


An Investigation of the Relationship Between Horizontal and Vertical Jumping vs Speed Performance in U-12 Soccer Players

Mehmet KARA*¹ 

İdris DEMİRSOY² 

¹Kahramanmaraş, TÜRKİYE

²Uşak University, Faculty of Engineering, Department of Computer Engineering, UŞAK

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Abstract

This study examined the relationship between horizontal and vertical jumps and speed performance in U-12 soccer players. Twenty-six amateur soccer players from a soccer club participated in the study. Speed tests (0-5m/0-10m/0-20m and 0-30m), horizontal jump tests, and vertical jump tests were applied. In the literature review, studies examining the relationship between speed performance with vertical and horizontal jump performance in young soccer players were observed, but, to our knowledge, no study has been found that evaluates horizontal jump as a standing long jump with hands on hips in young soccer players. The relationship between variables was measured by Spearman correlation, with a significance level of α set at 0.05. The mean values of the measured parameters of the U-12 soccer players who participated in the study were; age 10.88 ± 0.81 years, height 142.92 ± 4.65 cm, body weight 35 ± 3.44 kg, 5m speed time 2.36 ± 0.13 sec, 10m speed time 3.45 ± 0.16 sec, 20m speed time 5.40 ± 0.35 sec, 30m speed time 7.19 ± 0.45 sec, horizontal jump (SLJHH) value 140.42 ± 12.85 cm, horizontal jump (SLJHF) value 163.84 ± 13.79 cm, vertical jump (VJ) value 26.57 ± 4.33 cm. The study findings indicated significant relationships between 5m and SLJHF/VJ, 10m and SLJHF/SLJHW, and 20m and 30m with SLJHF/SLJHH/VJ ($p < 0.05$), while no significant relationship between 5m and SLJHF, and 10m and VJ ($p > 0.05$). In conclusion, a negative relationship was found between horizontal and vertical jump and speed performance in U-12 soccer players. Therefore, when evaluating speed performance in this age group, horizontal and vertical jump performance should also be taken into consideration. Developing lower extremity strength should be prioritized in training programs tailored to this age group, aiming to improve speed performance.

Keywords: Horizontal jump, Soccer, Speed performance, Vertical jump

* Sorumlu Yazar: Mehmet KARA

E-mail: mehkar4661@hotmail.com

Giriş

To be successful in soccer, players need to be faster than their opponents, whether they have the ball or not. Additionally, they need to be able to jump higher in aerial situations and remain physically strong during physical challenges. Therefore, the importance of speed and strength for future success in young soccer players should be taken into consideration (Taşkın et al., 2015). Several studies that evaluate leg strength through jumping performance have found significant relationships between jumping ability and linear speed between 5-100 meters (Lockie et al., 2016). It is known that the effect of strength during a sprint is greater during the initial acceleration phase of 0-10 meters compared to the 10–30-meter phase (Kleeberger, 2013). During a soccer match, 2-4 second sprints are performed every 90 seconds on average, accounting for 1-11% of the total distance covered (Stolen et al., 2005). These sprints, which are critical moments both in attack and defense, are known to be 96% from distances less than 30 meters and 49% from distances less than 10 meters (Reilly et al., 2000). Speed performance in young soccer players, which is proportional to age, is more complex than simply covering a certain distance in the shortest possible time and is affected by psychological characteristics in addition to physical and physiological ones (Cengiz , 2018; Slimani & Nikolaidis, 2017). Speed is categorized as reaction speed, negative and positive acceleration, maximal speed, agility, high-speed actions, movement speed, and soccer-specific endurance (Slimani & Nikolaidis, 2017).

Jumping, which is a fundamental movement requiring compound motor coordination of both upper and lower body parts (Ashby et al., 2019), is tested horizontally and vertically to evaluate leg strength. Although vertical jump tests are commonly used to measure explosive power, many sports require the production of force in both vertical and horizontal planes, and the horizontal jump test is also widely used as a reliable measure of lower body strength in sports (Dobbs et al., 2015). Speed performance is dependent on different physiological factors at different stages, namely acceleration and maintaining speed, and similarly, different types of jumps rely on different physiological characteristics. Therefore, different jump tests can be used to test speed performance (Dobbs et al., 2015).

Although the vertical jump is considered the most reliable test to predict the relationship between explosive strength and speed in soccer players of different age categories (Rodriguez-Rosell et al., 2017), limited studies examining the relationship

between horizontal jump and speed have reported that the horizontal jump is also a reliable and effective test, resemble to the vertical jump (Castro-Piñero et al., 2010; Dobbs et al., 2015). Furthermore, a study aimed at equalizing horizontal jump and vertical jump tests resulted in the conclusion that these two tests can be used interchangeably (Zhu et al., 2022). Both vertical and horizontal jump tests are performed with or without arm swing, and in standing long jump tests, a 21.2% better performance was observed when arm swing was used compared to when it was not used (Ashby and Heegaard, 2002). In literature reviews, studies focusing on young soccer players reveal research related to speed as well as vertical and horizontal jumping. However, no study has been found that specifically examines the horizontal jump as a horizontal jump with hands on the hips in young soccer players. This study was conducted with the aim of examining the relationship between horizontal and vertical jumping with speed in U-12 age group football players.

Methods

Participants

The study included a total of 26 soccer players with an average age of 10.88 ± 0.81 , average height of 142.92 ± 4.65 , and average weight of 35 ± 3.44 , who received soccer training for at least 6 months at Kartalgücü Sports Club and played amateur soccer licensed. The participants were verbally informed about the purpose of the study, the risks involved, and the measurements to be taken. Their consent was obtained, and a sample procedure was conducted. This study was approved by Usak University the Social and Human Sciences Scientific Research and Publication Ethics Board dated 12.04.2023, with the decision number 2023-84.

Vertical Jump Test (VJ)

The soccer player children who were ready for the test were asked to stand on a flat surface with their feet on the ground and their arm raised upward to touch the wall at the first point of contact. Then, they were asked to perform a vertical jump, and the point of contact was marked. The distance between the two points was measured and recorded in centimeters. This procedure was repeated twice, and the best value was noted in cm.

Standing Long Jump Test

In this study, standing long jump test was used as the horizontal jump test. During testing the soccer player children who were ready for the test were instructed

to stand on a flat surface with their feet at the starting line, keeping their toes behind the line. They were then asked to jump as far forward as possible with both feet, landing on both feet, and the distance they landed from the starting line was measured in meters from the back of their heels to the starting line. This test was performed in two different ways: with hands free swinging (SLJHF) and with hands on hips (SLJHH). Each test was repeated twice, and the best value was recorded in centimeters.

Speed Test (0-5m-0-10m-0-20m-0-30 meters)

The soccer player children who were ready for the test were made to do speed runs of 5-10-20-30 meters using a random order method through a two-gated photocell system. Each run was performed twice, and the best time was recorded in seconds. At least 3 minutes of rest was given after each run.

Analysis of the Data

Descriptive statistics refers to the branch of statistics that involves summarizing and describing the main features, characteristics, and patterns of a dataset. As descriptive statistics we computed mean and standard deviation for speed tests (5m-10m-20m and 30m), horizontal jump tests, and vertical jump tests along with soccer players' age, height and body weight. These statistical techniques help us to gain a better understanding of our data. Spearman Correlation, also known as the Spearman Rank-Order Correlation, is a nonparametric measure of correlation between two variables in a dataset. It is a useful alternative to the Pearson Correlation method (Lund&Lund, 2010) when the data do not meet the assumptions required for parametric tests. In this study we evaluated relationship between variables with spearman correlation, significant level α is taken as 0.05. All the analysis has been carried out using R programming version 4.0.1 (Team, 2000). The study was approved by Usak University the Socialand Human Sciences Scientific Research and Publication Ethics Board dated 12.04.2023, with the decision number 2023-84.

Results

Table 1: Descriptive information of the participating soccer players and their performance values in horizontal and vertical jumping as well as speed.

Variables	Mean	SD
Age (year)	10,88	0.81
Height (cm)	142.92	4.65
Body Weight (kg)	35.0	3.44
5m (sec)	2.36	0.13
10m (sec)	3.45	0.16
20m (sec)	5.40	0.35
30m (sec)	7.19	0.45
SLJHH (cm)	140.42	12.85
SLJHF (cm)	163.84	13.79
VJ (cm)	26.57	4.33

Descriptive information and performance values of the soccer players participating in the study are presented in Table 1. The participants had an average age of 10.88 ± 0.81 years, height of 142.92 ± 4.65 cm, body weight of 35 ± 3.44 kg. The average values for the 5-meter sprint were 2.36 ± 0.13 seconds, 10-meter sprint were 3.45 ± 0.16 seconds, 20-meter sprint were 5.40 ± 0.35 seconds, and 30-meter sprint were 7.19 ± 0.45 seconds. The average horizontal jump (SLJHH) was 140.42 ± 12.85 cm, the average horizontal jump (SLJHF) was 163.84 ± 13.79 cm, and the average vertical jump (VJ) was 26.57 ± 4.33 cm.

Table 2: The relationship between horizontal and vertical jumping and speed among U-12 age group soccer players.

Variables	SLJHH	SLJHF	VJ
5m	0.059	0.038*	0.000*
10m	0.012*	0.000*	0.101
20m	0.004*	0.000*	0.020*
30m	0.001*	0.000*	0.003*

* $p < 0.05$

The Spearman Correlation, also known as the Spearman Rank-Order Correlation, is a nonparametric measure of correlation between two variables in a dataset. It is a useful alternative to the Pearson Correlation method (Lund&Lund, 2010) when the data do not meet the assumptions required for parametric tests. In this study, Table 2 presents the p-values for the Spearman correlation between the variables 5m, 10m, 20m, 30m, SLJHF, SLJHH, and VJ. The significance level for α is set at 0.05, and the null hypothesis is that there is no correlation between the variables. Based on the hypothesis and p-values, we conclude that there is no significant correlation between 5m and SLJHF, and 10m and VJ.

Table 3: Correlations between horizontal and vertical jumping and speed among U-12 age group soccer players.

Variable	SLJHH	SLJHF	VJ
5m	-0.374	-0.408	-0.646
10m	-0.480	-0.621	-0.328
20m	-0.542	-0.641	-0.452
30m	-0.578	-0.681	-0.558

Table 3 provides the actual Spearman correlation coefficients in which reveal that 5m, 10m, 20m, 30m, SLJHF, SLJHH, and VJ are negatively correlated. Specifically, we observe that when a U-12 age group soccer player sprint time increases, the distance of their jump decreases. Notably, the strongest negative correlation is found between the 30 meters sprint test and SLJHF, with a correlation coefficient of -0.681, indicating strong correlation and their p value was obtained as $p=0.0001$, which indicated statistical significance. Additionally, the two lowest correlations in Table 3, 10m vs VJ and 5m vs SLJHH, were also determined to be statistically non-significant in Table 2.

Discussion

The purpose of this study to examine the relationship between horizontal and vertical jumping vs speed among U-12 age group soccer players, resulted in significant relationships between 5m sprint and SLJHF as well as VJ, between 10m sprint and SLJHF as well as SLJHH, and between 20m and 30m sprints and SLJHF, SLJHH, and VJ. However, no significant correlation was found between 5m and SLJHF, as well as between 10m and VJ.

The height of U-12 age group soccer players was determined to be 142.92 ± 4.65 cm. In similar studies conducted with age groups similar to our study group, the height of soccer players (cm) was found to be 151.63 ± 7.32 in U-11-U-12 age group players in a master's thesis (Bulduk, 2022), 139.94 ± 9.77 in 9-13 age group players (Kaplan, 2016), 1.6 ± 0.1 in 32 male soccer players playing in the top three teams in Burdur primary school soccer competitions, and 1.5 ± 0.1 in 45 male soccer players from teams that were eliminated or placed in the bottom ranks (Güler et al., 2010), 1.62 ± 0.04 cm in 13-year-old and younger male children who regularly practice soccer (Çetin, 2019),

and 142 ± 7 cm in 40 volunteer soccer players aged 12-13 randomly selected from two professional teams competing in the TFF 1st League (Sökmen, 2018).

In this study, the body weight of U-12 age group soccer players was determined to be 35 ± 3.44 . In studies conducted with similar age groups to our study group, the body weight (kg) of soccer players were reported as 40.95 ± 6.78 in a master's thesis on U-11-U-12 age group soccer players (Bulduk, 2022), 31.76 ± 4.99 in 9-13 age group soccer players (Kaplan, 2016), 48.4 ± 9.7 in 32 male soccer players playing in the top three teams in Burdur primary school soccer competitions, and 43.7 ± 9.2 in 45 male soccer players from the teams that were eliminated or ranked last (Güler et al., 2010), 50.90 ± 3.58 kg in 13 years and younger boys who regularly participate in soccer training (Çetin, 2019), and 45.7 ± 8.4 kg in 40 volunteer soccer players randomly selected from two professional teams competing in TFF 1st League in the 12-13 age group (Sökmen, 2018).

Studies conducted on soccer players of different ages and levels have reported significant relationships between vertical jump and speed (Ek et al., 2007; Taşkın et al. 2015; McFarland et al., 2016; Ateş&Çetin 2017; Egesoy et al., 2021). However, there are also studies that report no significant relationship between vertical jump and speed (Göral, 2014; Zileli and Söyler 2021; Zileli&Söyler, 2022). A master's thesis conducted on a similar age group to our study, U-12 soccer players, found that as vertical jump performance increased, speed performance also increased (Bulduk, 2022).

In a study conducted with thirteen - fourteen-year-old soccer players, a significant relationship was found between speed performance and vertical jump (Soraya, 2022). In a study conducted with 40 volunteer soccer players randomly selected from two professional teams competing in the TFF 1st League aged 12-13 years, a significant relationship was found between vertical jump and speed (10-20-30 meters) performance (Sökmen, 2018). Our study also obtained similar results, and a significant relationship was found between vertical jump performance and speed performance in U-12 age group soccer players (Table 2). In this study, horizontal jumping performance was discussed through the standing long jump test, standing long jump with hands free (SLJHF) and standing long jump with hands on waist (SLJHH). A similar study conducted with the same age group in a master's thesis revealed that there was a significant relationship between speed values and horizontal jump (SLJHF) values in U-12 age group soccer players, where the increase in

horizontal jumping performance was associated with an increase in speed performance (Bulduk, 2022).

In a study conducted with thirteen-fourteen-years old soccer players, a significant correlation was found between speed performance and horizontal jump (SLJHF) performance (Soraya, 2022). In another study conducted with U-13 and U-16 age group soccer players, a significant correlation was found between horizontal jump (SLJHF) and speed, with this relationship being 27.5% in the U-13 age group and 27% in the U-16 age group (Şahin et al., 2022). Similar results were obtained in our study as well, and it was found that horizontal jump performance (SLJHF) in U-12 age group soccer players was related to speed performance (Table 2).

It has been determined that there is a 20% better performance in standing long jump when there is arm swing compared to when there is no arm swing (Ashby and Heegaard, 2002). There is no study in the literature that evaluates horizontal jump performance for soccer players as SLJHH. In our study, horizontal jump performance (SLJHH) in U-12 soccer players was found to be associated with speed performance (Table 2).

The results obtained in our study are consistent with the study that equalizes the horizontal jump and vertical jump tests (Zhu et al., 2022), supporting that these two tests can be used interchangeably. At the end of the study, it has been determined that there is a negative relationship between horizontal and vertical jump vs speed in U-12 age group football players.

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