RELATIONSHIP BETWEEN STRENGTH/POWER AND DYNAMIC BALANCE IN 1ST-YEAR UNDERGRADUATE STUDENTS – PILOT STUDY

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ABSTRACT. Aim: Examine the relationship between lower limb strength/power and dynamic balance, and whether lower limb strength differences influence balance. **Methods:** 85 subjects (mean age 20.14, ±0.44) - female (n=63) and male (n=22) 1st-year undergraduate students - participated in this study. Standing long jump and single leg triple hop jump tests were used to determine strength/power, and balance board was used to determine balance. **Results:** The statistical analysis has revealed no statistically significant correlation between lower limb strength and the average time on balance board after three essays (r = 0.102, df = 83, p = 0.35). As for the relationship between the difference in the scores of the three successive single leg hop jumps and the average time on balance board after three essays, no statistically significant correlation has been found in this case either (r = 0.136, df = 83, p = 0.21). The average score of hop jumps on right leg is (M = 412.54 cm) and the average score of hop jumps on left leg is (M = 403.07 cm); according to the statistical analysis, they differ significantly (t = 2.227, df = 84, p = 0.029). There is a significant difference (t = - 2.625, df = 84, p = 0.01) between the average time on balance board after the first essay (M = 24. 77) and the average time on balance board after the third essay (M = 27.21). **Conclusions:** In this study, the statistical analysis has revealed no statistically significant correlation between lower limb strength/power and balance. No statistically significant correlation has been found between lower limb strength difference and balance either. Balance board is important in balance development, as shown by the average scores of the three essays (M1 = 24.77, M2 = 26.52, M3 = 27.21).

Keywords: strength/power, dynamic balance, balance board.

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REZUMAT. *Relația dintre forță/putere și echilibrul dinamic la nivelul studen-ților de anul I – studiu pilot.* **Obiective:** Analiza relației dintre forța/puterea membrelor inferioare și echilibrul dinamic, precum și dacă diferența de forță, la nivelul membrelor inferioare, influențează echilibrul. **Metode:** La studiu au participat 85 de subiecți (vârsta medie 20.14, ±0.44), fete (n=63) băieți (n=22) studenți, în anul I. Pentru determinarea forței/puterii s-au folosit testele săritura în lungime de pe loc și tripla săritură pe un membru inferior, iar pentru determinarea echilibrului s-a folosit placa de echilibru. **Rezultate:** În urma analizei statistice, nu s-a obținut o corelație statistică semnificativă între forța membrelor inferioare și media timpilor celor trei încercări realizate pe placa de echilibru (r = 0.102, df = 83, p = 0.35). În ceea ce privește relația dintre diferența valorilor obținute la cele trei sărituri succesive pe un singur membru inferior și media timpilor celor trei încercări, pe placa de echilibru, nici în acest caz nu s-a obținut o corelație statistică semnificativă (r = 0.136, df = 83, p = 0.21). Media săriturilor pe membrul inferior drept a fost (M = 412.54 cm), pe cel stâng (M = 403.07 cm), iar conform analizei statistice, ele diferă semnificativ (t = 2.227, df =84, p = 0.029). Între media timpilor obținuți la prima încercare pe placa de echilibru (M = 24.77) și media timpilor obținuți la a treia încercare pe placa de echilibru (M = 27.21) există o diferență semnificativă (t = - 2.625, df = 84, p = 0.01). **Concluzii:** În acest studiu analiza statistică nu a scos în evidență o corelație statistică semnificativă între forța/puterea membrelor inferioare și echilibru. De asemenea, nu s-a găsit o corelație statistică semnificativă între diferența de forță la nivelul membrelor inferioare și echilibru. Placa de echilibru este importantă în dezvoltarea echilibrului, acest aspect fiind evidențiat prin mediile celor trei încercări (M1 = 24.77, M2 = 26.52, M3 = 27.21).

Cuvinte cheie: forță/putere, echilibru dinamic, placa de echilibru.

INTRODUCTION

Balance is defined as quick postural adaptation against changes in the centre of gravity at the time of activity (Gürkan et al., 2016). Highly developed strength and good ability of body rebalancing after certain movements have an influence on athletic performance, everyday physical activities, while reducing injuries (Bhat & Jamal, 2013; Muehlbauer et al., 2015). The risk of injury, particularly ankle injury, is higher in those with poor balance ability (Bhat & Jamal, 2013). Low strength/power/balance increases the risk of falling in old adults (Muehlbauer et al., 2012). Differences in lower-limb strength development can also lead to injuries. This asymmetric development is usually found in sport games. Reducing this asymmetry can have a positive influence on sport performance (Barrera-Domínguez, et al., 2021).

In high-performance sport, at the beginning of the training season, it is important determine, through tests, the level of strength/power/balance development and the relationship between them so as to define the training priorities based on those results (Hammami et al., 2016).

MATERIAL AND METHODS

The study was conducted based on a protocol that had been read and accepted by the students. The study used tests to determine lower limb strength/power, i.e. standing long jump and triple hop jump, performed from a standing position, on the same leg – first on the right leg and then, after rest, on the left leg. Swinging of arms during jumps was allowed. Balance board and stopwatch were used to determine the level of dynamic balance. The subjects had three essays in this test. If they reached 30 seconds without the ends of the board touching the ground, the subjects were stopped. The average time on balance board after the three essays was calculated at the end.

85 subjects (mean age 20.14, ±0.44) – female (n=63) and male (n=22) 1st-year undergraduate students not involved in high-performance sport – participated in this study.

SPSS (version 19) was used for statistical data analysis. A paired sample t - Test was used for comparing the outcomes on balance board. The p value used in this study was p ≤ 0.05.

RESULTS

The first test was standing long jump and the scores are shown in the table below (Table 1).

Table 1. Standing long jump scores

N	Valid	85
	Missing	0
Mean		163.67
Median		158.00
Std. Deviation		33.919

The table below shows the scores of successive hop jumps, performed from a standing position, first on right leg (M = 412.54 cm), and then on left leg (M = 403.07 cm) (Table 2).

Table 2. Scores of hop jumps, performed from a standing position,
first on right leg, then on left leg

	Mean	N	Std. Deviation	Std. Error Mean
3 Hop jump on right leg	412.54	85	92.725	10.057
3 Hop jump on left leg	403.07	85	99.708	10.815

The average score of hop jumps on right leg is (M = 412.54, st. dev. = 92.72), the average score of hop jumps on left leg is (M = 403.07, st. dev. = 99.70); according to the statistical analysis, they differ significantly (t = 2.227, df =84, p = 0.029) (Table 3).

Table 3. Difference between average score of hop jumps
on right leg and average score of hop jumps on left leg

	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
3 Hop jump on right leg 3 Hop jump on left leg	9.471	39.205	4.252	2.2 27	84	.029

The table below shows the average time on balance board after three essays (Table 4).

Table 4. Average time on balance board after three essays

		Statistic	Std. Error
N	Valid	85	0
	Missing	0	0
Mean		26.1707	.7310
Median		30.0000	.2463
Std. Deviation		6.70076	.86600

The statistical analysis has revealed no correlation between lower limb strength and average time on balance board after 3 essays (r = 0.102, df = 83, p = 0.35) (Table 5).

Table 5. Correlation between standing long jump and average time
on balance board after three essays

		Standing long jump	Average time on balance board after 3 essays
Standing long jump	Pearson Correlation	1	.102
	Sig. (2-tailed)		.352
	N	85	85
Average time on balance board after 3 essays	Pearson Correlation	.102	1
	Sig. (2-tailed)	.352	
	N	85	85

As regards the relationship between the difference in the scores of the three successive single leg hop jumps (first on right leg, then on left leg) and the average time on balance board after three essays, no statistical correlation has been revealed in this case either (r = 0.136, df = 83, p = 0.21) (Table 6).

Table 6. Correlation between difference in scores of hop jumps on right leg
and on left leg and average time on balance board after three essays

		Difference between jumps scores	Average time on balance board after 3 essays
Difference between jumps scores	Pearson Correlation	1	.136
	Sig. (2-tailed)		.213
	N	85	85
Average time on balance board after 3 essays	Pearson Correlation	.136	1
	Sig. (2-tailed)	.213	
	N	85	85

There is a statistically significant difference between the average time on balance board after the first essay (M = 24.77, st. dev. = 9.71) and the average time on balance board after the third essay (M = 27.21, st. dev. = 7.04) (t = - 2.625, df = 84, p = 0.01) (Table 7).

Table 7. Difference between average time on balance board after
one essay and average time on balance board after three essays

	Mean	Std. Dev.	Std. Error Mean	t	df	Sig. (2-tailed)
Time 1 on balance board	-2.43647	8.55657	.92809	-2.625	84	.010
Time 3 on balance board						

DISCUSSIONS

In their study, Hammami et al., (2016) found correlations between spinal extensor strength and balance, and between lower limb strength (standing long jump/countermovement jump/3 - hop jump test) and balance.

In another study conducted by Muehlbauer et al. (2012), no significant associations were found between strength/power and balance.

In our study, a significant difference has been found in lower limb strength/power, and the recommendation would be that in the future subjects pay attention to improving the strength/power of their weaker lower limb.

Some studies point out that asymmetric development of lower limb strength is associated with injury (Barrera-Domínguez et al., 2021).

CONCLUSIONS

In this study, the statistical analysis has revealed no statistical correlation between lower limb strength/power and balance. No statistical correlation has been found between the difference in lower limb strength and the time on balance board either.

The statistical analysis has revealed that the subjects' right lower limb is stronger than their left lower limb, and the recommendation would be for them to pay more attention to developing strength in their weaker lower limb so as to prevent injuries during physical/sport activities.

Balance board is important in balance development, as shown by the average scores of the three essays. There is an evolution in the subjects' ability to keep their balance from the first essay to the third one. (M1 = 24.77, M2 = 26.52, M3 = 27.21).

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