Study Concerning Several Correlations Between Jump Score, Speed Score, and Anthropometrical Indicators Among Soccer Players

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Abstract

The anthropometrical measurements and the results recorded by the athletes – amateurs and professionals – in various effort tests may represent references for coaches regarding their state and training level. A quality's development and functionality level may influence another, and thus the fitness level. This study aims to identify correlations between the results obtained in the assessment of the jump force of lower limbs (squat jump, countermovement jump, and free jump, short-distance movement level (5, 10, and 20 m), and anthropometrical measurements (body mass index, fat tissue, and muscle mass) among soccer players. We measured and tested 19 athletes, soccer players (18.7 years ± nine months). Our study has not found any significant correlation between the anthropometrical indicators and jump or speed scores. Our findings show positive correlations (*r = 0.55163; p = 0.026749*) between the force index calculated using the three trials (jump score) and the speed score. We have also found a positive correlation between speed and jump force trials: squat jump, countermovement jump, and free jump, as well as a negative correlation between jump score and 20-m speed.

Keywords: *evaluation, correlations, soccer players.*

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1. Introduction

One of the main game and training factors in soccer is represented by physical training (in turn comprising two primary components (i.e., general and specific physical training). With its well-known genetic and nutritional factors, general physical training directly influences various anthropometrical indicators, such as body mass index (BMI), body fat, or muscle mass. In turn, they may directly affect the expression level of essential motor qualities in soccer, like force and speed (Cormier, 2021).

Within the specific physical training, jump force assessment is a significant reference for practice planning and evaluation of injury risk (Croisier, 2008) and the momentary state of the players' fitness level (Myer, 2011; Kusnanik, 2017). To measure jump force for lower limbs, specialists use various methods and devices recording ever more complex data regarding the power specific to a single jump or several repeated jumps, the flight duration, the difference between the agonistic and antagonistic muscle, or the impact on the osteoarticular system (Gokeler, 2019; Herrington, 2013; Read, 2017), especially at knee level (Hewett, 2005; Fältström 2017). Furthermore, numerous studies have reported the different potential jump scores between girls and boys, athletes practising other sports, or depending on age (Fort-Vanmeerhaeghe, 2019; Lininger, 2017; Smith, 2017). Some studies have shown how a quality can influence another, i.e., the correlation between speed and jump force (Yapici, 2014, Schons, 2018), while other studies have shown direct connections between jump force and some anthropometrical indicators (Trofin, 2021).

2. Method

This study aims to identify specific correlations between the results obtained in the assessment of the jump force of lower limbs (squat jump, countermovement jump, and free jump, short-distance movement level (5, 10, and 20 m), and anthropometrical measurements (body mass index, fat tissue, and muscle mass) among soccer players.

In this study, 19 soccer players (elite level) between 17 and 21 participated voluntarily; they agreed with the processing and publication of the data gathered throughout the research. The assessment of the anthropometrical parameters observed the methodology below:

For correct measurement of an athlete's height, they must stand barefoot (orthostatism), leaning their backside, head, and heels against a vertical wall; the head faces forward. Using a telemeter or a ruler (you can put a cm-graduated grid on the wall – subdivisions of at least 0.5 cm), you measure the distance from the floor to the perpendicular wall projection of the vertex point level (the highest cranial point), determined by a tool with an angle of 900 (e.g., a set square with sides of 15-20 cm) – one of the sides on the vertex and one on the wall. You record it in cm and subdivisions of 0.5 cm. Within the field tests performed for this profile, a telemeter with Bosch GLM 80 laser was used to obtain as highly accurate measurements as possible from the perspective of this parameter.

2.1. Weight and body composition

The indicators of body composition within our research are as follows: weight, fat tissue percentage (%), muscle mass, body fat, and body mass index (BMI).

We assessed all these parameters using body composition Omron HBF-511B-E scales, which feature the parameters mentioned above using the BIA (bioelectrical impedance analysis), based on eight sensors ensuring their accuracy.

Procedure: the first part of the protocol includes inputting data about athletes' age, height, and gender. Subsequently, the athletes stand barefoot with the feet on the two sensors at the level of the lower limbs while taking their outstretched arms forwards and grabbing the lower limb sensors, maintaining the position until the analyser assesses all the data.

The force test used trials for the jump force of lower limbs using the device called OPTOJUMP. We included the following tests: Squat Jump (SJ), Countermovement Jump (CMJ), and Free Jump (FJ) according to standard procedures (Trofin, 2017).

We assessed speed using Microgate photocells on distances of 5 m, 10 m, and 20 m (with a standing start).

For each player, each of the force tests (including the squat jump, countermovement jump, and the free move jump) and each of the speed tests (5m, 10m, and 20m) were graded on a 4-step scale ranging from mediocre through medium, good, to very good performance. To derive a Jump/Speed score, we transformed the scale into a numerical scale, ranging from 1 (mediocre) to 4 (very good). As such, both the resultant overall Jump and Speed scores could vary between a minimum 3 up to a maximum of 12 points.

3. Findings and discussions

The table below features the statistical scores obtained in the anthropometrical measurements, tests of the jump force of lower limbs and speed.

Table 1. Means and SDs of anthropometric measures and individual jump scores

	Mean	SD	Min	Max	Amplitude (Max-Min)
Height	178.13	5.33	170.00	188.00	18.00
Weight	71.24	8.90	50.10	83.70	33.60
BMI	22.45	2.58	16.36	26.13	9.77
Muscle mass	41.89	2.08	37.70	45.60	7.90
Body Fat	15.73	4.22	7.60	23.90	16.30
Squat jump	35.09	4.34	29.10	44.70	15.60
Countermovement jump	36.36	4.56	28.10	47.30	19.20
Free jump	39.88	6.53	29.70	53.40	23.70
5m	1.04	0.04	0.98	1.10	0.12
10m	1.72	0.10	1.50	1.88	0.38
20m	3.00	0.11	2.85	3.20	0.35
Spine mobility	-7.19	10.90	-18.00	25.00	43.00

The results obtained by the subjects within this study are consistent with the general mean reported by other authors in the same field (Trofin, 2017, Georgiy, 2019). Hence, the height mean is 178.1 cm (SD=5.33), and the weight average is 71.24 kg (SD=8.90); the BMI average is 22.45 (SD=2.58). Furthermore, our subjects have recorded a good muscle mass level (mean=41.89%; SD=2.08) correlated with normal body fat levels (mean=15.73%; SD=4.22). Concerning the jump force assessment, we have recorded the following results: squat jump (mean=35.09 cm; SD=4.34). countermovement jump (mean=36.36 cm; SD=4.56), and free jump (mean=39.88 cm; SD=6.53). Regarding the assessment of running speed, statistics show the following figures: 5 m (mean=1.04 sec; SD=0.04), 10 m (mean=1.72 sec; SD=0.10), and 20 m (mean=3.00 sec; SD=0.11).

To identify potential correlations between the indicators assessed, we have calculated Pearson's Correlation (Figure 1):

Pearson's Correlations

Variable		Jump_score	Înălțime	Greutate	Masă_Musculară	IMC	G_Corporală	Speed_score
1. Jump_score	Pearson's r	—						
	p-value	—						
2. Înălțime	Pearson's r	0.131	—					
	p-value	0.628	—					
3. Greutate	Pearson's r	−0.126	0.409	—				
	p-value	0.641	0.116	—				
4. Masă_Musculară	Pearson's r	0.428	−0.053	−0.617	—			
	p-value	0.098	0.844	0.011	—			
5. IMC	Pearson's r	−0.214	−0.073	0.879	−0.645	—		
	p-value	0.426	0.789	< .001	0.007	—		
6. G_Corporală	Pearson's r	−0.453	−0.108	0.565	−0.969	0.670	—	
	p-value	0.078	0.690	0.023	< .001	0.005	—	
7. Speed_score	Pearson's r	0.552	−0.073	−0.049	0.292	−0.019	−0.318	—
	p-value	0.027	0.788	0.856	0.272	0.945	0.231	—

Figure 1. Pearson's correlations (jump score, height, weight, muscle mass, BMI, body fat, speed score)

The data recorded within our study and the statistical calculations regarding the purpose of the research have highlighted only one correlation: between speed score and jump score (*r=0.552; p=0.027*). This correlation is positive; in other words, the higher the jump score, the higher the speed score (Figure 2). On the other hand, our study has failed to find any significant correlation between the anthropometrical indicators and the jump score or speed score.

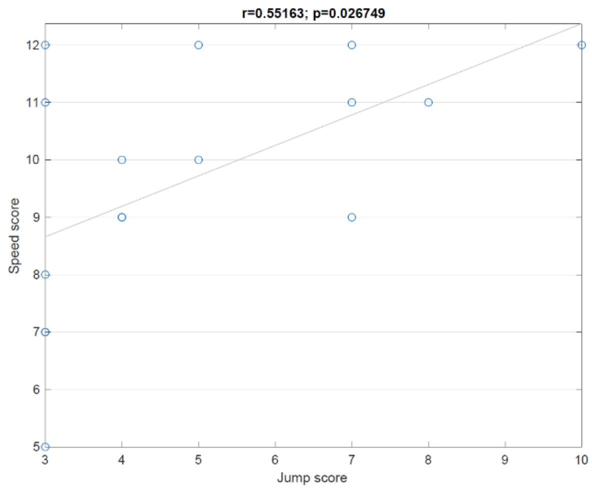

Figure 2. Positive correlation between jump score and speed score (*r=0.55163; p=0.026749*)

It is also worth noting a correlation tendency between muscle mass and jump score (r=0.428). However, it is not statistically significant (*p=0.098*) but may still be considered, especially within the practice in the field. Force has been proven to be influenced directly by the development level of muscle mass.

Subsequently, we have been interested in calculating Pearson's correlation index between jump score and each of the speed tests performed (Figure 3). Thus, among the three, we have found a negative correlation between jump score and 20-m speed (*r=0.919; p=0.01*); in other words, the higher the jump score, the lower the time for 20 m.

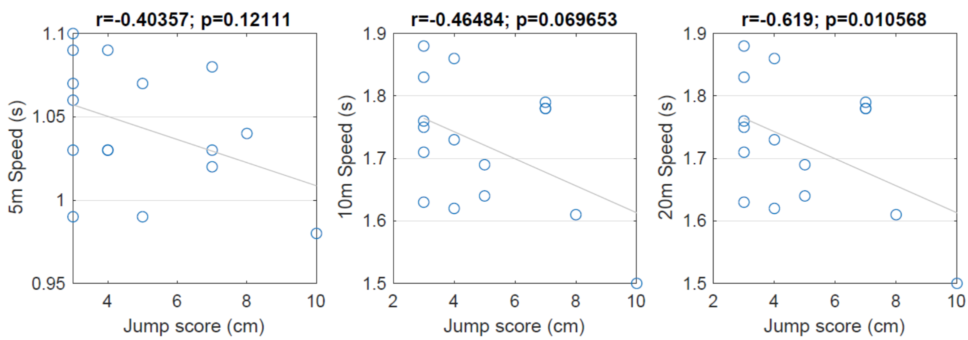

Figure 3. The correlation level between jump score and speed trials (5m, 10m, 20m)

We have made the same calculations for speed score and jump tests: squat jump, countermovement jump, and free jump (Figure 4). In this case, we have recorded positive correlations for all three comparisons with speed score: 5 m (*r=0.69; p=0.002*), 10 m (*r=0.81; p=0.0001*), and 20 m (*r=0.57; p=0.02*), which shows the direct relationship between speed and jump scores.

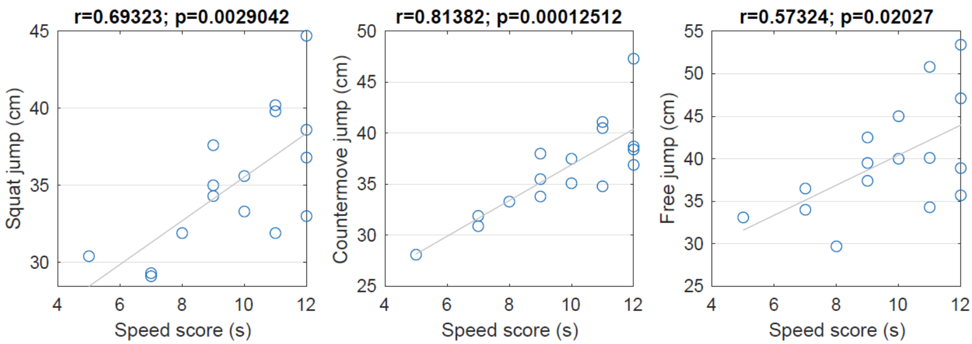

Figure 4. The correlation level between speed score and jump trials

4. Conclusions

Our findings show that jump score correlates positively with speed score, which means that jump score directly influences short-distance running speed.

Separately, we have found a positive correlation between speed score and jump tests (squat jump, countermovement jump, and free jump) and a negative correlation between jump score and 20-m speed.

Our study has not found any significant correlation between the anthropometrical indicators and jump or speed scores.

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