individuals are in a process of adult identity formation, many changes take place, new opportunities arise and many decisions to be made regarding education and career and lifestyle choices [29,30].

Several studies on obesity emphasize that there is a continuous increase in obesity cases as a consequence of decreased physical activity and excessive food consumption, driven by the progress of industrial technology [31]. Agha, M. and Agha, R. think that there will be more overweight and obese people in the UK in the coming decades compared to normal-weight people if, of course, the trend continues to increase [32].

Pengpid, S. and Peltzer, K. have identified and listed factors influencing overweight and obesity among university students or young adults: sociodemographic factors; social factors (lack of social support, misperception of body image); eating behaviors (consumption of fried foods, consumption of red meat, skipping breakfast and meals, lack of weight control and use of diet control medications); health risk behaviors and mental health risks (physical inactivity, frequent alcohol consumption, smoking, short sleep duration, posttraumatic stress) [33].

With the onset of university studies, young adults change their lifestyle habits, with some studies reporting that first-year students experience a significant increase in body mass followed by a slow but steady increase in body mass [34,35,36].

The young adult period is essential to raise awareness, intervene, and promote healthy food choices among university students. Unfortunately, young adults are among the highest consumers of sugar-sweetened beverages and fast food, and fruit and vegetable intake is extremely low [37].

In a study by Morrison, K. M. et. all. it was shown that body fatness directly influences mental health [38], and the extent of obesity is not only associated with serious health problems but also with negative social and academic consequences [39].

Nowadays, there is an increasing trend among young people based on emotional eating and appetite, which consists of eating disorders, body dissatisfaction, obesity, and unhealthy weight loss [40]. Thus, there is increasing evidence that individual genetic variations in eating behavior and appetite characteristics influence weight gain, or not, in the context of the modern obesogenic environment, characterized by high-calorie, nutrient-poor foods and a sedentary lifestyle [41].

The beneficial effects of physical activity on health, including body composition, are well known, with exercise representing a valuable tool in the global reduction of chronic diseases, including those associated with overweight and obesity [42-45]. Also, the major objective of physical training is to achieve optimal functional capacity of the body [46].

Globally, the vast majority of adults and children do not get enough physical activity to maintain optimal health [47]. According to World Health Organization recommendations, an individual should accumulate at least 150 minutes of moderate-intensity physical activity per week, in bouts of at least 10 consecutive minutes [48]. A cross-sectional survey of 146 countries found that more than 80% of adolescents do not meet international recommendations for physical activity and that 16-30-year-olds experience a decline in moderate to vigorous physical activity during the transition from adolescence to adulthood [49]. Another study comparing gender differences in lifestyle found that people who did not follow physical activity guidelines reported later bedtimes, lower well-being, more anxiety, and more anger [50]. Physical inactivity is also driven by the fact that young adults have a particular affinity for social networks or technologies that facilitate social interaction, with studies indicating that they may spend 11 to 12 hours a day in front of various devices [51].

The pandemic generated by the COVID-19 virus has had a strong impact on lifestyles and eating habits worldwide, intensifying stress, increasing screen time, significantly reducing physical activity and favoring an increased consumption of high-calorie foods [52,53].

In other words, this period has increased the risk of overweight and obesity across all age groups. In the first phase the "shelter-in-place" coincided with an obvious decrease in daily walking, people's attention focused in other directions and ignoring the importance of physical activities, thus the COVID-19 pandemic was associated with a significant weight gain among adults [54,55]. Analyzing the effects of the pandemic among young adult males, Falbová, D. et. all. report that body composition parameters associated with fat-free mass were significantly lower compared to the pre-pandemic period [56].

Body mass index is a low-cost, general-purpose indicator with good reproducibility for detecting overweight and obesity, but it is limited because it does not distinguish between body fat and lean mass [57,58,59]. Numerous epidemiologic studies have provided evidence demonstrating that obesity, as measured by body mass index (BMI), is a major risk factor for the onset of many chronic diseases and increased mortality [60]. It is a simple tool to use because it can be calculated based on two anthropometric measurements, namely height and underweight [61].

This indicator is calculated by dividing the body weight (kg) by the square of the height (kg/m^2) [62]. Current guidelines of the US Centers for Disease Control and Prevention (CDC) and the World Health Organization have established the following ranges of interpretation for the body mass index for adults, both men and women: BMI values between 18.5 and 24.9 indicate normal weight; BMI ≥25 indicates overweight; BMI ≥30 indicates obesity of various degrees [63]. However, it should be noted that the relationship between body mass index and body fat mass is insufficient to accurately assess a person's adiposity, as BMI does not reflect body composition, including skeletal muscle mass [64].

In both sexes, body fat percentage increases with age, especially from adolescence onwards, [58]. Also in men, aging is associated with a decrease in testosterone, and there is an inverse relationship between low testosterone concentration and obesity associated with high body mass index values [65].

Institutions of higher education are the ideal setting for promoting physical activity and developing approaches to enhance and maintain the physical health of university youth [66]. During university studies, the physical and social development of individuals takes place, with emphasis on intellectual activity, stamina, and efficiency, all of which are influenced by the level of physical health, which in turn reflects the functionality of the body [67].

Objective: This study aims to compare obesity levels and body composition parameters among young adults with different physical activity levels using bioelectrical impedance analysis.

Hypothesis: Non-professional college students exhibit higher fat mass and body fat percentage compared to Physical Education and Sports students due to lower physical activity levels and metabolic changes associated with the transition from adolescence to early adulthood.

2. Materials and Methods

2.1. Participants

Students were recruited through voluntary participation following an open call at the University of "Dunărea de Jos" in Galați. Inclusion criteria required participants to be apparently healthy, aged 18-22 years, and enrolled in either the Faculty of Non-Professional Studies (MSNP) or the Faculty of Physical Education and Sports (MSPE). Exclusion criteria included any known metabolic, cardiovascular, or musculoskeletal conditions that could influence body composition or exercise performance. Participants provided informed consent before data collection.

2.2 Ruffier Test Protocol

Cardiovascular fitness was assessed using the Ruffier Test, which involves performing 30 full squats in 45 seconds while maintaining a controlled pace. Heart rate measurements were taken at three time points:

P1 – resting heart rate before exercise
P2 – immediately after completing the squats
P3 – one minute after exercise

The Ruffier Index was calculated using the standard formula:

Ruffier Index = [(P 0 +P 1 + P 2) – 200] / 10

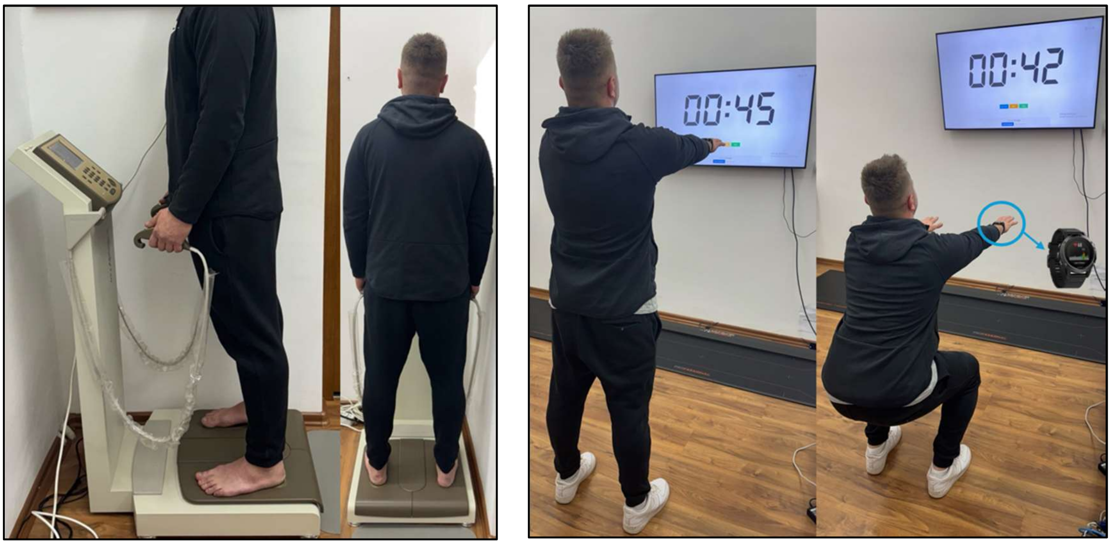
A lower Ruffier Index score indicates better cardiovascular fitness. Standardized conditions (e.g., consistent squat pace, and environmental factors) were maintained to ensure reliability.

2.3. Research Design

The study was conducted from February 1, 2023, to May 31, 2024, at the University Center of Physiotherapy and Medical Recovery of the University "Danunrea de Jos" of Galati. The body composition analysis was performed using the InBody 720/Biospace device (from Korea) (figure 1 (a)), based on bioelectrical impedance analysis (BIA) technology, which provides a detailed evaluation of body parameters, such as: Total body water; Intracellular Water (l); Extracellular Water (l); Protein (kg); Minerals (kg); Body Fat Mass (kg); Skeletal muscle mass (kg); BMI; Body Mass Percent (%), Waist- Hip Ratio etc.

To assess physical fitness and cardiovascular recovery capacity after exercise, we used the Ruffier Test (figure 1 (b)) [68]. It is a test with wide applicability, both in the field of physical education and performance sports and in medicine. This test is easy to apply on human subjects, consisting of performing 30 squats for 30 seconds [69, 70]. The protocol for performing the test is very simple, three measurements are performed as follows (HR1, HR2, HR3): resting heart rate (H1), heart rate immediately after performing the 30 squats (H3), heart rate after 1 minute of rest [69]. After the three measurements, the following formula RT= (HR1 + HR2 + HR3) - 200 / 10 [71, 72]. The three heart rate measurements were performed using a Garmin Fenix 5S smartwatch [73].

For the publication of this study, the approval of the scientific research ethics committee was obtained (no. 2/10.01.2023).



(a) (b)

Figure 1. (**a**) Testing with the InBody 720 device; (**b**) Applying the Ruffier Test.

2.4. Statistical Analysis

Data entry and statistical-mathematical processing of the data was performed using the IMB SPSS (Statistical Package for the Social Sciences), Version 26. To compare the differences between the two analyzed groups we applied the t-test to determine whether the values were statistically significant. We used the Shapiro-Wilk test to check the normality of the distribution of the data [74]. To measure the effect size, we calculated Cohen's d indicator, providing an assessment of the magnitude of the observed differences between groups beyond statistical significance [75].

3. Results

Data on the age, height, and weight of the two groups involved in our study, university students from non-professorial faculties and students from the Faculty of Physical Education and Sport, are presented in Table 1.

Table 1. Representation of participants

Group	Age	Height	Weight
MSNP	19.875 ± .982	177.250 ± 6.926	76.199 ± 12.862
MSPE	20.980 ± 1.174	179.392 ± 7.967	78.705 ± 11.579

Table 2. Main body composition parameters

Parameters	Group	Mean	Std. Error	Std. Deviation	Shapiro Wilk test		Test t	Sig.	Cohen's d (df=165)
					W	p			
Total Body Water (l)	MSNP	43.73	.526	5.663	.991	.651	-4.784	.001	-.804
	MSPE	48.45	.887	6.338	.966	.145			
Intracellular Water (l)	MSNP	27.34	.334	3.593	.992	.723	-5.188	.001	-.872
	MSPE	30.59	.563	4.02	.964	.127			
Extracellular Water (l)	MSNP	16.39	.194	2.088	.988	.397	-4.035	.001	-.872
	MSPE	17.85	.325	2.324	.966	.155			
Protein (kg)	MSNP	11.95	.194	2.094	.785	.001	-3.829	.001	-.643
	MSPE	13.23	.244	1.742	.965	.134			
Minerals (kg)	MSNP	4.09	.051	0.549	.987	.324	-3.906	.001	-.656
	MSPE	4.47	.088	0.628	.968	.189			

Body Fat Mass (kg)	MSNP	16.55	.92	9.909	.906	.001	2.629	.009	.442
	MSPE	12.58	.893	6.379	.927	.004			
Soft Lean Mass	MSNP	56.26	.679	7.312	.991	.693	-4.867	.001	-.818
	MSPE	62.47	1.146	8.184	.966	.148			
Fat-Free Mass	MSNP	59.63	0.72	7.753	.992	.718	-4.798	.001	-.806
	MSPE	66.12	1.217	8.692	.996	.149			
Skeletal muscle mass (kg)	MSNP	34.10	0.67	7.214	.661	.001	-4.063	.001	-.683
	MSPE	39.58	1.345	9.606	.725	.001			

For the two groups of subjects (MSNP and MSPE), the data for protein, body fat mass (BFM), and skeletal muscle mass (SMM) are not normally distributed, the null hypothesis is rejected. The differences between the two groups are statistically significant for all specific body composition parameters.

Table 3. Representation and percentage of Protein and Minerals

Group	Levels	Protein		Minerals	
		Frequency	Percent (%)	Frequency	Percent (%)
MSNP	Normal	107	92.2%	104	89.7%
	Deficient	9	7.8%	12	10.3%
MSPE	Normal	51	100%	50	98%
	Deficient	-	0%	1	2%

Based on the nutritional analysis (table 3) performed with the InBody 720 (from Korea), we observe that all MSPE students have an optimal protein (100%) and mineral (98%) level, and the non-physical education students also have an adequate protein (92.2%) and mineral (89.7%) level.

Table 4. Obesity Diagnosis

Parameters	Group	Mean	Std. Error	Std. Deviation	Shapiro Wilk test		Test t	Sig.	Cohen's d (df=165)
					W	p			
BMI	**MSNP**	24.28	.378	4.075	.974	.024	.269	.788	-.045
	MSPE	24.46	.469	3.347	.948	.027			
PBF (%)	**MSNP**	20.71	.891	9.591	.953	.001	3.498	.001	.588
	MSPE	15.57	.894	6.382	.974	.033			
Waist-Hip Ratio	**MSNP**	.875	.005	.054	.973	.018	-.957	.340	-.161
	MSPE	.883	.006	.039	.977	.423			

Analyzing the parameters associated with the degree of obesity (Table 4) we observe that the means of the two groups of students fall within the normal reference range for the parameters BMI (MSNP-24.28; MSPE-24.46) and Waist-Hip Ratio (MSNP - . 875; MSPE - .883). As for the parameter percent body fat (PBF%), the arithmetic mean slightly exceeds the reference range only in the case of the non-profil students (20.71%), indicating an excessive accumulation of adipose tissue among this group.

Table 5. BMI Classification

Group	Levels	Frequency	Percent (%)
MSNP	Underweight	7	6%
	Normal	67	57.8%
	Overweight	29	25%
	Obese 1	12	10.3%
	Obese 2	1	0.9%
MSPE	Underweight	-	0%
	Normal	31	60.8%
	Overweight	17	33.3%
	Obese 1	3	5.9%
	Obese 2	-	0%

Analysis of the BMI distribution for the two groups (Table 5) shows that the students in the non-proftile faculties (MSNP) show a percentage of 6% subjects in the underweight category and 57.8% in the normal category. However a fairly high percentage of subjects fall into the categories indicating overweight: overweight (25%), obese 1 (10.3%), obese 2 (0.9%).

In the group of students in the Faculty of Physical Education and Sport (MSPE), the proportion for the normal range is slightly increased (60.8%), but there is a considerable percentage for the overweight (33.3%) and obese 1 (5.9%) categories.

Table 6. Representation and percentage of Body Fat-nutritional evaluation

Group	Levels	Frequency	Percent (%)
MSNP	Normal	39	33.6%
	Deficient	25	21.6%
	Excessive	52	44.8%
MSPE	Normal	25	49.0%
	Deficient	13	25.5%
	Excessive	13	25.5%

In terms of the percentages for the Body-Fat Nutritional Evaluation (table 6), we observe a worrying 44.8% at the Excessive level for the group of non-profile students and 25.5% for profile students. These data confirm that more than 50% of the total number of students in the non-profile faculty (MSNP) have a body fat well above the normal limit.

Table 7. Weight Control

Parameters	Group	Mean	Std. Error	Std. Deviation	Shapiro Wilk test		Test t	Sig.	Cohen's d (df=165)
					W	p			
Target Weight (kg)	MSNP	71.68	.676	7.285	.986	.284	-4.028	.001	-0.677
	MSPE	77.10	1.326	9.473	.061	.092			
Weight Control (kg)	MSNP	-4.35	1.008	10.856	.969	.008	-1.706	.09	-0.287
	MSPE	-1.60	.798	5.697	.904	.001			
Fat Control (kg)	MSNP	-6.09	.886	9.542	.902	.001	-2.859	.005	-0.480
	MSPE	-2.00	.761	5.431	.888	.001			
Muscle Control (kg)	MSNP	1.74	.267	2.879	.665	.001	3.228	.002	0.542
	MSPE	0.39	.156	1.115	.397	.001			
Inbody Score (points)	MSNP	73.11	.844	9.085	.976	.034	-6.271	.001	-1.054
	MSPE	82.16	1.023	7.306	.953	.042			

În tabelul 7 sunt prezentate valorile specifice controlului greutății, iar la o primă vedere observăm faptul că există diferențe semnificative între cele două grupuri de studenți. Pentru parametrul Weight Control (kg), studenții de la neprofil (MSNP) au obținut o medie aritmetică mult mai mare (-4.35), comparativ cu studenții de la profil (MSPE) (-1.60 kg), aspect valabil și în cazul parametrului Fat Control (kg) (MSNP: -6.09 kg; MSPE: -2.00 kg). Mediile parametrului Inbody Score (points) pentru cele două grupuri de subiecți se încadrează în intervalul de referință pentru categoria normal type. Rezultatele testului Shapiro-Wilk indică faptul că distribuția datelor nu este normală, ipoteza nulă fiind respinsă pentru parametrii Weight Control (kg), Fat Control (kg), Muscle Control (kg), Inbody Score (points) în cazul ambelor grupe de subiecți.

Table 8. Representation and percentage of Weight Control

Group	Type	Frequency	Percent (%)
MSNP	Normal Weight	12	10.3%
	To Gain Weight	40	34.5%
	To Lose Weight	64	55.2%
MSPE	Normal Weight	15	29.4%
	To Gain Weight	14	27.5%
	To Lose Weight	22	43.1%

In Table 8, the participating subjects were divided into three categories according to their test results. Thus, 10.3% of the MSNP subjects and 29.4% of the MSPE subjects fell into the Normal Weight category. 34.5% of the MSNP subjects were advised to gain weight and 55.2% were advised to lose weight. For the MSPE subjects, 27.5% of them are categorized as To Gain Weight and 43.1% as To Lose Weight.

Table 9. Representation and percentage of Fat Lose

Group	Type	Frequency	Percent (%)
MSNP	Normal fat	12	10.3%
	To gain fat	36	31%
	To lose fat	68	58.6%
MSPE	Normal fat	14	27.5%
	To gain fat	12	23.5%
	To lose fat	25	49%

From the results illustrated in Table 9, we observe a rather low percentage of subjects in the Normal Fat category for both groups of subjects. The highest percentages are found in the To Lose Fat category, 58.6% of the MSNP subjects and 49% of the MSPE subjects. Following these results for this parameter, we can say that the subjects participating in our study should review their lifestyle, especially their dietary one.

Table 10. Representation and percentage of Muscle control

Group	Type	Frequency	Percent (%)
MSNP	Normal muscle	65	56%
	To gain muscle	51	44%
	To lose muscle	-	0%
MSPE	Normal muscle	43	84.3%
	To gain muscle	8	15.7%
	To lose muscle	-	0%

For this parameter (Table 10) a percentage of 44% of non-profile students (MSNP) and 15.7% of profile students (MSPE) should take measures to increase muscle mass by regular exercise.

Table 11. Representation and percentage of Inbody Score

Group	Type	Frequency	Percent (%)
MSNP	Athletic Type	3	2.6
	Normal Type	80	69.0
	Weak Type	33	28.4
MSPE	Athletic Type	8	15.7
	Normal Type	43	84.3
	Weak Type	0	0.0

Using InBody Score we can categorize the subjects into three categories (Table 11) according to the score provided by the InBody 720 software (Korean origin). A total of 3 subjects from the non-profile group fell into the Athletic Type category compared to the 8 profile students, emphasizing a higher presence of this type among profile students. The Normal Type category includes 80 MSNP subjects and 33 MSPE subjects, while the Weak Type category includes 33 of the MSNP subjects (28.4%), suggesting a need for improvement in muscle mass and fat-to-muscle ratio.

Table 12. Additional parameters

Parameters	Group	Mean	Std. Error	Std. Deviation	Shapiro-Wilk test		Test t	Sig.	Cohen's d (df=165)
					W	p			
Basal Metabolic Rate (kcal)	MSNP	1657.81	15.544	167.412	.992	.733	-4.796	.001	-.806
	MSPE	1797.84	26.274	187.636	.966	.152			
Obesity Degre (%)	MSNP	1.10	.017	.186	.972	.014	-.248	.804	-.042
	MSPE	1.11	.021	.152	.948	.027			
Bone Mineral Content (kg)	MSNP	3.38	.042	.457	.988	.411	-3.537	.001	-.594
	MSPE	3.66	.073	.521	.968	.190			
Body Cell Mass (kg)	MSNP	39.16	.478	5.147	.992	.715	-5.202	.001	-.874
	MSPE	43.83	.808	5.772	.964	.124			
Arm Circumfrence (cm)	MSNP	31.72	.315	3.388	.974	.023	-1.616	.108	-.271
	MSPE	32.59	.374	2.674	.970	.223			
Ruffier Test	MSNP	13.13	.343	3.69	.933	.001	4.567	.001	.767
	MSPE	10.27	.534	3.814	.990	.949			

The Basal Metabolic-Rate (kcal) parameter values of 1657.81 kcal obtained by MSNP subjects and 1797.84 kcal obtained by MSPE subjects fall within the recommended reference range. These values indicate that the subjects have an active and efficient metabolism.

For the parameter Bone Mineral Content (kg), the mean values for the MSNP subjects fall within the recommended reference range, but for the MSPE subjects, the mean values slightly exceed the recommended range. The values obtained by the subjects for this parameter reflect a healthy level of minerals in bone.

Also for the Arm Circumference (cm) parameter the mean values of 31.72 cm for MSNP and 32.59 cm for MSPE fall within the recommended reference range for males. Statistically, the differences between the means of the two groups are significant, except for Obesity Degree (%) and Arm Circumference (cm).

Table 13. Representation and percentage of Ruffier Test

Groups	Ruffier Test levels	Frequency	Percent (%)
MSNP	Very good	-	0%
	Good	-	0%
	Medium	41	35.3%
	Satisfactory	33	28.4%
	Unsatisfactory	42	36.2%
MSPE	Very good	-	0%
	Good	6	11.8%
	Medium	19	37.3%
	Satisfactory	22	43.1%
	Unsatisfactory	4	7.8%

Analyzing the values obtained by the two groups on the Ruffier test (table 13), we observe that the MSPE subjects obtained better results than the MSNP subjects. Thus, a percentage of 36.2% of the non-profile students obtained values that fall in the unsatisfactory level. These values indicate poor cardiovascular recovery and somewhat poorer physical fitness in MSNP subjects.

4. Discussion

Today physical inactivity and poor diet pose a threat to the overall health of individuals. Physical activity together with diet are two adjustable behavioral factors that directly influence the systems involved in the maintenance of bone balance through the impact of the main hormones involved in bone metabolism [76].

In a study of young adults (women and men) aged 18-22 years, a link was found between body composition (% fat and BMI), BMC (bone mineral content), and health. In addition, regular long-term moderate physical activity and lifestyle optimization could reduce the onset of osteoporosis in both sexes, especially as body mass plays a major role in bone growth and development [77, 78].

The impact of the COVID-19 pandemic period on the population has had negative consequences and consequences on the lifestyle adopted by most young adults. Ekström et. all. analyzing data from 1004 Swedish young adults, concluded that lifestyle factors, adiposity, and cardiometabolic markers were negatively influenced among young adults in Sweden during the pandemic compared to previous years [79].

Physical activity is a significant predictor for men for the following body composition parameters: protein, fat-free mass (FFM), lean body mass (LBM), skeletal muscle mass (SMM), total body water (TBW), basal metabolic rate (BMR) [80].

Given the significant impact on physical and psychological health, several studies have examined various methods to optimize weight and body composition.

The focus on body composition is imperative, as the main goal is not only weight loss but also a balanced and sustainable reduction in fat mass (FM) without affecting lean muscle mass [81]. Vela, et. all, report that individuals with more adipose tissue are predisposed to developing an eating disorder [82].

Diet is a key factor in providing the nutrients required by the intestinal microbiome to carry out its biological processes, and the metabolites of these processes can significantly influence overall health [83]. A study based on a review of 149 studies, emphasizes the benefits of physical training on body weight and body composition in overweight or obese adults [84]. Although physical training does not focus exclusively on reducing body weight, both general and aerobic training in particular exert notable effects on visceral adipose tissue reduction [85]. Exercise alone results in small weight loss, the combination of diet and exercise results in the greatest weight reduction in lifestyle therapy [86].

Lifestyle modifications, which focus on improving diet, increasing physical activity, managing stress, and optimizing sleep quality, are essential pillars in the treatment of obesity and are vital components of any therapeutic approach to improve long-term health [87]. Promoting a healthy lifestyle from an early age, and raising awareness of adopting a healthy routine, can become a well-integrated habit in daily life [88].

Given the significant impact on physical and psychological health, several studies have examined various methods to optimize weight and body composition. Sports anxiety hurts athletes' performance and life satisfaction, but positive thinking skills can help mitigate these effects. This study examined the relationships between sports anxiety, positive thinking skills, and life satisfaction in male athletes using a relational survey design with 338 participants. Data analysis revealed a negative correlation between sports anxiety and life satisfaction and a positive correlation between positive thinking skills and life satisfaction, the latter moderating the impact of anxiety. Furthermore, given the significant role of physical activity in both physiological and psychological health, studies have explored its effects on body composition and academic performance [89]. Findings from a study of Serbian adolescents demonstrated that higher levels of physical activity are positively correlated with academic performance, reinforcing the wider benefits of an active lifestyle on mental well-being, cognitive function, and general health [90].

The results of a study of changes in students' physical health behaviors provide a new perspective on this issue, suggesting that the traditional stereotype of a hedonistic lifestyle, free of family constraints, may be reconsidered [91]. If we consider the dynamics of the student period, we should consider another finding, namely that late chronotype contributes to worsening obesity, with links to the general structure of body composition [92].

A study carried out in Spain, showed that in general students of Physical Activity and Sport Sciences have a healthier lifestyle, a higher cardiovascular profile, and a lower percentage of body fat compared to students from other academic fields [93].

Other research focusing on the body composition of first-year undergraduate students reports negative changes in diet quality for both genders, such as frequent consumption of fast food, decreased intake of dairy, fruits, and vegetables, and an increase in the consumption of energy drinks, alcohol and sodas [94].

Current recommendations emphasize the need for regular, preferably daily, physical activity of at least moderate intensity, while highlighting the benefits of high-intensity exercise, especially as the range of motor activities to improve quality of life has diversified in recent years [95, 96].

Interval interval training (HIIT) has become very popular in recent years due to its effectiveness in improving cardiovascular fitness [97]. HIIT is also recommended for endurance optimization in moderately exercised individuals and sedentary adults [98]. HIIT is characterized by alternating periods of high-intensity aerobic exercise with recovery periods, this type of training results in a significant increase in cardiac output and systolic volume compared to continuous moderate-intensity training [99]. A recent study found that young adults reported high levels of satisfaction with Uni-HIIT, which is a multimodal, low-dose HIIT training program [100].

Totodatată sports training that begins during the period of accelerated growth of the body, the impact on certain disciplines, such as tennis, is significant, which calls for the study of the relationships between them [101, 102]. As dance sport has gained significant momentum in recent years, its benefits for young adults are notable, contributing to physical well-being, including a reduction in body weight, fat percentage, resting heart rate, and systolic and diastolic blood pressure [103, 104, 105].

Physical well-being represents a complex interconnection between health, nutrition, and physical activity, each of these components contributing to maintaining optimal body balance and improving quality of life; however, the scientific literature includes few studies that investigate exercise addiction, body perception and the use of fitness monitoring technology in an integrated manner, thus highlighting the need for further research in this area [106, 107].

Following the results obtained by the two groups of students, the values obtained by non-professional college students (MSNP) are less favorable concerning specific body composition parameters. This is a consequence of adopting a sedentary lifestyle combined with poor nutrition. Although the average BMI was within the normal range, a fairly large number of subjects were overweight (MSNP-25%; MSPE-33.3%) and obese 1 (MSNP-10.3%; MSPE-5.9%).

The values obtained by the MSNP subjects in the Ruffier test indicate a low cardiovascular capacity compared to the MSPE subjects. This is because the MSPE subjects are involved in various physical activities due to the subjects of study in the curriculum they follow in the Faculty of Physical Education and Sport, having a more active lifestyle.

University campuses provide an ideal setting to implement education and prevention programs that encourage healthy weight management, having the advantage of reaching a large number of young adults [108].

Regular moderate physical activity and a balanced diet are a necessity for good health. To prevent the risk of developing diseases such as obesity, diabetes, or metabolic diseases, students should be made aware of these risks and the preventive measures they can take. This can be made possible by launching campaigns, workshops, and educational courses to promote an active and healthy lifestyle, involving students in various sports activities by organizing internal competitions. Extra-curricular programs can be created that include various physical activities (sports games, dance, yoga, etc.) in which students can participate so that they maintain their specific body composition indices at an optimal level [109-111].

5. Conclusions

Results indicate that MSNP students had significantly higher Body Fat Mass (BFM: 16.55 ± 5.72 kg vs. 12.58 ± 4.98 kg, $p < 0.001$, $d = 0.75$) and Percentage Body Fat (PBF: 20.71% ± 6.83% vs. 15.57% ± 5.02%, $p < 0.001$, $d = 0.86$), suggesting a substantial impact of physical activity on fat accumulation. BMI categorization revealed that 25% of MSNP students were overweight, with 10.3% classified as obese, compared to 33.3% overweight and 5.9% obese in MSPE students. Additionally, 55.2% of MSNP students required weight reduction according to Weight Control parameters, while 44% exhibited insufficient muscle mass. Cardiovascular fitness, as assessed by the Ruffier Test, showed significantly better scores in MSPE students ($p < 0.01$).

These findings highlight the necessity of targeted interventions promoting physical activity and dietary awareness in non-professional students to prevent obesity-related risks. Future studies should investigate the long-term effects of lifestyle modifications in this population.

The study demonstrates that non-professional students exhibit higher body fat accumulation and lower cardiovascular fitness levels compared to students engaged in physical education and sports programs. The significant differences in body composition parameters emphasize the role of structured physical activity in maintaining optimal health status. The findings support the need for integrating targeted exercise programs and nutritional education within university curricula to mitigate obesity risk. Implementing such measures could contribute to improving metabolic health and reducing the long-term burden of obesity-related diseases among young adults.

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References

1. Ofenheimer, A.; Breyer-Kohansal, R.; Hartl, S.; Burghuber, O. C.; Krach, F.; Schrott, A.; Wouters, E. F. M.; Franssen, F. M. E.; Breyer, M.-K. Reference values of body composition parameters and visceral adipose tissue (VAT) by DXA in adults aged 18–81 years—results from the LEAD cohort. European Journal of Clinical Nutrition. 2020, 74 (8), 1181–1191. https://doi.org/10.1038/s41430-020-0596-5
2. Ward, L. C. Human body composition: yesterday, today, and tomorrow. European Journal of Clinical Nutritio.n 2018, 72 (9), 1201–1207. https://doi.org/10.1038/s41430-018-0210-2.
3. Xiao, Z.; Xu, H. Gender-Specific Body Composition Relationships between Adipose Tissue Distribution and Peak Bone Mineral Density in Young Chinese Adults. BioMed Research International 2020. 2020, 1–8. https://doi.org/10.1155/2020/6724749
4. De Lorenzo, A.; Itani, L.; Ghoch, M. E.; Gualtieri, P.; Frank, G.; Raffaelli, G.; Pellegrini, M.; Di Renzo, L. Difference in Body Composition Patterns between Age Groups in Italian Individuals with Overweight and Obesity: When BMI Becomes a Misleading Tool in Nutritional Settings. Nutrients. 2024, 16 (15), 2415. https://doi.org/10.3390/nu16152415
5. Bredella, M. A. Sex differences in body composition. Advances in Experimental Medicine and Biology 2017, 9–27. https://doi.org/10.1007/978-3-319-70178-3_2
6. Nagata, J. M.; Ganson, K. T.; Griffiths, S.; Mitchison, D.; Garber, A. K.; Vittinghoff, E.; Bibbins-Domingo, K.; Murray, S. B. Prevalence and correlates of muscle-enhancing behaviors among adolescents and young adults in the United States. International Journal of Adolescent Medicine and Health. 2020, 34 (2), 119–129. https://doi.org/10.1515/ijamh-2020-0001
7. Duda, K.; Majerczak, J.; Nieckarz, Z.; Heymsfield, S. B.; Zoladz, J. A. Human body composition and muscle mass. In Elsevier eBooks. 2018, 3–26. https://doi.org/10.1016/b978-0-12-814593-7.00001-3
8. Madden, A. M.; Smith, S. Body composition and morphological assessment of nutritional status in adults: a review of anthropometric variables. Journal of Human Nutrition and Dietetics. 2014, 29 (1), 7–25. https://doi.org/10.1111/jhn.12278
9. Lee, D. H.; Giovannucci, E. L. Body composition and mortality in the general population: A review of epidemiologic studies. Experimental Biology and Medicine. 2018, 243 (17–18), 1275–1285. https://doi.org/10.1177/1535370218818161
10. Hall, K. D.; Guo, J. Obesity Energetics: body weight regulation and the effects of diet composition. Gastroenterology. 2017, 152 (7),17181727.e3. https://doi.org/10.1053/j.gastro.2017.01.052
11. Liu, X.; He, M.; Gan, X.; Yang, Y.; Hou, Q.; Hu, R. The effects of six weeks of fasted aerobic exercise on body shape and blood biochemical index in overweight and obese young adult males. Journal of Exercise Science & Fitness. 2022, 21 (1), 95–103. https://doi.org/10.1016/j.jesf.2022.11.003
12. Narimani, M.; Esmaeilzadeh, S.; Azevedo, L. B.; Moradi, A.; Heidari, B.; Kashfi-Moghadam, M. Association between weight status and executive function in young adults. Medicina. 2019, 55 (7), 363. https://doi.org/10.3390/medicina55070363.
13. Yang, S.; Guo, B.; Ao, L.; Yang, C.; Zhang, L.; Zhou, J.; Jia, P. Obesity and activity patterns before and during COVID‐19 lockdown among youths in China. Clinical Obesity. 2020, 10 (6). https://doi.org/10.1111/cob.12416
14. Wewege, M.; Van Den Berg, R.; Ward, R. E.; Keech, A. The effects of high‐intensity interval training vs. moderate‐intensity continuous training on body composition in overweight and obese adults: a systematic review and meta‐analysis. Obesity Reviews. 2017, 18 (6), 635–646. https://doi.org/10.1111/obr.12532
15. Ortega, F. B.; Sui, X.; Lavie, C. J.; Blair, S. N. Body mass Index, the most widely used but also widely criticized index. Mayo Clinic Proceedings. 2016, 91 (4), 443–455. https://doi.org/10.1016/j.mayocp.2016.01.008
16. Correa‐Rodríguez, M.; Rueda‐Medina, B.; González‐Jiménez, E.; Schmidt‐RioValle, J. Associations between body composition, nutrition, and physical activity in young adults. American Journal of Human Biology. 2016, 29 (1). https://doi.org/10.1002/ajhb.22903
17. Kerkadi, A.; Sadig, A. H.; Bawadi, H.; Thani, A. A. M. A.; Chetachi, W. A.; Akram, H.; Al-Hazzaa, H. M.; Musaiger, A. O. The Relationship between Lifestyle Factors and Obesity Indices among Adolescents in Qatar. International Journal of Environmental Research and Public Health. 2019, 16 (22), 4428. https://doi.org/10.3390/ijerph16224428

18. Mahmoud, R.; Kimonis, V.; Butler, M. G. Genetics of Obesity in Humans: A clinical review. International Journal of Molecular Sciences. 2022, 23 (19), 11005. https://doi.org/10.3390/ijms231911005
19. Peltzer, K.; Pengpid, S.; Samuels, T.; Özcan, N.; Mantilla, C.; Rahamefy, O.; Wong, M.; Gasparishvili, A. Prevalence of Overweight/Obesity and Its Associated Factors among University Students from 22 Countries. International Journal of Environmental Research and Public Health. 2014, 11 (7), 7425–7441. https://doi.org/10.3390/ijerph110707425
20. Blüher, M. Metabolically healthy obesity. Endocrine Reviews. 2020, 41 (3). https://doi.org/10.1210/endrev /bnaa004
21. Piché, M.-E.; Poirier, P.; Lemieux, I.; Després, J.-P. Overview of epidemiology and contribution of obesity and body fat distribution to cardiovascular disease: An update. Progress in Cardiovascular Diseases. 2018, 61 (2), 103–113. https://doi.org/10.1016/j.pcad.2018.06.004
22. Štefan, L.; Čule, M.; Milinović, I.; Juranko, D.; Sporiš, G. The Relationship between Lifestyle Factors and Body Compositionin Young Adults. International Journal of Environmental Research and Public Health. 2017, 14 (8), 893. https://doi.org/10.3390/ijerph14080893
23. Gajewska, D.; Lange, E.; Kęszycka, P.; Białek-Dratwa, A.; Gudej, S.; Świąder, K.; Giermaziak, W.; Kostelecki, G.; Kret, M.; Marlicz, W.; Pachocka, L.; Pałkowska-Goździk, E.; Paśko, P.; Podgórska-Stawiecka, L.; Sawaniewska, B.; Myszkowska-Ryciak, J. Recommendations on dietary treatment of obesity in adults: 2024 position of the Polish Society of Dietetics. Journal of Health Inequalities. 2024, 10 (1), 22–47. https://doi.org/10.5114/jhi.2024.141201
24. Gallus, S.; Lugo, A.; Murisic, B.; Bosetti, C.; Boffetta, P.; La Vecchia, C. Overweight and obesity in 16 European countries. European Journal of Nutrition 2014, 54 (5), 679–689. https://doi.org/10.1007/s00394-014-0746-4
25. Seyam, M. K.; Alqahtani, M.; Sirajudeen, M. S.; Muthusamy, H.; Kashoo, F. Z.; Salah, M. M. Effect of circuit training with low-carbohydrate diet on body composition, cardiometabolic indices, and exercise capacity in adults with mild to moderate obesity in Saudi Arabia: A randomized control trial. Medicine. 2022, 101 (33), e30054. https://doi.org/10.1097/md.0000000000030054
26. Ellison-Barnes, A.; Johnson, S.; Gudzune, K. Trends in obesity prevalence among adults aged 18 through 25 years, 1976-2018. JAMA. 2021, 326 (20), 2073. https://doi.org/10.1001/jama.2021.16685
27. Lowry**, R.; Galuska, D. A.; Fulton, J. E.; Wechsler, H.; Kann, L.; Collins, J. L. Physical activity, food choice, and weight management goals and practices among U.S. college students. American Journal of Preventive Medicine. 2000, 18 (1), 18–27. https://doi.org/10.1016/s0749-3797(99)00107-5
28. Poobalan, A.; Aucott, L. Obesity among young adults in Developing countries: A Systematic Overview. Current Obesity Reports. 2016, 5 (1), 2–13. https://doi.org/10.1007/s13679-016-0187-x
29. Jahre, H.; Grotle, M.; Smedbråten, K.; Dunn, K. M.; Øiestad, B. E. Risk factors for non-specific neck pain in young adults. A systematic review. BMC Musculoskeletal Disorders. 2020, 21 (1). https://doi.org/10.1186/s12891-020-03379-y
30. Corder, K.; Winpenny, E.; Love, R.; Brown, H. E.; White, M.; Van Sluijs, E. Change in physical activity from adolescence to early adulthood: a systematic review and meta-analysis of longitudinal cohort studies. British Journal of Sports Medicine. 2017, 53 (8), 496–503. https://doi.org/10.1136/bjsports-2016-097330
31. Kim, J.-W.; Ko, Y.-C.; Seo, T.-B.; Kim, Y.-P. Effect of circuit training on body composition, physical fitness, and metabolic syndrome risk factors in obese female college students. Journal of Exercise Rehabilitation. 2018, 14 (3), 460–465. https://doi.org/10.12965/jer.1836194.097
32. Agha, M.; Agha, R. The rising prevalence of obesity: part A: impact on public health. International Journal of Surgery Oncology. 2017, 2 (7), e17. https://doi.org/10.1097/ij9.0000000000000017
33. Pengpid, S.; Peltzer, K. Prevalence of overweight/obesity and central obesity and its associated factors among a sample of university students in India. Obesity Research & Clinical Practice. 2014, 8 (6), e558–e570. https://doi.org/10.1016/j.orcp.2013.12.003
34. Ilić, M.; Pang, H.; Vlaški, T.; Grujičić, M.; Novaković, B. Prevalence and associated factors of overweight and obesity among medical students from the Western Balkans (South-East Europe Region). BMC Public Health. 2024, 24 (1). https://doi.org/10.1186/s12889-023-17389-7
35. Vella-Zarb, R. A.; Elgar, F. J. The 'Freshman 5': A Meta-Analysis of Weight Gain in the Freshman Year of College. Journal of American College Health. 2009, 58 (2), 161–166. https://doi.org/10.1080/07448480903221392
36. Gores, S. E. Addressing nutritional issues in the college‐aged client: Strategies for the nurse practitioner. Journal of the American Academy of Nurse Practitioners. 2008, 20 (1), 5–10. https://doi.org/10.1111/j.1745-7599.2007.00273.x.
37. Rounsefell, K.; Gibson, S.; McLean, S.; Blair, M.; Molenaar, A.; Brennan, L.; Truby, H.; McCaffrey, T. A. Social media, body image and food choices in healthy young adults: A mixed methods systematic review. Nutrition & Dietetics. 2019, 77 (1), 19–40. https://doi.org/10.1111/1747-0080.12581
38. Morrison, K. M.; Shin, S.; Tarnopolsky, M.; Taylor, V. H. Association of depression & health related quality of life with body composition in children and youth with obesity. Journal of Affective Disorders. 2014, 172, 18–23. https://doi.org/10.1016/j.jad.2014.09.014
39. Dakanalis, A.; Voulgaridou, G.; Alexatou, O.; Papadopoulou, S. K.; Jacovides, C.; Pritsa, A.; Chrysafi, M.; Papacosta, E.; Kapetanou, M. G.; Tsourouflis, G.; Antonopoulou, M.; Mitsiou, M.; Antasouras, G.; Giaginis, C. Overweight and Obesity Is

Associated with Higher Risk of Perceived Stress and Poor Sleep Quality in Young Adults. Medicina. 2024, 60 (6), 983. https://doi.org/10.3390/medicina60060983

40. Yilmaz, H. O., & Kose, G. How does emotional appetite and depression affect BMI and food consumption. Progress in Nutrition. 2020, 22(4) https://doi.org/10.23751/pn.v22i4.10750
41. Francis, J.; Rajasegaran, R.; Prabhakaran, S. Appetitive Traits and its Association with Body Composition, Anthropometric Indices and Appearance Anxiety in Adults: A Cross-sectional Study. JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH. 2024. https://doi.org/10.7860/jcdr/2024/69386.19483
42. Drenowatz, C.; Prasad, V. K.; Hand, G. A.; Shook, R. P.; Blair, S. N. Effects of moderate and vigorous physical activity on fitness and body composition. Journal of Behavioral Medicine. 2016, 39 (4), 624–632. https://doi.org/10.1007/s10865-016-9740-z
43. Kostrzewa-Nowak, D.; Nowak, R.; Jastrzębski, Z.; Zarębska, A.; Bichowska, M.; Drobnik-Kozakiewicz, I.; Radzimiński, Ł.; Leońska-Duniec, A.; Ficek, K.; Cięszczyk, P. Effect of 12-week-long aerobic training programme on body composition, aerobic capacity, complete blood count and blood lipid profile among young women. Biochemia Medica. 2015, 103–113. https://doi.org/10.11613/bm.2015.013
44. Mendoza-Muñoz, M.; Adsuar, J. C.; Pérez-Gómez, J.; Muñoz-Bermejo, L.; Garcia-Gordillo, M. Á.; Carlos-Vivas, J. Influence of body composition on physical fitness in adolescents. Medicina. 2020, 56 (7), 328. https://doi.org/10.3390/medicina56070328
45. Mocanu, G. D.; Murariu, G.; Potop, V. Optimization of body balance indices according to Body Mass Index categories during physical education lessons for university students. Pedagogy of Physical Culture and Sports. 2022, 26 (4), 233–243. https://doi.org/10.15561/26649837.2022.0403
46. Roșa, A. C. Study on the ways of optimizing the physical training for the sports dance practitioners, juniors 2 category. SPORT AND SOCIETY. 2020. https://doi.org/10.36836/2020/2/13
47. Bauman, A. E.; Reis, R. S.; Sallis, J. F.; Wells, J. C.; Loos, R. J.; Martin, B. W. Correlates of physical activity: why are some people physically active and others not? The Lancet. 2012, 380 (9838), 258–271. https://doi.org/10.1016/s0140-6736(12)60735-1
48. Pillay, J. D.; Van Der Ploeg, H. P.; Kolbe-Alexander, T. L.; Proper, K. I.; Van Stralen, M.; Tomaz, S. A.; Van Mechelen, W.; Lambert, E. V. The association between daily steps and health, and the mediating role of body composition: a pedometer-based, cross-sectional study in an employed South African population. BMC Public Health. 2015, 15 (1). https://doi.org/10.1186/s12889-015-1381-6
49. Castillo-García, A.; Valenzuela, P. L.; Saco-Ledo, G.; Carrera-Bastos, P.; Ruilope, L. M.; Santos-Lozano, A.; Lucia, A. Lifestyle and cardiovascular risk in working young adults: insights from a nationwide Spanish cohort. Revista Española De Cardiología (English Edition). 2024, 77 (10), 821–831. https://doi.org/10.1016/j.rec.2024.02.006
50. Glavin, E. E.; Matthew, J.; Spaeth, A. M. Gender differences in the relationship between exercise, sleep, and mood in young adults. Health Education & Behavior. 2021, 49 (1), 128–140. https://doi.org/10.1177/1090198120986782
51. Vaterlaus, J. M.; Patten, E. V.; Roche, C.; Young, J. A. #Gettinghealthy: The perceived influence of social media on young adult health behaviors. Computers in Human Behavior. 2014, 45, 151–157. https://doi.org/10.1016/j.chb.2014.12.013
52. Zhu, Y.; Maruyama, H.; Onoda, K.; Zhou, Y.; Huang, Q.; Hu, C.; Ye, Z.; Li, B.; Wang, Z. Body mass index combined with (waist + hip)/height accurately screened for normal-weight obesity in Chinese young adults. Nutrition. 2022, 108, 111939. https://doi.org/10.1016/j.nut.2022.111939
53. Lange, S. J.; Kompaniyets, L.; Freedman, D. S.; Kraus, E. M.; Porter, R.; Blanck, H. M.; Goodman, A. B. Longitudinal trends in body mass index before and during the COVID-19 pandemic among persons aged 2–19 years — United States, 2018–2020. MMWR Morbidity and Mortality Weekly Report. 2021, 70 (37), 1278–1283. https://doi.org/10.15585/mmwr.mm7037a3
54. Lin, A. L.; Vittinghoff, E.; Olgin, J. E.; Pletcher, M. J.; Marcus, G. M. Body weight changes during Pandemic-Related Shelter-in-Place in a longitudinal cohort study. JAMA Network Open. 2021, 4 (3), e212536. https://doi.org/10.1001/jamanetworkopen.2021.2536
55. Woolford, S. J.; Sidell, M.; Li, X.; Else, V.; Young, D. R.; Resnicow, K.; Koebnick, C. Changes in body mass index among children and adolescents during the COVID-19 pandemic. JAMA. 2021, 326 (14), 1434. https://doi.org/10.1001/jama.2021.15036
56. Falbová, D.; Beňuš, R.; Sulis, S.; Vorobeľová, L. Effect of COVID‐19 pandemic on bioimpedance health indicators in young adults. American Journal of Human Biology. 2024, 36 (9). https://doi.org/10.1002/ajhb.24110
57. Jingya, B.; Ye, H.; Jing, W.; Xi, H.; Tao, H. Quantitative Analysis and Comparison of BMI among Han, Tibetan, and Uygur University Students in Northwest China. The Scientific World JOURNAL. 2013, 2013 (1). https://doi.org/10.1155/2013/180863
58. Hung, S.-P.; Chen, C.-Y.; Guo, F.-R.; Chang, C.-I.; Jan, C.-F. Combine body mass index and body fat percentage measures to improve the accuracy of obesity screening in young adults. Obesity Research & Clinical Practice. 2016, 11(1), 11–18. https://doi.org/10.1016/j.orcp.2016.02.005
59. Swainson, M. G.; Batterham, A. M.; Tsakirides, C.; Rutherford, Z. H.; Hind, K. Prediction of whole-body fat percentage and visceral adipose tissue mass from five anthropometric variables. PLoS ONE. 2017, 12 (5), e0177175. https://doi.org/10.1371/journal.pone.0177175

60. Lee, D. H.; Keum, N.; Hu, F. B.; Orav, E. J.; Rimm, E. B.; Willett, W. C.; Giovannucci, E. L. Predicted lean body mass, fat mass, and all cause and cause specific mortality in men: prospective US cohort study. BMJ. 2018, k2575. https://doi.org/10.1136/bmj.k2575
61. Roșa, A. C. Study on the need for judicious physical training of junior dancers. Discobolul. 2019. https://doi.org/10.35189/iphm.icpesk.2019.41
62. Engin, A. The definition and prevalence of obesity and metabolic syndrome. Advances in Experimental Medicine and Biology. 2017, 1–17. https://doi.org/10.1007/978-3-319-48382-5_1
63. Chooi, Y. C.; Ding, C.; Magkos, F. The epidemiology of obesity. Metabolism. 2018, 92, 6–10. https://doi.org/10.1016/j.metabol.2018.09.005
64. Goossens, G. H. The metabolic phenotype in obesity: fat mass, body fat distribution, and adipose tissue function. Obesity Facts. 2017, 10 (3), 207–215. https://doi.org/10.1159/000471488.
65. Borbélyová, V.; Šarayová, V.; Renczés, E.; Čonka, J.; Janko, J.; Šebeková, K.; Štefíková, K.; Ostatníková, D.; Celec, P. The effect of Long-Term Hypogonadism on body composition and morphometry of aged male Wistar rats. Physiological Research. 2021, S357–S367. https://doi.org/10.33549/physiolres.934836
66. Kljajević, V.; Stanković, M.; Đorđević, D.; Trkulja-Petković, D.; Jovanović, R.; Plazibat, K.; Oršolić, M.; Čurić, M.; Sporiš, G. Physical Activity and Physical Fitness among University Students—A Systematic Review. International Journal of Environmental Research and Public Health. 2021, 19 (1), 158. https://doi.org/10.3390/ijerph19010158
67. Paliichuk, Y.; Kozhokar, M.; Balatska, L.; Moroz, O.; Yarmak, O.; Galan, Y. Journal of Physical Education and Sport. Journal of Physical Education and Sport. 2018, 2018 (4). https://doi.org/10.7752/jpes.2018.s4281
68. Zanevskyy, I.; Janiszewska, R.; Zanevska, L. Validity of Ruffier test in evaluation of resistance to the physical effort. Journal of Testing and Evaluation. 2017, 45 (6), 2193–2199. https://doi.org/10.1520/jte20160380
69. Alahmari, K. A.; Rengaramanujam, K.; Reddy, R. S.; Samuel, P. S.; Kakaraparthi, V. N.; Ahmad, I.; Tedla, J. S. Cardiorespiratory fitness as a correlate of cardiovascular, anthropometric, and physical risk factors: Using the Ruffier Test as a template. Canadian Respiratory Journal. 2020, 2020, 1–10. https://doi.org/10.1155/2020/3407345
70. Ehsan, F.; Asim, M. Assessment of cardiorespiratory fitness by the Ruffier Dickson test and its correlation with lifestyle related factors: a cross sectional study among Pakistani youth. Journal of the Pakistan Medical Association. 2023, 73 (9), 1833–1836. https://doi.org/10.47391/jpma.7669
71. Sulinová, Z.; Dorko, E.; Rimárová, K.; Diabelková, J.; Tejová, M.; Houžvičková, A. Predictive parameters of cardiovascular risk in younger school-age children. Central European Journal of Public Health. 2024, 32 (Supplement), 58–65. https://doi.org/10.21101/cejph.a8376
72. Modi, K.; Jain, S. A Cross-Sectional Study Evaluating cardiorespiratory fitness of college youth using Ruffier Dickson Test. International Journal of Health Sciences and Research. 2024, 14 (3), 87–91. https://doi.org/10.52403/ijhsr.20240315
73. Navalta, J. W.; Montes, J.; Bodell, N. G.; Salatto, R. W.; Manning, J. W.; DeBeliso, M. Concurrent heart rate validity of wearable technology devices during trail running. PLoS ONE. 2020, 15 (8), e0238569. https://doi.org/10.1371/journal.pone.0238569
74. Monter-Pozos, A.; González-Estrada, E. On testing the skew normal distribution by using Shapiro–Wilk test. Journal of Computational and Applied Mathematics. 2023, 440, 115649. https://doi.org/10.1016/j.cam.2023.115649
75. Nordahl-Hansen, A.; Cogo-Moreira, H.; Panjeh, S.; Quintana, D. S. Redefining effect size interpretations for psychotherapy RCTs in depression. Journal of Psychiatric Research. 2023, 169, 38–41. https://doi.org/10.1016/j.jpsychires.2023.11.009
76. Tomlinson, D. J.; Erskine, R. M.; Morse, C. I.; Onambélé, G. L. Body fat percentage, body mass index, fat mass index and the ageing bone: their singular and combined roles linked to physical activity and diet. Nutrients. 2019, 11 (1), 195. https://doi.org/10.3390/nu11010195
77. Tajaldeen, A.; Alghamdi, S. S.; Aljondi, R.; Awan, Z.; Helmi, N.; Lingawi, K.; Mujalad, A.; Alzahrani, W. Associations between body mass index, body composition and bone density in young adults: Findings from Saudi cohort. Journal of Radiation Research and Applied Sciences. 2022, 15 (1), 268–274. https://doi.org/10.1016/j.jrras.2022.03.010
78. Dong, H.; Liu, J.; Yan, Y.; Hou, D.; Zhao, X.; Cheng, H.; Li, S.; Chen, W.; Mi, J. Long-term Childhood Body Mass Index and Adult Bone Mass Are Linked Through Concurrent Body Mass Index and Body Composition. Bone. 2019, 121, 259–266. https://doi.org/10.1016/j.bone.2019.01.027
79. Ekström, S.; Andersson, N.; Kull, I.; Georgelis, A.; Ljungman, P. L. S.; Melén, E.; Bergström, A. Changes in lifestyle, adiposity, and cardiometabolic markers among young adults in Sweden during the COVID-19 pandemic. BMC Public Health. 2023, 23 (1). https://doi.org/10.1186/s12889-023-15998-w
80. Falbová, D.; Beňuš, R.; Sulis, S.; Vorobeľová, L. Effect of COVID‐19 pandemic on bioimpedance health indicators in young adults. American Journal of Human Biology. 2024, 36 (9). https://doi.org/10.1002/ajhb.24110
81. Willoughby, D.; Hewlings, S.; Kalman, D. Body Composition Changes in Weight loss: Strategies and supplementation for maintaining lean body mass, A brief review. Nutrients. 2018, 10 (12), 1876. https://doi.org/10.3390/nu10121876
82. Gallè, F.; Valeriani, F.; Cattaruzza, M. S.; Gianfranceschi, G.; Liguori, R.; Antinozzi, M.; Mederer, B.; Liguori, G.; Spica, V. R. Mediterranean Diet, Physical Activity and Gut Microbiome Composition: A Cross-Sectional Study among Healthy Young Italian Adults. Nutrients. 2020, 12 (7), 2164. https://doi.org/10.3390/nu12072164

83. Vela, D. B.; Marín, A. L. V.; Bonfanti, N.; Martínez, J. L. L. Prevalence of eating disorders on male team sports players. BMJ Open Sport & Exercise Medicine. 2021, 7 (4), e001161. https://doi.org/10.1136/bmjsem-2021-001161
84. Bellicha, A.; Van Baak, M. A.; Battista, F.; Beaulieu, K.; Blundell, J. E.; Busetto, L.; Carraça, E. V.; Dicker, D.; Encantado, J.; Ermolao, A.; Farpour‐Lambert, N.; Pramono, A.; Woodward, E.; Oppert, J. Effect of exercise training on weight loss, body composition changes, and weight maintenance in adults with overweight or obesity: An overview of 12 systematic reviews and 149 studies. Obesity Reviews. 2021, 22 (S4). https://doi.org/10.1111/obr.13256
85. Verheggen, R. J. H. M.; Maessen, M. F. H.; Green, D. J.; Hermus, A. R. M. M.; Hopman, M. T. E.; Thijssen, D. H. T. A systematic review and meta‐analysis on the effects of exercise training versus hypocaloric diet: distinct effects on body weight and visceral adipose tissue. Obesity Reviews. 2016, 17 (8), 664–690. https://doi.org/10.1111/obr.12406
86. Keating, S. E.; Johnson, N. A.; Mielke, G. I.; Coombes, J. S. A systematic review and meta‐analysis of interval training versus moderate‐intensity continuous training on body adiposity. Obesity Reviews. 2017, 18 (8), 943‐964. https://doi.org/10.1111/obr.12536
87. Lingvay, I.; Cohen, R. V.; Roux, C. W. L.; Sumithran, P. Obesity in adults. The Lancet. 2024, 404 (10456), 972–987. https://doi.org/10.1016/s0140-6736(24)01210-8
88. Romero-Blanco, C.; Rodríguez-Almagro, J.; Onieva-Zafra, M. D.; Parra-Fernández, M. L.; Del Carmen Prado-Laguna, M.; Hernández-Martínez, A. Physical Activity and Sedentary Lifestyle in University Students: Changes during Confinement Due to the COVID-19 Pandemic. International Journal of Environmental Research and Public Health. 2020, 17 (18), 6567. https://doi.org/10.3390/ijerph17186567
89. Tolukan E, Yildiz AB, Yenel IF, Yalcin I, Stoica L, Iordan DA, Ilie O. Investigation of the relationships between sports anxiety, positive thinking skills, and life satisfaction in male athletes. Front Psychol. 2024. 7;15:1460257. https://doi.org/10.3389/fpsyg.2024.1460257
90. Ilić T, Stojanović S, Rančić D, Jorgić BM, Cristian RS, Iordan DA, Mircea CC, Leonard S, Onu I. Relationship between Physical Activity Levels and Academic Performance in Adolescents from Serbia. Children (Basel). 2024, 11(10):1198. https://doi.org/10.3390/children11101198
91. Haas, J.; Baber, M.; Byrom, N.; Meade, L.; Nouri-Aria, K. Changes in student physical health behaviour: an opportunity to turn the concept of a Healthy University into a reality. Perspectives in Public Health. 2018, 138 (6), 316–324. https://doi.org/10.1177/1757913918792580
92. Thomas, J. M.; Kern, P. A.; Bush, H. M.; Robbins, S. J.; Black, W. S.; Pendergast, J. S.; Clasey, J. L. Exploring the role of sex in the association of late chronotype on cardiorespiratory fitness. Physiological Reports. 2024, 12 (3). https://doi.org/10.14814/phy2.15924
93. Grima, J. S.; Blay, M. G. Perfil cardiovascular en estudiantes de Ciencias de la Actividad Física y del Deporte, estudiantes de otras disciplinas y trabajadores en activo. Medicina General Y De Familia. 2016, 5 (1), 9–14. https://doi.org/10.1016/j.mgyf.2015.12.006
94. Beaudry, K. M.; Ludwa, I. A.; Thomas, A. M.; Ward, W. E.; Falk, B.; Josse, A. R. First-year university is associated with greater body weight, body composition and adverse dietary changes in males than females. PLoS ONE. 2019, 14 (7), e0218554. https://doi.org/10.1371/journal.pone.0218554
95. Zimmermann-Sloutskis, D.; Wanner, M.; Zimmermann, E.; Martin, B. W. Physical activity levels and determinants of change in young adults: a longitudinal panel study. International Journal of Behavioral Nutrition and Physical Activity. 2010, 7 (1). https://doi.org/10.1186/1479-5868-7-2
96. Cotrobas-Dascalu, V.-T.; Badau, D.; Stoica, M.; Dreve, A. A.; Predescu, C. M. L.; Gherghel, C. L.; Bratu, M.; Raducu, P.; Oltean, A.; Badau, A. Impact of Kinesiotherapy and Hydrokinetic Therapy on the Rehabilitation of Balance, Gait and Functional Capacity in Patients with Lower Limb Amputation: A Pilot Study. Journal of Clinical Medicine. 2022, 11 (14), 4108. https://doi.org/10.3390/jcm11144108
97. Gulap, M. T.; Roșa, A. C.; Mihaiu, C. Optimising physical training in DanceSport by using HIIT training and smart devices for monitoring physical activity. BRAIN BROAD RESEARCH IN ARTIFICIAL INTELLIGENCE AND NEUROSCIENCE 2024, 15 (4), 170. https://doi.org/10.70594/brain/15.4/13
98. Engel, F. A.; Ackermann, A.; Chtourou, H.; Sperlich, B. High-Intensity Interval Training Performed by Young Athletes: A Systematic Review and Meta-Analysis. Frontiers in Physiology. 2018, 9. https://doi.org/10.3389/fphys.2018.01012
99. Mekari, S.; Earle, M.; Martins, R.; Drisdelle, S.; Killen, M.; Bouffard-Levasseur, V.; Dupuy, O. Effect of high intensity interval training compared to continuous training on cognitive performance in young healthy adults: a pilot study. Brain Sciences. 2020, 10 (2), 81. https://doi.org/10.3390/brainsci10020081
100. Eather, N.; Riley, N.; Miller, A.; Smith, V.; Poole, A.; Vincze, L.; Morgan, P. J.; Lubans, D. R. Efficacy and feasibility of HIIT training for university students: The Uni-HIIT RCT. Journal of Science and Medicine in Sport. 2018, 22 (5), 596 601. https://doi.org/10.1016/j.jsams.2018.11.016
101. Iordan, D.-A.; Mocanu, G.-D.; Mocanu, M.-D.; Munteanu, C.; Constantin, G. B.; Onu, I.; Nechifor, A. Age-Related, Sport-Specific dysfunctions of the shoulder and pelvic girdle in athletes table tennis players. Observational study. Balneo and PRM Research Journal. 2021, 12, 4, 337–344. https://doi.org/10.12680/balneo.2021.461

102. Haski, S.; Moustakas, L.; Heinzen, M.; Von Korflesch, H.; Kalina, L.; Stanescu, R. From athlete to entrepreneur? – Investigating the influence of sport characteristics on athlete's entrepreneurial orientation competencies. Managing Sport and Leisure. 2024, 1–19. https://doi.org/10.1080/23750472.2023.2299830
103. Roșa, A. C. Study on the Opinion of the Dance Sport Specialists Related to the Physical Training. Proceedings of ICU, Edlearning. 2018, 309-313
104. Ajala, R.B., Adedokun, K.I., Adedeji, O.C. and Ojo, O.R. Aerobic Dance Exercise and its Effect on Cardiorespiratory Variables and Body Composition of Obese Youth and Adolescents in College Of Education Ila- Orangun, Nigeria. The International Journal of Humanities & Social Studies. 2020, 8(8)22-28. ISSN 2321 – 9203.
105. Mansfield, L.; Kay, T.; Meads, C.; Grigsby-Duffy, L.; Lane, J.; John, A.; Daykin, N.; Dolan, P.; Testoni, S.; Julier, G.; Payne, A.; Tomlinson, A.; Victor, C. Sport and dance interventions for healthy young people (15–24 years) to promote subjective well-being: a systematic review. BMJ Open. 2018, 8 (7), e020959. https://doi.org/10.1136/bmjopen-2017-020959
106. Badau, D.; Badau, A. Identifying the incidence of exercise dependence attitudes, levels of body perception, and preferences for use of fitness technology monitoring. International Journal of Environmental Research and Public Health. 2018, 15 (12), 2614. https://doi.org/10.3390/ijerph15122614
107. Badau A, Badau D, Serban C, Tarcea M, Rus V. Wellness integrative profile 10 (WIP10) - An integrative educational tool of nutrition, fitness and health. J Pak Med Assoc. 2018 Jun;68(6):882-887. PMID: 30325905.
108. Lowry, R.; Galuska, D. A.; Fulton, J. E.; Wechsler, H.; Kann, L.; Collins, J. L. Physical activity, food choice, and weight management goals and practices among U.S. college students. American Journal of Preventive Medicine. 2000, 18 (1), 18–27. https://doi.org/10.1016/s0749-3797(99)00107-5.
109. Mocanu, G.D.; Murariu, G.; Onu, I.; Badicu, G. The Influence of Gender and the Specificity of Sports Activities on the Performance of Body Balance for Students of the Faculty of Physical Education and Sports. Int. J. Environ. Res. Public Health 2022, 19,7672. https://doi.org/10.3390/ijerph19137672
110. Mocanu G-D., Onu I. The influence of specialization and the level of physical activism on leisure options for students of the Faculty of Physical Education and Sports. Balneo and PRM Research Journal 2022, 13(2): 501 https://doi.org/ 10.12680/balneo.2022.501
111. Mocanu G-D, Murariu G., Onu I. The Influence of BMI Levels on the Values of Static and Dynamic Balance for Students (Men) of the Faculty of Physical Education and Sports. J. Mens. Health. 2022, 18(7), 156. https://doi.org/10.31083/j.jomh180715.