Balneo and PRM Research Journal

Research article

Differences in the manifestation of balance according to BMI levels for women students of the Faculty of Physical Education and Sports

George-Danut Mocanu[1]*, Ilie Onu[2]*

[1] "Dunărea de Jos" University, Faculty of Physical Education and Sports, 63-65 Gării Street, Galați, România, george.mocanu@ugal.ro

[2] Department of Biomedical Sciences, Faculty of Medical Bioengineering, University of Medicine and Pharmacy "Grigore T. Popa" Iasi, 700454 Iasi, Romania, ilie.onu@umfiasi.ro

* Correspondence: G.D.M. george.mocanu@ugal.ro ; I.O. ilie.onu@umfiasi.ro ;

Citation: Mocanu G.-D., Onu I. - Differences in the manifestation of balance according to BMI levels for women students of the Faculty of Physical Education and Sports, Balneo and PRM Research Journal 2022, 13(3): 513

Academic Editor(s): Constantin Munteanu

Received: date
Accepted: date
Published: date

Publisher's Note: Balneo and PRM Research Journal stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Abstract ***Background:*** Static and dynamic balance are factors of major importance in the manifestation of human motor skills at a higher level. ***Purpose:*** The determination of variations in the performance of balance tests for young women students at the Faculty of Physical Education and Sports (48 cases in the 1st year of bachelor's degree), divided and analyzed 3 BMI levels (underweight / 7 cases, normal weight / 34 cases and overweight / 7 cases) and comparing these results with other similar research. ***Material and method*:** The testing of the group was scheduled at the Research Center for Human Performance, belonging to the Faculty of Physical Education and Sports in Galați, in the month of April of the 2018-2019 academic year. For the assessment of balance, 7 tests were used, of which 4 associated with dynamic postural stability (Walk and turn field sobriety test/errors, Functional reach test/cm, Fukuda test/degrees of rotation, Bass test/points) and 3 measuring static stability (Flamingo test/falls, One leg standing with eyes closed/sec, Stork test/sec). Nonparametric tests (Mann-Whitney U) were applied to compare differences between batches. ***Results:*** The average values of underweight and normal-weight women are better than those of overweight women for the entire set of assessment tests. The underweight group has the best results for the Standing balance test, Functional reach test, Flamingo test, Walk and turn field sobriety test, Fukuda test, and the normal weight women for Stork test, respectively Bass test. We found a lack of significant thresholds when comparing the results between the 3 groups (P> 0.05) for Stork test, Standing balance test and Functional reach test, so the working hypothesis formulated is only partially confirmed. The only significant difference between underweight and normal weight (P <0.05) is found in the Flamingo test, with better values for underweight. Significant difference thresholds for Flamingo test and Fukuda test are recorded between the underweight and overweight groups (Z values have associated thresholds P<0.05). The most significant differences are found between the normal weight and overweight groups (P <0.05), respectively for the Bass test, Fukuda test and Walk and turn field sobriety test. ***Conclusion:*** Constant physical activity (as a feature of the analyzed group) reduces the chances of significant differences in all balance tests between BMI levels.

Keywords: female students; university specialization; static and dynamic postural control; physical activity

1. Introduction

The manifestation of balance is evident in sports activities, static and dynamic postural control involving vestibular, kinesthetic and visual analyzers [1]. Visual stimuli generate an excitatory input on postural muscles, but visual feedback influences neuromuscular control differently in young men and women, which generates different postural effects [2]. The existence of visual feedback optimizes the ability to maintain balance, according [3]. Modern technology, statistical and video analysis, as well as investigations in the field of biomechanics facilitate the understanding of the factors that influence the stability and movements of the body during sports activities [4–6]. The stability of the body is directly influenced by the involvement of different categories of the population in leisure or sports physical activities. They improve quality of life, motor skills and promote an active lifestyle [7–10]. The balance is affected by the existence of musculoskeletal problems and deficiencies of the spine in the frontal plane (scoliosis) [11].

In obese people, the quality of walking and maintaining the orthostatic position are affected, due to the excess of adipose tissue and the deficit of muscle mass and strength. Greater postural instability, compared to normal weight and characterized by wider oscillations of the CoP/center of pressure in the antero-posterior plane generates problems related to injuries and falls [12]. Other research indicates greater problems related to postural stability for the obese (12-67 years) but does not report significant differences between genders [13]. Physical activity is important in maintaining optimal body weight in children, the increase in BMI values is associated with higher risks of impaired balance, poor fitness forecasting poor motor skills [14]. Actions aimed at increasing the values of muscle strength of the lower limbs of obese are not enough to improve balance, if not supported by loss of body mass, this ensures better controlled movements of the upper limbs [15]. Indicators of body composition (lean body mass) are associated with the values of body stability and muscle strength, physical effort being a factor that allows the functional independence of the elderly and a better balance [16]. For those who are overweight but physically active, higher balance scores have been identified, compared to those who are physically inactive, so gains in muscle strength generate superior postural stability [17]. The on one-leg balance is better for physically active women, who have better relative and absolute strength, and lower limb muscle loss is lower for this category. Significant correlations are reported between balance and involvement in vigorous physical exercise [18]. Research at the level of sports and non-sports university students has shown a strong association between the values of the strength of the back muscles, the increase of BMI indices and the endurance capacity with postural stability, according to [19].

Sports activity is an attribute that improves the value of balance and resistance to fatigue, sports adolescent girls with better scores of dynamic stability than non-sports, at the end of an exercise of 20 min [20]. The installation of fatigue decreases the performance in the balance tests for the snipers, the lots that were not physically tired before the shooting have better performances [21]. High-intensity anaerobic efforts reduce the values of dynamic balance for university athletes, affecting performance in all planes and directions of movement [22].

The participation of students with sports specialization in physical activities / PA is less represented for European men, except in Germany, where girls have better levels [23]. There is no consensus on gender differences for postural stability in adolescence, according to [24]. For other authors, no gender differences are reported for dynamic postural stability during adolescence [25]. The analysis of balance on one leg (with eyes open and closed) in children showed better stability in the case of girls, who have a lower average radius of distribution of CoP than boys, a possible effect of the higher body mass of boys [26]. No significant gender differences are reported for static and dynamic balance in people with chronic low back pain, but women are associated with higher pain intensity and impaired dynamic balance [27].

Static balance testing (one leg standing) for healthy young people (x = 23 years) does not signal significant differences between the dominant and non-dominant leg.

However, poorer performance is observed for the closed-eye and low-stability variants of the support surface/foam ground, according to [28]. The comparison of the balance results for one leg standing does not identify significant differences in the values of the dominant leg vs. non-dominant, regardless of test conditions: stable and unstable surfaces, eyes closed and open [29].

Increasing body stability, mobility and walking quality by using Pilates techniques for several weeks for older adults is argued by [30]. Trainings based on the use of dynamic balance boards (Indo Board), planned 4 days a week, 10min / session during the competition season will generate an improvement in balance for collegiate women athletes (volleyball), according to [31]. Improving the static and dynamic stability of Turkish volleyball players (18-25 years) is possible through strength training, according to [32]. The use of the FIFA11 + program for 6 weeks, at the level of young football players in puberty has beneficial effects on the values of static and dynamic balance indicators, with improved movement quality and reduced risk of injury [33]. However, other research does not find the optimization of static and dynamic balance values by applying the FIFA11 program (10 weeks x 2 sessions per week) for amateur futsal players [34]. Significant improvements in dynamic balance (especially for women) are noted through Unicycling training (5 weeks) for Croatian university students with a specialization in sports [35]. For obese and normal-weight college students, Wii Fit Exergames programs (6 weeks) generate favorable effects on static balance values [36]. The use of strength exercises for 6 weeks in the training of young athletes has beneficial and significant effects on static and dynamic balance, due to increased muscle strength and decreased disinhibition and stimulating of muscles' spindles [37].

The sudden reduction in body weight for judo practitioners has no beneficial effects on reaction speed and balance, these values being better for those where weight loss is slow or it is kept constant [38]. For university students practicing team sports, with functional ankle instability, the implementation of a 4-week program based on balance exercises performed at home has improved the functional capacity of the ankle [39]. Young sportswomen in Turkey have higher values of body stability compared to sedentary groups, basketball players excel in dynamic assessment tests, and female football players and female volleyball players in static ones (Flamingo test) [40]. Stimulating proprioception in women football players favors achieving higher scores of static balance and agility, according to [41]. Bone health and improved balance values, with reduced risk of falling are achieved by using the handball game for recreational purposes, for women aged 48-79 [42]. No significant differences were found in the manifestation of the balance for Spanish children, between the sedentary, practitioners of individual sports and sports games, during the pandemic of Covid 19, according to [43]. During the covid pandemic, health specialists provided help to overweight people, by adapting and implementing exercise programs and accommodating them to online activities [44]. Polish female students with sports specialization better withstand sleep deprivation (24 hours), with superior results to men in balance tests [45].

2. Materials and Methods

2.1. Working hypotheses:

We estimated that the inclusion of students in one of the 3 BMI stages would determine statistically significant differences between the performances of underweight, normal weight and overweight in static and dynamic balance tests.

2.2. Participants

The studied group includes the female students of the Faculty of Physical Education and Sports from Galați (48 cases, year 1 bachelor's degree), belonging to the specializations Physical Education and Sports, respectively Physical Therapy and Special Motor Skills (age = 20.21 ± 1.51, weight = 56.75 ± 9.13, height = 164.00 ± 7.31, BMI = 21.05 ± 2.77). The group was divided into 3 categories, depending on the BMI values: underweight (N = 7, BMI = 17.27), normal weight (N = 34, BMI = 20.86), overweight (N = 7, BMI = 25.77).

The average values for age and anthropometric data of these groups are summarized in Table 1. Both specializations went through the same practical disciplines during the academic year, all students being physically active (practical curricular activities, forms of leisure or performance sports). All investigated subjects received a favorable medical opinion to go through set of applied tests.

Table 1. Central tendency indicators by investigated subgroups (age, anthropometric indicators and BMI values)

Group type	Parameters analyzed	Minimum	Maximum	Mean	Std. Error	Std. Deviation	Variance
Underweight N=7	Age	19.00	20.00	19.2857	.18443	.48795	.238
	Weight	39.00	53.00	44.8571	2.09794	5.55063	30.810
	Height	148.00	171.00	161.0000	3.69040	9.76388	95.333
	BMI	15.60	18.20	17.2714	.38958	1.03072	1.062
Normal weight N=34	Age	19.00	27.00	20.3235	.28234	1.64631	2.710
	Weight	46.00	78.00	56.9706	1.14811	6.69457	44.817
	Height	155.00	180.00	165.1176	1.09753	6.39964	40.955
	BMI	18.70	25.00	20.8647	.29554	1.72326	2.970
Overweight N=7	Age	19.00	22.00	20.5714	.48093	1.27242	1.619
	Weight	59.00	84.00	67.5714	3.26494	8.63823	74.619
	Height	152.00	177.00	161.5714	3.26494	8.63823	74.619
	BMI	25.40	26.80	25.7714	.18350	.48550	.236
Whole lot N=48	Age	19.00	27.00	20.2083	.21871	1.51529	2.296
	Weight	39.00	84.00	56.7500	1.31868	9.13609	83.468
	Height	148.00	180.00	164.0000	1.05647	7.31946	53.574
	BMI	15.60	26.80	21.0563	.40109	2.77886	7.722

2.3. The organization of the research

The testing of the group was scheduled at the Research Center for Human Performance, belonging to the Faculty of Physical Education and Sports in Galați, in the month of April of 2018-2019 academic year. For the assessment of balance, 7 tests were used, of which 4 associated with dynamic postural stability (Walk and turn field sobriety test/errors, Functional reach test/cm, Fukuda test/degrees of rotation, Bass test/points) and 3 measuring static stability (Flamingo test/falls, One leg standing with eyes closed/sec, Stork test/sec). The manner of application, the measurement of results and the data related to the fidelity and validity of these evaluation tools are stipulated by [46–49]. The testing of the group was performed in small groups and in the time interval 12^{00}-16^{00} PM, in order to avoid gathering poorer performance, generated by variations in circadian rhythm [50,51]. The participants were previously explained the purpose of the study and the technique of execution of each test, being allowed to practice them, for better accommodation to the specific effort, they received the recommendation to avoid long or high-intensity efforts before testing, to avoid installation of nervous and muscular fatigue. The study stages complied with the rules of ethics related to research involving human subjects, according to the Helsinki Declaration [52,53].

2.4. The statistical analysis of data

The statistical calculation was performed using the SPSS software (Statistical Package for the Social Sciences - Vers.24). The normality distribution curves of the data were analyzed (Shapiro Wilk test), and because most of the tests (for the 3 batches) the normal distribution curve is not observed and the normality conditions of the results are not met, nonparametric tests were used to compare the test results between BMI levels, for independent samples (Mann-Whitney U), with highlighting of Z values and related significance thresholds. The indicators of the central trend (average, standard deviation, average error, variance and identification of upper and lower limits) for each test at the level of the 3 BMI categories were calculated and summarized in Table 2, for a more accurate picture of the results obtained. The confidence interval was set to 95% (P <0.05), according to [54–56]. The graphs with individual performance of the groups were made using the Microsoft Excel editor.

3. Results

The average test performance values and the central tendency indicators (separately for each BMI level) are summarized in Table 2. It is observed that the average values of underweight and normal-weight women are better than those of overweight for the entire set of assessment samples. The underweight group has the best results for the Standing balance test, Functional reach test, Flamingo test, Walk and turn field sobriety test, Fukuda test, and the normal weight women for Stork test, respectively Bass test.

Table 2. Central tendency indicators in balance tests for the 3 BMI categories

Dependent variable	Group	N	Minimum	Maximum	Mean	Std. deviation	Std. error	Variance
Standing balance test (sec)	a. underweight	7	5.01	23.43	10.8071	7.10947	2.132	50.545
	b. normal weight	34	2.72	26.62	8.0041	5.75896	.967	33.166
	c. overweight	7	2.39	9.52	5.3957	2.38637	2.132	5.695
Functional reach test (cm)	a. underweight	7	39.00	48.50	44.5714	4.12743	1.566	17.036
	b. normal weight	34	37.00	53.00	44.3882	4.32756	.711	18.728
	c. overweight	7	41.00	50.00	44.0143	2.95828	1.566	8.751
Stork test (sec)	a. underweight	7	2.25	18.69	6.5757	5.82959	2.085	33.984
	b. normal weight	34	1.65	24.79	7.2968	5.55460	.946	30.854
	c. overweight	7	1.22	15.87	5.2743	4.94815	2.085	24.484
Flamingo test (attempts)	a. underweight	7	1.00	4.00	2.1429	1.06904	.942	1.143
	b. normal weight	34	1.00	12.00	4.0000	2.43709	.428	5.939
	c. overweight	7	2.00	12.00	5.8571	3.57904	.942	12.810
Bass test (points)	a. underweight	7	60.00	95.00	76.4286	12.72605	4.327	161.952
	b. normal weight	34	46.00	97.00	82.1765	12.00371	1.963	144.089
	c. overweight	7	70.00	85.00	75.2857	5.34522	4.327	28.571
Walk and turn field sobriety test (errors)	a. underweight	7	.00	.00	.0000	.00000	.000	.000
	b. normal weight	34	.00	1.00	.0294	.17150	.042	.029
	c. overweight	7	.00	1.00	.4286	.53452	.092	.286
Fukuda test (degrees)	a. underweight	7	4.00	50.00	13.0000	16.56301	5.132	274.333
	b. normal weight	34	.00	60.00	15.2647	12.77381	2.329	163.170
	c. overweight	7	8.00	50.00	28.4286	14.52420	5.132	210.952

The comparison of the results between the 3 groups (by ranks) by means of the nonparametric Mann-Whitney U test, with the expression of Z values and the associated significance thresholds are summarized in tables 3-5, and the variation of individual results for each test applied and for each BMI level is represented graphically in fig.1-8.

Table 3. Mann Whitney U test results for the pair underweight- normal weight / Test Statistics[a]

Dependent variable	**Group**	**N**	**Mean Rank**	**Sum of Ranks**	**Mann-Whitney U**	**Z**	**Sig. (2-tailed)**
Standing balance test (sec)	underweight	7	26.00	182.00	84.000	-1.213	.225
	normal weight	34	19.97	679.00			

Functional reach test (cm)	underweight	7	22.50	157.50	108.500	-.365	.715
	normal weight	34	20.69	703.50			
Stork test (sec)	underweight	7	19.29	135.00	107.000	-.416	678
	normal weight	34	21.35	726.00			
Flamingo test (attempts)	underweight	7	12.50	87.50	59.500	-2.091	.037
	normal weight	34	22.75	773.50			
Bass test (points)	underweight	7	15.21	106.50	78.500	-1.406	.160
	normal weight	34	22.19	754.50			
Walk and turn field sobriety test (errors)	underweight	7	20.50	143.50	115.500	-.454	.650
	normal weight	34	21.10	717.50			
Fukuda test (degrees)	underweight	7	16.86	118.00	90.000	-1.007	.314
	normal weight	34	21.85	743.00			

a. Grouping Variable: BMI levels

Table 4. Mann Whitney U test results for the pair underweight- overweight / Test Statistics[a]

Dependent variable	Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Sig. (2-tailed)
Standing balance test (sec)	underweight	7	9.57	67.00	10.000	-1.853	.064
	overweight	7	5.43	38.00			
Functional reach test (cm)	underweight	7	7.93	55.50	21.500	-.385	.701
	overweight	7	7.07	49.50			
Stork test (sec)	underweight	7	8.14	57.00	20.000	-.575	.565
	overweight	7	6.86	48.00			
Flamingo test (attempts)	underweight	7	5.07	35.50	7.500	-2.227	.026
	overweight	7	9.93	69.50			
Bass test (points)	underweight	7	7.14	50.00	22.000	-.320	.749
	overweight	7	7.86	55.00			
Walk and turn field sobriety test (errors)	underweight	7	6.00	42.00	14.000	-1.883	.060
	overweight	7	9.00	63.00			
Fukuda test (degrees)	underweight	7	5.21	36.50	8.500	-2.058	.040
	overweight	7	9.79	68.50			

a. Grouping Variable: BMI levels

Table 5. Mann Whitney U test results for the pair normal weight- overweight / Test Statistics[a]

Dependent variable	Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Z	Sig. (2-tailed)
Standing balance test (sec)	normal weight	34	21.94	746.00	87.000	-1.109	.268
	overweight	7	16.43	115.00			
Functional reach test (cm)	normal weight	34	21.31	724.50	108.500	-.365	.715
	overweight	7	19.50	136.50			
Stork test (sec)	normal weight	34	22.00	748.00	85.000	-1.178	.239
	overweight	7	16.14	113.00			
Flamingo test (attempts)	normal weight	34	19.82	674.00	79.000	-1.401	.161
	overweight	7	26.71	187.00			
Bass test (points)	normal weight	34	22.90	778.50	54.500	-2.240	.025
	overweight	7	11.79	82.50			
Walk and turn field sobriety test (errors)	normal weight	34	19.60	666.50	71.500	-3.201	.001
	overweight	7	27.79	194.50			
Fukuda test (degrees)	normal weight	34	19.04	647.50	52.500	-2.308	.021
	overweight	7	30.50	213.50			

a. Grouping Variable: BMI levels

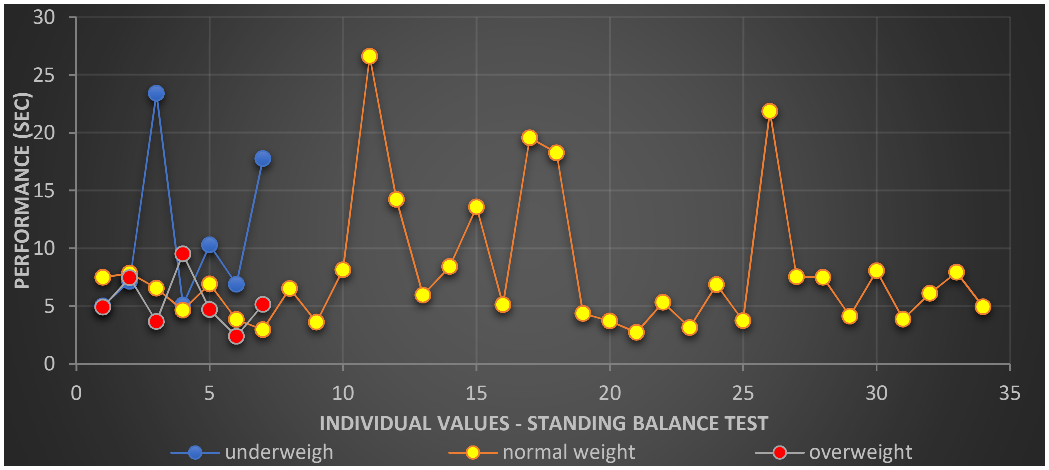

Fig. 1. Individual results for the Standing balance test

For the Standing balance test, the average value of the underweight is higher than both the normal weight and the overweight. However, the difference between the performances of the pairs (by means of the nonparametric Mann-Whitney U test) indicates values of Z associated with insignificant thresholds (P> 0.05), so the higher values of underweight and normal weight are not statistically confirmed. The graphical representation of the individual values (fig. 1) indicates many higher scores for the group of normal and underweight, respectively a concentration of the values of the group of overweight students in the area of medium and low scores.

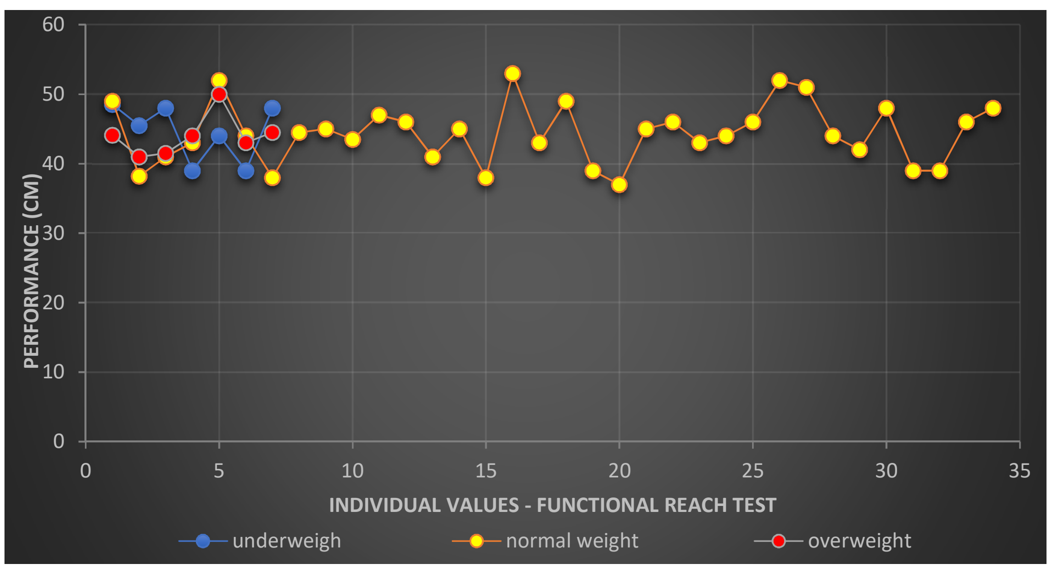

Fig. 2. Individual results for the Functional reach test

At the level of the Functional reach test, a balance is found between the average performances of the 3 groups, without signaling significant differences between the analyzed pairs (all values of Z correspond to P> 0.05 thresholds and are therefore insignificant). The individual results shown in fig. 2 indicate some lower values (below 40cm) for the groups of normal and underweight, but these are compensated in these groups by the presence of top scores (close to and even over 50cm).

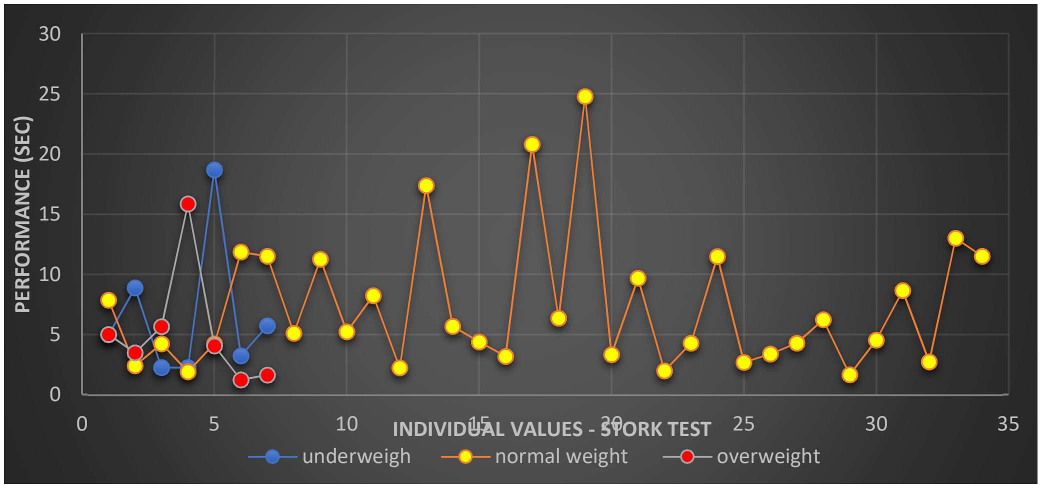

Fig. 3. Individual results for the Stork test

For the Stork test we identified the best average scores at the level of the normal weight, followed by the underweight, but all the differences between the resulting pairs are statistically insignificant (Z values are associated with P> 0.05 thresholds). The presentation of the individual results (fig. 3) signals a placement of the overweight results below the average value of this group (5.27sec), with one exception, which exceeds 15 sec. Even if in the normal weight and underweight groups we encounter isolated individual values of less than 5 sec, at the level of these groups the highest individual results are registered (with an extreme score of 25 sec), which increases the average of the mentioned groups.

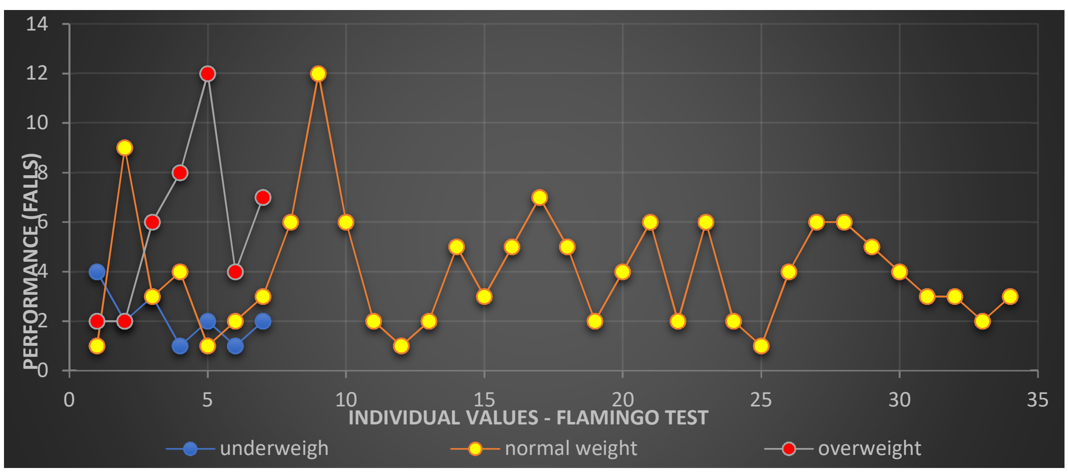

Fig. 4. Individual results for the Flamingo test

The comparison of the results between the groups for the Flamingo test generates the first significant differences between the groups, the best average performances being reported for the group of underweight students (only 2.14 falls). There is a significant difference between the results of the underweight and normal weight group (Z = -2.091 and P = .037), an aspect confirmed for the comparison at the level of the underweight-overweight pair (Z = -2.227 and P = .026). However, there are no significant differences between the groups of normal and overweight (Z = -1.401 and P = .161, value> 0.05). The presentation of the individual results (fig. 4) signals the existence of a large number of falls for most of the overweight group, as well as the existence of performance without error/falls (performing the test in the first attempt) for the group of underweight (2 cases) and normal weight (4 cases).

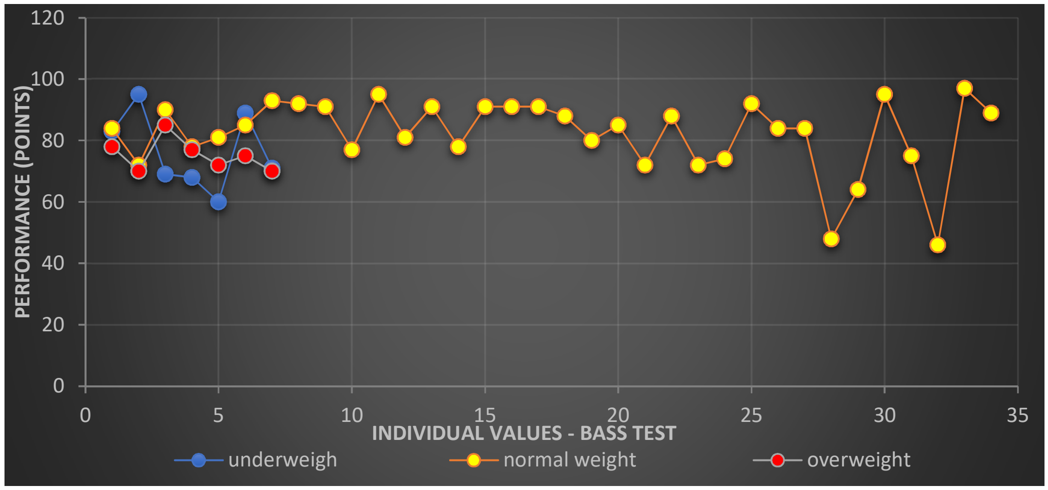

Fig. 5. Individual results for the Bass test

The average values recorded in the Bass test indicate the superiority of the group of normal-weight students, and the average scores of the groups of overweight and underweight are close, with a slight advantage for underweight. Significant differences are registered only between the performances of normal weight and overweight (Z = -2.240, P = .025, value <0.05), for the other compared pairs being reported only insignificant differences (P> 0.05). The individual results (fig. 5) indicate lower extreme scores (below 50 points) for 2 cases at the level of the normal weight group, but compensated by 11 cases placed at higher extreme scores (which have values over 90 points) and thus increasing the average value of this analyzed group.

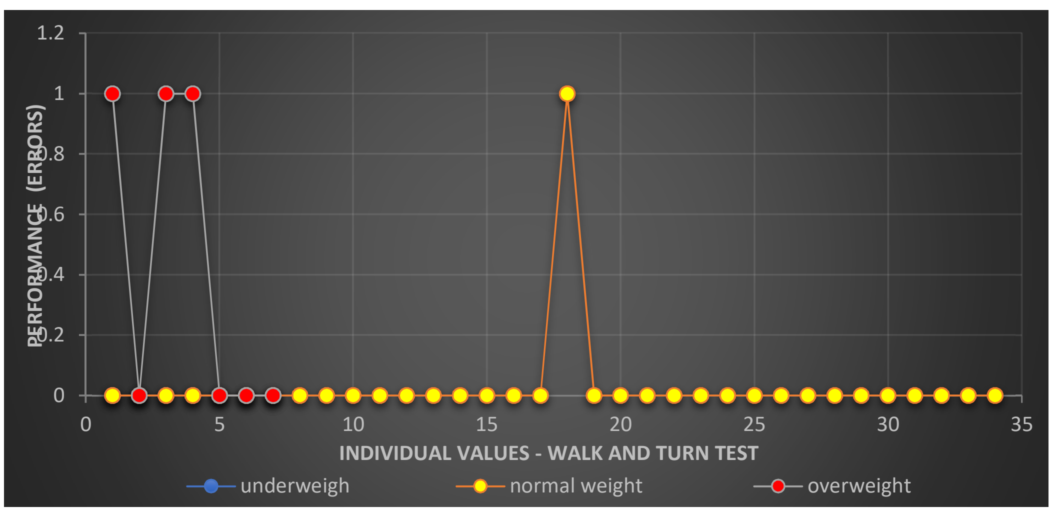

Fig. 6. Individual results for the Walk and turn field sobriety test

Walk and turn field sobriety test generates the best average result for underweight students (who complete the test without any mistakes), for the group of normal weight there is only one case where errors are present, but for overweight there are 3 cases that make mistakes (for turning to 180^0 or exceeding the marking line), according to fig. 6. However, no student commits more than one error in this test. Significant differences are registered only between the group of normal weight and the group of overweight (Z = -3.201, P = .001), for the other comparisons being reported only insignificant differences (P> 0.05).

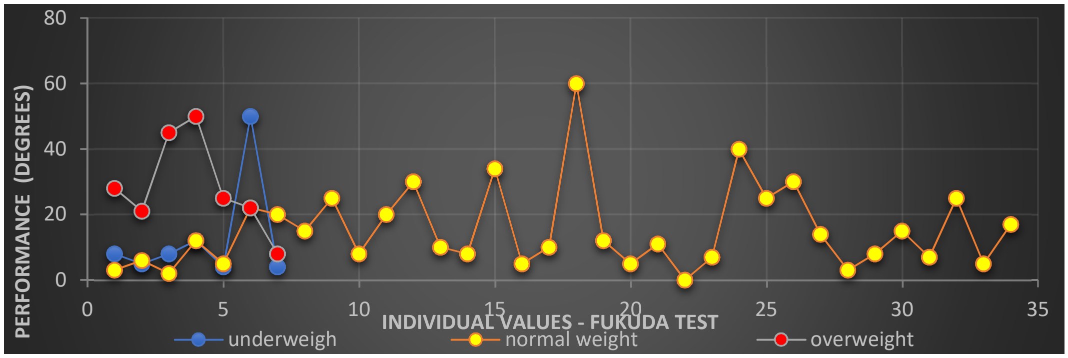

Fig. 7. Individual results for the Fukuda test

The average results in the Fukuda test indicate higher stability of normal weight and underweight, significant differences being reported between the group of underweight and overweight students (Z = -2.058, P = .040), respectively between the normal weight and overweight (Z = -2.308, P = .021). However, there are no significant differences between the underweight and normal weight groups (P> 0.05). At the level of individual values of overweight (fig. 7) it is observed that only one student has values below 10^0, there are 2 cases that exceed the value of 30^0, as a threshold that signals the manifestation of vestibular problems. For the underweight group the situation is reversed, with a single extreme score (50^0), the rest of the values being mostly below 10^0. At the level of the whole group dominates the rotation of the body around its own axis to the right (34 cases, ie 70.83%) and only 14 students perform the rotation on the left side (29.16%).

4. Discussion

Research on athletes of varying ages and various specializations (running, wrestling, tennis, football, skiing, gymnastics, boxing, alpine skiing, speed skating) identifies a better balance of them, compared to similar groups of non-athletes, maintaining the bipedal position with eyes open and closed [57]. For children and adolescents (6-18 years) it was found that the absolute values of the balance parameters changed with increasing age, but the athletic / sports activity does not influence the parameters of absolute and relative balance, regardless of age and gender [58]. Other sources highlight the importance of puberty in influencing the values of body stability [59,60]. Very good values of the balance of Slovenian gymnasts (characterized by lower balance and speed of the CoP), compared to young non-gymnasts are identified by [61]. Branches and sports events influence the manifestation of static balance differently: gymnasts and martial arts practitioners are at the top, followed by practitioners of soccer, wrestling, weight lifting and basketball. Wrestling practitioners, then soccer and gymnastics practitioners have superior values of dynamic balance [62]. For our group, the good results and the lack of significant differences for a series of tests are explained by the fact that most students are involved in physical performance activities or leisure activities.

The comparison of gender balance (10-29 years) by video-force plate analysis indicates a superior postural stability of women for bipodal and unipodal evaluation [63]. Young women with military specializations / Air Assault (x = 26.4 years) have better values than men in static balance tests, without confirming these differences for the dynamic one, according to [64]. Research by age ranges indicates a constancy of the values of balance at youth and maturity, but they decrease after 50 years, overweight women having poorer performance than normal weight, an aspect similar to our research [65]. Another study identifies walking problems and weaker balance values for the obese when taking the Functional reach test, in according to [66]. However, in this test we did not identify significant differences between the studied groups. Analyzes on young people (10-21 years old) signal the difficulties of overweight in the performance of the Bruininks-Oseretsky set of tests [67]. For overweight and obese pubertal children (12-15 years), muscle strength deficits are reported in the lower limbs and lower performance of the balance in the antero-posterior direction / AP compared to normal-weight children [68]. Obese young people (x = 21.7 years) have the lowest scores on bipodal and unipodal assessment of balance, compared to underweight and normal weight [69], conclusions also confirmed by our research. Another study conducted on Brazilian children (6-9 years) identifies negative associations between one leg standing performance, respectively standing on tiptoes and high BMI scores, according to [70], ideas also confirmed by our study.

Although no statistically significant differences were found between normal and obese young people in dynamic balance tests, obese people had poorer results, accompanied by spinal problems and head orientation (lordosis, kyphosis, and head protrusion), increased time to solve motor loads, mid-lateral oscillations and higher risks of falling [71]. Physical activities / PA implemented in the programs of adult obese people with hypertension / HA problems, increase fitness level and balance performance in one leg standing test [72]. Other sources highlight the beneficial effects of exercise performed in water for therapeutic purposes [73]. The application of dynamic balance optimization programs (5 weeks) for older overweight women (with the request of the involved muscular and visual components) is effective in terms of the values of static stability obtained [74]. Physical exercises specifically designed for obese people are proposed by [75]. Other research confirms the usefulness of implementing balanced training (for 4 weeks) in obese adults (under 50 years), improving static and dynamic performance, according to [76]. Using Yoga techniques (also 4 weeks x 3 lessons per week) increases performance on the Functional reach test and One leg standing balance test, for obese young people (21-25 years) [77].

Sporty Japanese university students have superior balance and superior visual acuity compared to similar groups of non-athletes [78]. The use of training programs based on balance exercises gives Czech sports students, with gymnastic specialization, a superior static stability in the Flamingo test, for both legs, according to [79]. Other research indicates that dancers have a higher balance than non-dancers [80]. Polish university students with a long history of practicing regular dancing (at least 7 years old) have obviously better values of unipodal and bipodal static stability compared to sedentary ones [81]. Young Slovenian sports dancers have better static balance scores than other athletes, with girls performing better than boys, according to [82]. Women involved in technical sports (gymnastics, diving, ski jumping) have better postural stability, compared to recreational sports and those involved in sports games/basketball [83]. For Turkish students with sports specialization there are progress in the performance of static balance / Flamingo test, after the implementation of a program lasting 12 weeks, based on structures in artistic gymnastics [84]. Adaptations of proprioceptive and vestibular functions to the specific demands of rowing give the practitioners of this sport better values of unipodal and bipodal static balance, compared to field sport athletes [85]. Limiting physically inactive behaviors improves the values of static balance, the involvement of young people (x = 21 years) in physical activities of moderate to vigorous intensity generates a reduction in the CoP balance, being found better scores of women and higher values when testing with open eyes [86].

The information provided by these analyzed researches confirms the results of our study, related to the fact that overweight students have the poorest performance on balance tests. However, the constant involvement of the analyzed groups in physical activities limits the differences between the groups, which is a strong argument for the role of physical effort, in the improvement of static and dynamic body stability values.

5. Conclusions

We found a lack of significant thresholds when comparing the results between the 3 groups ($P > 0.05$) for Stork test, Standing balance test and Functional reach test, so the working hypothesis formulated is only partially confirmed. The group of normal-weight students has the best average results in the Stork test and Bass test, and the underweight in the rest of the tests, the overweight women still having the weakest average performance in all balance tests.

The only significant difference between underweight and normal weight (P <0.05) is found in the Flamingo test, with better values of underweight, for the rest of the tests being reported only insignificant differences between the 2 groups. Significant difference thresholds are recorded between the underweight and overweight groups only for the Flamingo test and the Fukuda test (Z values have associated thresholds P<0.05). The most significant differences are found between the normal weight and overweight groups (P <0.05), respectively for the Bass test, Fukuda test and Walk and turn field sobriety test.

The results indicate that constant physical activity (as a feature of the analyzed group) reduces the chances of significant differences in all balance tests between BMI levels, most studies analyzed identify significantly lower values for overweight / obese groups.

The resulting data cannot be generalized, primarily due to the low number of cases for the underweight and overweight group, but also because all investigated students have constant concerns about involvement in physical activities, which is a feature of the investigated group.

Author Contributions: "Conceptualization, G.D.M.; methodology, G.D.M. and I.O.; software, G.D.M.; validation, G.D.M.; formal analysis, G.D.M. and I.O.; investigation, G.D.M.; resources, G.D.M, I.O.; data curation, G.D.M.; writing—original draft preparation, G.D.M.; writing—review and editing, G.D.M. and I.O.; visualization, G.D.M. and I.O.; supervision, G.D.M.; project administration, G.D.M. and I.O; funding acquisition, G.D.M. All authors have read and agreed to the published version of the manuscript." **These authors contributed equally to this paper as senior authors.**

Funding: "This research received no external funding"

Institutional Review Board Statement: "The study was conducted according to the guidelines of the Declaration of Helsinki, and ap-proved by the Institutional Review Board (or Ethics Committee) of "Dunarea de Jos" University of Galati.".

Informed Consent Statement: All investigated students agreed to participate in the stud

Acknowledgments: The authors of this work thank the students of the Faculty of Physical Education and Sports from Galati, for their involvement in the research carried out.

Conflicts of Interest: "The authors declare no conflict of interest."

References

1. Feletti, F.; Mucci, V.; Aliverti, A. Chapter 62 - Posture Analysis in Extreme Sports. In *DHM and Posturography*; Scataglini, S., Paul, G., Eds.; Academic Press, 2019; pp. 791–798 ISBN 978-0-12-816713-7.
2. Raffi, M.; Piras, A.; Persiani, M.; Squatrito, S. Importance of Optic Flow for Postural Stability of Male and Female Young Adults. *Eur J Appl Physiol* **2014**, *114*, 71–83, doi:10.1007/s00421-013-2750-4.
3. Vos, L.A.; Prins, M.R.; Kingma, I. Training Potential of Visual Feedback to Improve Dynamic Postural Stability. *Gait & Posture* **2022**, *92*, 243–248, doi:10.1016/j.gaitpost.2021.11.040.
4. Potop, V.A.; Grad, R.; Boloban, V.N. Biomechanical Indicators of Key Elements of Sports Equipment Gymnastic Exercises. *Pedagogics, psychology, medical-biological problems of physical training and sports* **2013**, *17*, 59–72.
5. Dobre, A.G.; Gheorghe, C. The Optimization of the Running Technique Using Video Analysis Method. *J. Phys.: Conf. Ser.* **2021**, *1746*, 012086, doi:10.1088/1742-6596/1746/1/012086.
6. Harabagiu, N.; Pârvu, C. The Statistical Analysis of the Game Actions of the Middle-Blocker Based on the Application of the "Data Volley" Software. *Revista Romaneasca pentru Educatie Multidimensionala* **2022**, *14*, 101–110, doi:10.18662/rrem/14.1Sup1/539.
7. Bădicu, G. Physical Activity and Health-Related Quality of Life in Adults from Braşov, Romania. *Education Sciences* **2018**, *8*, 52, doi:10.3390/educsci8020052.
8. Constantinescu, M.; Vizitiu, E. A Comparative Approach on the Impact of Diet and Physical Activity on Young People between 19 and 26 Years. *Balneo and PRM Research Journal* **2021**, *12*, 265–269, doi:10.12680/balneo.2021.447.
9. Postelnicu, M.G.; Mihaila, M.I. Study on the Importance of Physical Training for Junior Female Handball Teams from Romania. *Bulletin of the Transilvania University of Braşov. Series IX: Sciences of Human Kinetics* **2022**, 9–16, doi:10.31926/but.shk.2022.15.64.1.1.

10. Olănescu, M. Study On Sports Socialization Among University Students. *GYMNASIUM* **2021**, *XXII*, 19–33, doi:10.29081/gsjesh.2021.22.1.02.
11. Năstase, F.; Radaschin, D.S.; Niculeţ, E.; Brădeanu, A.V.; Verenca, M.C.; Nechita, A.; Chioncel, V.; Nwabudike, L.C.; Baroiu, L.; Polea, E.D.; et al. Orthopaedic Manifestations of Neurofibromatosis Type 1: A Case Report. *Experimental and Therapeutic Medicine* **2022**, *23*, 1–7, doi:10.3892/etm.2021.11058.
12. Pagnotti, G.M.; Haider, A.; Yang, A.; Cottell, K.E.; Tuppo, C.M.; Tong, K.-Y.; Pryor, A.D.; Rubin, C.T.; Chan, M.E. Postural Stability in Obese Preoperative Bariatric Patients Using Static and Dynamic Evaluation. *OFA* **2020**, *13*, 499–513, doi:10.1159/000509163.
13. Cruz-Gómez, N.S.; Plascencia, G.; Villanueva-Padrón, L.A.; Jáuregui-Renaud, K. Influence of Obesity and Gender on the Postural Stability during Upright Stance. *OFA* **2011**, *4*, 212–217, doi:10.1159/000329408.
14. Verbecque, E.; Coetzee, D.; Ferguson, G.; Smits-Engelsman, B. High BMI and Low Muscular Fitness Predict Low Motor Competence in School-Aged Children Living in Low-Resourced Areas. *International Journal of Environmental Research and Public Health* **2021**, *18*, 7878, doi:10.3390/ijerph18157878.
15. Teasdale, N.; Simoneau, M.; Corbeil, P.; Handrigan, G.; Tremblay, A.; Hue, O. Obesity Alters Balance and Movement Control. *Curr Obes Rep* **2013**, *2*, 235–240, doi:10.1007/s13679-013-0057-8.
16. Castillo-Rodríguez, A.; Onetti-Onetti, W.; Sousa Mendes, R.; Luis Chinchilla-Minguet, J. Relationship between Leg Strength and Balance and Lean Body Mass. Benefits for Active Aging. *Sustainability* **2020**, *12*, 2380, doi:10.3390/su12062380.
17. Cancela Carral, J.M.; Ayán, C.; Sturzinger, L.; Gonzalez, G. Relationships Between Body Mass Index and Static and Dynamic Balance in Active and Inactive Older Adults. *Journal of Geriatric Physical Therapy* **2019**, *42*, E85, doi:10.1519/JPT.0000000000000195.
18. Abe, T.; Ogawa, M.; Loenneke, J.P.; Thiebaud, R.S.; Loftin, M.; Mitsukawa, N. Association between Site-Specific Muscle Loss of Lower Body and One-Leg Standing Balance in Active Women: The HIREGASAKI Study. *Geriatrics & Gerontology International* **2014**, *14*, 381–387, doi:10.1111/ggi.12112.
19. Ángyán, L.; Téczely, T.; Ángyán, Z. Factors Affecting Postural Stability of Healthy Young Adults. *Acta Physiologica Hungarica* **2007**, *94*, 289–299, doi:10.1556/aphysiol.94.2007.4.1.
20. Baghbani, F.; Woodhouse, L.J.; Gaeini, A.A. Dynamic Postural Control in Female Athletes and Nonathletes After a Whole-Body Fatigue Protocol. *Journal of Strength and Conditioning Research* **2016**, *30*, 1942–1947, doi:10.1519/JSC.0000000000001275.
21. Krawczyk-Suszek, M.; Martowska, B.; Sapuła, R. Analysis of the Stability of the Body in a Standing Position When Shooting at a Stationary Target—A Randomized Controlled Trial. *Sensors* **2022**, *22*, 368, doi:10.3390/s22010368.
22. Johnston, W.; Dolan, K.; Reid, N.; Coughlan, G.F.; Caulfield, B. Investigating the Effects of Maximal Anaerobic Fatigue on Dynamic Postural Control Using the Y-Balance Test. *Journal of Science and Medicine in Sport* **2018**, *21*, 103–108, doi:10.1016/j.jsams.2017.06.007.
23. Maciaszek, J.; Honsová, Š.; Knisel, E.; Epping, R.; Ołpińska-Lischka, M.; Michał, B.; Pospieszna, B. Physical Activity Rates of Male and Female Students from Selected European Physical Education Universities. *Trends in Sport Sciences 2020 Vol.27 No.2* **2020**, 63–69, doi:10.23829/TSS.2020.27.2-3.
24. Holden, S.; Boreham, C.; Delahunt, E. Sex Differences in Landing Biomechanics and Postural Stability During Adolescence: A Systematic Review with Meta-Analyses. *Sports Med* **2016**, *46*, 241–253, doi:10.1007/s40279-015-0416-6.
25. Holden, S.; Boreham, C.; Doherty, C.; Wang, D.; Delahunt, E. Dynamic Postural Stability in Young Adolescent Male and Female Athletes. *Pediatric Physical Therapy* **2014**, *26*, 447–452, doi:10.1097/PEP.0000000000000071.
26. Lee, A.J.Y.; Lin, W.-H. The Influence of Gender and Somatotype on Single-Leg Upright Standing Postural Stability in Children. *Journal of Applied Biomechanics* **2007**, *23*, 173–179, doi:10.1123/jab.23.3.173.
27. Ozcan Kahraman, B.; Kahraman, T.; Kalemci, O.; Salik Sengul, Y. Gender Differences in Postural Control in People with Nonspecific Chronic Low Back Pain. *Gait & Posture* **2018**, *64*, 147–151, doi:10.1016/j.gaitpost.2018.06.026.
28. Muehlbauer, T.; Mettler, C.; Roth, R.; Granacher, U. One-Leg Standing Performance and Muscle Activity: Are There Limb Differences? *Journal of Applied Biomechanics* **2014**, *30*, 407–414, doi:10.1123/jab.2013-0230.
29. Schorderet, C.; Hilfiker, R.; Allet, L. The Role of the Dominant Leg While Assessing Balance Performance. A Systematic Review and Meta-Analysis. *Gait & Posture* **2021**, *84*, 66–78, doi:10.1016/j.gaitpost.2020.11.008.
30. Casonatto, J.; Yamacita, C.M. Pilates Exercise and Postural Balance in Older Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Complementary Therapies in Medicine* **2020**, *48*, 102232, doi:10.1016/j.ctim.2019.102232.
31. Oliver, G.D.; Brezzo, R.D. Functional Balance Training in Collegiate Women Athletes. *The Journal of Strength & Conditioning Research* **2009**, *23*, 2124–2129, doi:10.1519/JSC.0b013e3181b3dd9e.
32. Eylen, M.A.; Daglioglu, O.; Gucenmez, E. The Effects of Different Strength Training on Static and Dynamic Balance Ability of Volleyball Players. *Journal of Education and Training Studies* **2017**, *5*, 13–18, doi:10.11114/jets. v5i13.2881.
33. Dunsky, A.; Barzilay, I.; Fox, O. Effect of a Specialized Injury Prevention Program on Static Balance, Dynamic Balance and Kicking Accuracy of Young Soccer Players. *World J Orthop* **2017**, *8*, 317–321, doi:10.5312/wjo.v8.i4.317.
34. Lopes, M.; Lopes, S.; Patinha, T.; Araújo, F.; Rodrigues, M.; Costa, R.; Oliveira, J.; Ribeiro, F. Balance and Proprioception Responses to FIFA 11+ in Amateur Futsal Players: Short and Long-Term Effects. *Journal of Sports Sciences* **2019**, *37*, 2300–2308, doi:10.1080/02640414.2019.1628626.
35. Čular, D.; Miletić, A.; Miletić, Đ. UNICYCLING AND BALANCE IMPROVEMENT. *Acta kinesiologica* **2010**, *4*, 75-81.

36. Davoodeh, S.; Sheikh, M.; Houminiyan Sharifabadi, D.; Bagherzadeh, F. The Effect of Wii Fit Exergames on Static Balance and Motor Competence in Obese and Non-Obese College Women. *Acta Gymnica* **2020**, *50*, 61–67, doi:10.5507/ag.2020.008.
37. Mohammadi, V.; Alizadeh, M.; Gaieni, A. The Effects of Six Weeks Strength Exercises on Static and Dynamic Balance of Young Male Athletes. *Procedia - Social and Behavioral Sciences* **2012**, *31*, 247–250, doi:10.1016/j.sbspro.2011.12.050.
38. Morales, J.; Ubasart, C.; Solana-Tramunt, M.; Villarrasa-Sapiña, I.; González, L.-M.; Fukuda, D.; Franchini, E. Effects of Rapid Weight Loss on Balance and Reaction Time in Elite Judo Athletes. *International Journal of Sports Physiology and Performance* **2018**, *13*, 1371–1377, doi:10.1123/ijspp.2018-0089.
39. Seyedi, M.; Nobari, H.; Abbasi, H.; Khezri, D.; Oliveira, R.; Pérez-Gómez, J.; Badicu, G.; Afonso, J. Effect of Four Weeks of Home-Based Balance Training on the Performance in Individuals with Functional Ankle Instability: A Remote Online Study. *Healthcare* **2021**, *9*, 1428, doi:10.3390/healthcare9111428.
40. Gökdemir, K.; Cigerci, A.E.; er, fa; Suveren Erdoğan, C.; Sever, O. The Comparison of Dynamic and Static Balance Performance of Sedentary and Different Branches Athletes. *World Applied Sciences Journal* **2012**, *17*, 1079–1082.
41. Göktepe, M.M.; Günay, M. The Effects of Proprioceptive Exercise Programme given to Female Footballers Their on Balance, Proprioceptive Sense and Functional Performance: Kadın Futbolculara Uygulanan Proprioseptif Egzersiz Programının, Denge, Proprioseptif Duyu ve Fonksiyonel Performans Üzerine Etkisi. *Journal of Human Sciences* **2019**, *16*, 1051–1070, doi:10.14687/jhs.v16i4.5824.
42. Pereira, R.; Krustrup, P.; Castagna, C.; Coelho, E.; Santos, R.; Helge, E.W.; Jørgensen, N.R.; Magalhães, J.; Póvoas, S. Effects of Recreational Team Handball on Bone Health, Postural Balance and Body Composition in Inactive Postmenopausal Women — A Randomised Controlled Trial. *Bone* **2021**, *145*, 115847, doi:10.1016/j.bone.2021.115847.
43. Martínez-Córcoles, V.; Nieto-Gil, P.; Ramos-Petersen, L.; Ferrer-Torregrosa, J. Balance Performance Analysis after the COVID-19 Quarantine in Children Aged between 8 and 12 Years Old: Longitudinal Study. *Gait & Posture* **2022**, *94*, 203–209, doi:10.1016/j.gaitpost.2022.03.019.
44. Vizitiu, E.; Constantinescu, M. Chapter 27 - Impact of Physical Activities on Overweight People during the COVID-19 Pandemic. In *Biomedical Engineering Applications for People with Disabilities and the Elderly in the COVID-19 Pandemic and Beyond*; Balas, V.E., Geman, O., Eds.; Academic Press, 2022; pp. 313–324 ISBN 978-0-323-85174-9.
45. Olpińska-Lischka, M.; Kujawa, K.; Maciaszek, J. Differences in the Effect of Sleep Deprivation on the Postural Stability among Men and Women. *International Journal of Environmental Research and Public Health* **2021**, *18*, 3796, doi:10.3390/ijerph18073796.
46. Balance Fitness Tests Available online: https://www.topendsports.com/testing/balance.htm (accessed on 27 January 2022).
47. Functional Reach Test (FRT) Available online: https://www.physio-pedia.com/Functional_Reach_Test_(FRT) (accessed on 27 January 2022).
48. Walden, T. Standardized Field Sobriety Testing: Learning from Our Mistakes.
49. Zhang, Y.; Wang, W. Reliability of the Fukuda Stepping Test to Determine the Side of Vestibular Dysfunction. *J Int Med Res* **2011**, *39*, 1432–1437, doi:10.1177/147323001103900431.
50. Amir, D.; Amir, H.S.; Saeed, G.; Amir, G.R. The Effect of Diurnal Rhythms on Static and - ProQuest. *Biomedical Human Kinetic* **2021**, *13*, 205–211, doi:0.2478/bhk-2021-0025.
51. Karagul, O.; Nalcakan, G.R.; Dogru, Y.; Tas, M. EFFECTS OF CIRCADIAN RHYTHM ON BALANCE PERFORMANCE. *Polish Journal of Sport and Tourism* **2017**, *24*, 155–161, doi:10.1515/pjst-2017-0016.
52. Sandu, A.S. *Etica si deontologie profesionala*; Lumen: Iasi, 2012; ISBN 978-973-166-302-9.
53. World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. *JAMA* **2013**, *310*, 2191, doi:10.1001/jama.2013.281053.
54. Murariu, G. *Fizică Statistică Și Computațională-Aspecte Contemporane Si Aplicații*; Galați University Press: Galati, 2018;
55. Murariu, G.; Munteanu, D. *Lucrări Practice de Identificare, Modelare Şi Simulare a Proceselor Fizice*; Galați: University Press: Galati, 2018;
56. Opariuc, D.C. *Statistica Aplicata in Stiintele Socio-Umane. Analiza Asocierilor Şi a Diferenţelor Statistice*; Arhip Art: Sibiu, 2011;
57. Andreeva, A.; Melnikov, A.; Skvortsov, D.; Akhmerova, K.; Vavaev, A.; Golov, A.; Draugelite, V.; Nikolaev, R.; Chechelnickaia, S.; Zhuk, D.; et al. Postural Stability in Athletes: The Role of Sport Direction. *Gait & Posture* **2021**, *89*, 120–125, doi:10.1016/j.gaitpost.2021.07.005.
58. Ludwig, O.; Kelm, J.; Hammes, A.; Schmitt, E.; Fröhlich, M. Neuromuscular Performance of Balance and Posture Control in Childhood and Adolescence. *Heliyon* **2020**, *6*, e04541, doi:10.1016/j.heliyon.2020.e04541.
59. Alexe, D.I. *Implicaţiile Psihomotricităţii În Manifestarea Echilibrului La Pubertate*; Performantica: Iasi, 2012; ISBN 978-973-730-968-6.
60. Alexe, D.I. *Echilibrul La Pubertate. Relaţia Dominanţă Emisferică – Performanţă*; Performantica: Iasi, 2013; ISBN 978-606-685-004-9.
61. Čeklić, U.; Šarabon, N.; Kozinc, Ž. Postural Control in Unipedal Quiet Stance in Young Female Gymnasts and the Effects of Training with Consideration of Transient Behavior of Postural Sway. *International Journal of Environmental Research and Public Health* **2022**, *19*, 982, doi:10.3390/ijerph19020982.

62. Feizolahi, F.; Azarbayjani, M.-A. Comparison of Static and Dynamic Balance in Amateur Male Athletes. *The Scientific Journal of Rehabilitation Medicine* **2014**, *3*, 89–98, doi:10.22037/jrm.2014.1100069.
63. Howell, D.R.; Hanson, E.; Sugimoto, D.; Stracciolini, A.; Meehan, W.P.I. Assessment of the Postural Stability of Female and Male Athletes. *Clinical Journal of Sport Medicine* **2017**, *27*, 444–449, doi:10.1097/JSM.0000000000000374.
64. Sell, T.C.; Lovalekar, M.T.; Nagai, T.; Wirt, M.D.; Abt, J.P.; Lephart, S.M. Gender Differences in Static and Dynamic Postural Stability of Soldiers in the Army's 101st Airborne Division (Air Assault). *Journal of Sport Rehabilitation* **2018**, *27*, 126–131, doi:10.1123/jsr.2016-0131.
65. Iverson, G.L.; Koehle, M.S. Normative Data for the Balance Error Scoring System in Adults. *Rehabilitation Research and Practice* **2013**, *2013*, e846418, doi:10.1155/2013/846418.
66. Sarkar, A.; Singh, M.; Bansal, N.; Kapoor, S. Effects of obesity on balance and gait alterations in young adults. *Indian J Physiol Pharmacol* **2011**, *55(3)*, 7.
67. Goulding, A.; Jones, I.E.; Taylor, R.W.; Piggot, J.M.; Taylor, D. Dynamic and Static Tests of Balance and Postural Sway in Boys: Effects of Previous Wrist Bone Fractures and High Adiposity. *Gait & Posture* **2003**, *17*, 136–141, doi:10.1016/S0966-6362(02)00161-3.
68. Alhusaini, A.A.; Melam, G.; Buragadda, S. The Role of Body Mass Index on Dynamic Balance and Muscle Strength in Saudi Schoolchildren. *Science & Sports* **2020**, *35*, 395.e1-395.e9, doi:10.1016/j.scispo.2019.11.007.
69. Ku, P.X.; Abu Osman, N.A.; Yusof, A.; Wan Abas, W.A.B. Biomechanical Evaluation of the Relationship between Postural Control and Body Mass Index. *Journal of Biomechanics* **2012**, *45*, 1638–1642, doi:10.1016/j.jbiomech.2012.03.029.
70. Cardoso, L. de P.; Pereira, K.; Bertoncello, D.; Castro, S.S. de; Fonseca, L.L.M.; Walsh, I.A.P. de OVERWEIGHT AND BALANCE IN SCHOOLCHILDREN: A CASE-CONTROL STUDY. *J. Phys. Educ.* **2017**, *28*, doi:10.4025/jphyseduc.v28i1.2827.
71. do Nascimento, J.A.; Silva, C.C.; dos Santos, H.H.; de Almeida Ferreira, J.J.; de Andrade, P.R. A Preliminary Study of Static and Dynamic Balance in Sedentary Obese Young Adults: The Relationship between BMI, Posture and Postural Balance. *Clinical Obesity* **2017**, *7*, 377–383, doi:10.1111/cob.12209.
72. Krzysztoszek, J.; Maciaszek, J.; Bronikowski, M.; Karasiewicz, M.; Laudańska-Krzemińska, I. Comparison of Fitness and Physical Activity Levels of Obese People with Hypertension. *Applied Sciences* **2021**, *11*, 10330, doi:10.3390/app112110330.
73. Munteanu, C.; Munteanu, D. Thalassotherapy Today. *BALNEO* **2019**, *10*, 440–444, doi:10.12680/balneo.2019.278.
74. Bellafiore, M.; Battaglia, G.; Bianco, A.; Paoli, A.; Farina, F.; Palma, A. Improved Postural Control after Dynamic Balance Training in Older Overweight Women. *Aging Clin Exp Res* **2011**, *23*, 378–385, doi:10.1007/BF03337762.
75. Raţă, E.; Havriş, D. Alternative Exercise in Fighting Obesity. *Annals of "Dunarea de Jos" University of Galati. Fascicle XV, Physical Education and Sport Management* **2012**, *2*, 5.
76. Rojhani-Shirazi, Z.; Azadeh Mansoriyan, S.; Hosseini, S.V. The Effect of Balance Training on Clinical Balance Performance in Obese Patients Aged 20–50 Years Old Undergoing Sleeve Gastrectomy. *Eur Surg* **2016**, *48*, 105–109, doi:10.1007/s10353-015-0379-8.
77. Jorrakate, C.; Kongsuk, J.; Pongduang, C.; Sadsee, B.; Chanthorn, P. Effect of Yoga Training on One Leg Standing and Functional Reach Tests in Obese Individuals with Poor Postural Control. *Journal of Physical Therapy Science* **2015**, *27*, 59–62, doi:10.1589/jpts.27.59.
78. Koide, Y.; Ueki, Y.; Asai, Y.; Morimoto, H.; Asai, H.; Johnson, E.G.; Lohman, E.B.; Sakuma, E.; Mizutani, J.; Ueki, T.; et al. Differences in Postural Stability and Dynamic Visual Acuity among Healthy Young Adults in Relation to Sports Activity: A Cross Sectional Study. *Journal of Physical Therapy Science* **2019**, *31*, 53–56, doi:10.1589/jpts.31.53.
79. Krištofič, J.; Malý, T.; Zahálka, F. The effect of intervention balance program on postural stability. *Science of Gymnastics Journal* **2018**, *10*, 13.
80. Harmon, B.V.; Reed, A.N.; Rogers, R.R.; Marshall, M.R.; Pederson, J.A.; Williams, T.D.; Ballmann, C.G. Differences in Balance Ability and Motor Control between Dancers and Non-Dancers with Varying Foot Positions. *Journal of Functional Morphology and Kinesiology* **2020**, *5*, 54, doi:10.3390/jfmk5030054.
81. Stawicki, P.; Wareńczak, A.; Lisiński, P. Does Regular Dancing Improve Static Balance? *International Journal of Environmental Research and Public Health* **2021**, *18*, 5056, doi:10.3390/ijerph18105056.
82. Trajković, N.; Smajla, D.; Kozinc, Ž.; Šarabon, N. Postural Stability in Single-Leg Quiet Stance in Highly Trained Athletes: Sex and Sport Differences. *Journal of Clinical Medicine* **2022**, *11*, 1009, doi:10.3390/jcm11041009.
83. Lauenroth, A.; Reinhardt, L.; Schulze, S.; Laudner, K.G.; Delank, K.-S.; Schwesig, R. Comparison of Postural Stability and Regulation among Female Athletes from Different Sports. *Applied Sciences* **2021**, *11*, 3277, doi:10.3390/app11073277.
84. Özer, Ö.; Soslu, R. Comparison of the Static Balance, Strength and Flexibility Characteristics of the University Students Who Taken Artistic Gymnastic Lesson. *Turkish Journal of Sport and Exercise* **2019**, *21*, 229–233, doi:10.15314/tsed.573516.
85. Marinkovic, D.; Pavlovic, S.; Madic, D.; Obradovic, B.; Németh, Z.; Belic, A. Postural Stability – a Comparison between Rowers and Field Sport Athletes. *JPES* **2021**, *21*, 1525–1532, doi:10.7752/jpes.2021.03194.
86. Zhu, W.; Li, Y.; Wang, B.; Zhao, C.; Wu, T.; Liu, T.; Sun, F. Objectively Measured Physical Activity Is Associated with Static Balance in Young Adults. *International Journal of Environmental Research and Public Health* **2021**, *18*, 10787, doi:10.3390/ijerph182010787.