# CORRELATION BETWEEN SPRINT, AGILITY AND VERTICAL JUMP OF ELITE SOCCER PLAYERS

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### Abstract

The purpose of this study was to determine the level of correlation between sprint, agility and vertical jump in soccer players of HŠK Zrinjski and FK Velež, champions of the Premier League of BiH (first rank of the competition) and champions of the First League of FBiH (second rank of the competition). The survey was conducted on a sample of 50 football players. Subjects were tested in the variables Sprint 30m, T-test and CMJ (Countermovement jump). Statistically significant strong correlation between Sprint 30m and T-test (r = 0.66) were achieved among HŠK Zrinjski football players. The 30m sprint also showed moderate correlation with the CMJ variable (r = -0.45). The correlation between the T-test and the CMJ test was not statistically significant. In soccer players of FK Velež Sprint30m has a moderate correlation with the T-test variable (r = 0.49), as well as with the CMJ variable (r = -0.57). The correlation of the T-test and CMJ variables is not statistically significant. The results of this research indicate statistically significant, moderate correlations between sprint and agility, and that the researched abilities have similar determining factors. These abilities contribute to more efficient execution of fast actions in football which directly conquer the possession of the ball and score a goal (Reilly, Bangsbo & Franks, 2000). Adequate resources can greatly raise the level of these motor abilities (Bompa, 1999).

*Keywords:* sprint, agility, jump, soccer.

## Introduction

Soccer is the most popular sport in the world for more than twenty years, whether we look at it in terms of the number of spectators or the number of active athletes. During this period, soccer developed continuously, especially in the direction of increasing the physical demands and loads to which soccer players are exposed during training and competition. So today, players cover much greater distances at a higher pace than was the case a decade ago. Also, the number of games players play in one season is constantly growing, the number of training sessions per week has increased, and the recovery time between training sessions and matches has decreased. All of the above also increased the risk of injuries. In order to be able to successfully cope with the stressed physical requirements of playing football, and to reduce the risk of injury, players must pay special attention to quality fitness during their careers. The number of researches dedicated to the improvement of the game of soccer and sports in general is significantly increasing. Among these researches, a special place is occupied by research on the physical requirements of the game and the physiological characteristics of soccer players, as well as on the methods and means of fitness training. Unfortunately, at least in our area, these findings are very slowly being put into practice. Today, it can be said with certainty that top sports performance can only be achieved if training is cond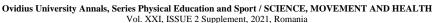ucted on the basis of scientific knowledge and principles. Soccer is characterized by a relatively short preparation period with a large number of matches in the competitive part of the season. The soccer match lasts 90 minutes, or twice 45 minutes with a 15-minute break in between, with the possibility of overtime in certain matches. There are interesting cases where the winner is decided by shooting a penalty, in which case the players have 90 minutes of standard game time with a 15 minute break with 30 minutes of overtime and 2x5 minutes break, if we add up, for example 6 minutes of referee compensation and penalty shootouts we get over 160 minutes of the game, which is certainly a huge stress for the human body.

There is little that thrills more than fast and agile players who leave their opponents unsolvable puzzles. Although many agree that the level of innate of speed and explosive power is largely genetically defined and that sensitive phases are best for developing these abilities. Adequate resources can greatly improve the level of these abilities (Bompa, 1999).

CNS impact, muscle characteristics, flexibility, movement technique, and motivation are just some of the possible ways to increase speed, agility, and explosiveness. Connecting these abilities with the technical and tactical requirements of the soccer game is what is the goal of development and the final requirement for training these abilities. Each of the above characteristics can be improved and brought to a higher level during sports development and,

accordingly, the level of speed, agility and explosiveness applied on the football field can be constantly increased.

The problem with agility is how to define this complex motor ability. The ability to maintain and control body position while rapidly changing direction

commonly described as the ability to rapidly change direction, react, and stop (Gambetta, 1996).

During a game, the player often performs activities that require rapid force development, such as sprinting or a quick change of direction (Bangsbo, 1996). Although quick actions contribute only 11% of the total distance covered in soccer, they actually directly contribute to winning possession of the ball and scoring goals. (Reilly, Bangsbo & Franks, 2000).

The importance of sprint, agility and vertical jump in football is sufficiently shown by the data that in one game players make an average of 30 sprints, about 600 changes of direction, and 10-15 jumps.

One way to examine the correlation between these abilities is to determine the degree of correlation. Pauole, Madole, Garhammer, Lacourse, and Rozenek (2000) obtained results showing a significant correlation between the agility T-test and the 40-yard sprint in male and female athletes. Buttifant, Graham, and Cross (1999) and Young, Hawken, and McDonald (1996) did not obtain significant correlations between sprint and agility tests in soccer players and Australian football players. Young, McDowell, and Scarlett (2001) - linear sprint and agility are specific abilities and have limited transfer to each other, Križaj, J. (2020) – strong correlation between spint, agility and CMJ of female soccer players.

In this paper, we will explore the correlation between these three motor spaces, sprint, agility and vertical jump, in elite soccer players of different levels of competition.

## METHODS

This research aimed to determine the correlation between sprint, agility and vertical jump off elite soccer players.

### Subjects

during a series of movements is called agility (Twist and Benicky, 1995). Agility is also defined as a combination of strength, speed, balance, and coordination (Draper and Lancaster 1985). Agility thus lacks some general definition but is most

The research performed on the soccer players of the HŠK Zrinjski Mostar and FK Velež Mostar teams. The number of players per group is HŠK Zrinjski (N = 26), average age 24.59 ± 4.15 and FK Velež (N = 25), average age 22.00 ± 2.95.

### Testing procedure

Variables used in this research to determine the values of the examined motor spaces: S30M (Sprint 30m), TT (T-test) CMJ - Flight time of Countermovement jump. These variables were tested using Microgate photocells, and Microgate Optojump.

### Statistical analyses

The data are entered into the software package for social sciences (Statistical Package for Social Sciences - SPSS, Version 26.0) in which statistical data processing was performed. The following parameters were calculated for all variables: arithmetic mean, standard deviation, all with the aim of ascertaining the basic indicators of the distribution of the normality of the results. To examine the correlation between the sprint, agility, and vertical jump variables, we used the Pearson correlation coefficient.
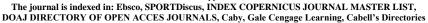
### RESULTS AND DISCUSSIONS

Insight into Table 1, which shows the percentage of soccer players by position in the game for HŠK Zrinjski and FK Velež, we can see that the largest representation in the tested clubs is made up of mid-fielders. Of the total number of tested soccer players in HŠK Zrinjski (22), 27% of them are midfielders. When it comes to FK Velež, out of the total number of tested soccer players (25), 36% of them are midfield-ers. The smallest number of tested players are strikers, 11% at HŠK Zrinjski and 4% at FK Velež.

**Table 1.** Percentage of positions in game HŠK Zrinjski and FK Velež

|  | Percentage of positions HŠK Zrinjski | Percentage of positions FK Velež |
|---|---|---|
| GK | 15.4 | 12.0 |
| CB | 15.4 | 16.0 |
| WB | 15.4 | 16.0 |
| MF | 26.9 | 36.0 |
| S | 11.5 | 4.0 |
| W | 15.4 | 16.0 |
| Total | 100.0 | 100.0 |

Looking at Table 2, we can see that all variables that were subjected to measurement have homogeneous results. We can also see from the average values that each variable goes in favor of HŠK Zrinjski. We must mention that this measurement was carried out at a time when FK Velež played in a lower league than HŠK Zrinjski. For all variables, tests were performed to examine the normality of the distribution of results, and the results indicate that each of them belongs to the normal distribution.

**Table 2.** Descriptive statistical parameters of HŠK Zrinjski and FK Velež

| Variables | N | A.S. | Std.dev. | Var. | N | A.S. | Std.dev. | Var. |
|---|---|---|---|---|---|---|---|---|
| | | **HŠK Zrinjski** | | | | **FK Velež** | | |
| Age (years) | 22 | 24.59 | 4.159 | 17.301 | 25 | 22.00 | 2.958 | 8.750 |
| Body Height | 22 | 185.045 | 6.3357 | 40.141 | 25 | 182.440 | 6.9945 | 48.923 |
| Body Weight | 22 | 80.773 | 6.9209 | 47.898 | 25 | 76.968 | 8.6488 | 74.801 |
| S30 m | 26 | 4.1762 | .15847 | .025 | 25 | 4.3384 | .15255 | .023 |
| T-test | 25 | 9.4688 | .40193 | .162 | 25 | 10.0772 | .43244 | .187 |
| CMJ (s) | 22 | .57723 | .032847 | .001 | 25 | .56844 | .029628 | .001 |
| CMJ (cm) | 22 | 40.959 | 4.7082 | 22.167 | 25 | 39.704 | 4.1553 | 17.266 |
| Valid N (listwise) | 22 | | | | 25 | | | |

Table 3 shows the correlation values for the variables Sprint30m, T-test and CMJ for soccer players HŠK Zrinjski and FK Velež. Based on the obtained values, in players of HŠK Zrinjski, we see that the speed variable S30m has a medium correlation with the agility variable T-test (r = 0.66), (and this correlation is statistically significant at the level of p = 0.00). Similar results were obtained by Sporiš et al. (2011) who, as authors, investigated the correlation between speed, agility and quickness. They found that there are significant correlations between the tests used to assess the agility and sprint. Another study on a similar topic was conducted by Koklu, Alemdaroglu, Ozkan, Kozc, and Ersozc (2015), and in their research they concluded that there is a significant correlation between sprint ability and agility. In addition to this correlation, a significant correlation was detected between the ability to jump vertically and the ability to sprint, as well as between sprint and the agility of soccer players. McFarland (2016) in his research comes to results that indicate a medium to strong correlation between the attributes of maximum speed and vertical jump. Križaj (2020), based on the results of his study, concludes a medium correlation between vertical jump and the agility and a strong correlation between the ability of linear velocity and rapid change of direction. The 30m sprint also showed a medium correlation with the CMJ variable (r = - 0.45). The significance of this correlation is also high (p = 0.03). The negative sign in this relationship arises from the reason of inverse proportionality expressed in the measurement. This means that players who were faster in the S30m test spent more seconds in the flight phase in the CMJ test, and vice versa. A positive sign in the previous correlation means that players who are faster in the S30m test, also recorded a good result in the T-test. The correlation between the T-test and the CMJ test is low, and is also negative, meaning it has inverse proportionality. It is not interesting because it did not show statistical significance (p = 0.11) which is> 0.05.

**Table 3.** Pearson correlation coefficient for all parameters (Sprint 30m, T-test, CMJ) of players HŠK Zrinjski, FK Velež

| | | **S30 m** | **T-test** | **CMJ** |
|---|---|---|---|---|
| **S30m** | HŠK Zrinjski | | r = 0,66 Medium | r = -0,45 Medium |
| | | | Sig = 0,00 | Sig = 0,00 |
| | FK Velež | | r = 0,49 Medium | r = -0,57 Medium |
| | | | Sig = 0,01 | Sig = 0,00 |
| **T-test** | HŠK Zrinjski | r = 0,66 Medium | | r = 0,34 Low |
| | | Sig = 0,00 | | Sig = 0,11 |
| | FK Velež | r = 0,49 Medium | | r = -0,25 Low |
| | | Sig = 0,01 | | Sig = 0,21 |

| | | | | |
|---|---|---|---|---|
| **CMJ** | HŠK Zrinjski | r = -0,45 Medium | r = 0,34 Low | |
| | | Sig = 0,00 | Sig = 0,11 | |
| | FK Velež | r = -0,57 Medium | r = -0,25 Low | |
| | | Sig = 0,00 | Sig = 0,21 | |

According to the results of FK Velež players, we can conclude that the variable Sprint30m has medium correlation with the variable T-test (r = 0.49), as well as with the variable CMJ (r = -0.57), with the correlation between the sprint and CMJ of negative sign, which we explained earlier. The correlation between the variables T-test and CMJ is low and negative. In addition to the low correlation, the correlation between these two variables did not achieve statistical significance. Based on these results of our research (medium correlation between sprint and agility, and sprint and vertical jump), we can say that the speed and agility share common physiological and biomechanical characteristics, just as speed and vertical jump, which we can't say for agility and jump performance because they are low correlated.

**CONCLUSION**

In this study we tested the soccer players of teams HŠK Zrinjski Mostar and FK Velež Mostar, which competed in the Premier League and the First League in Bosnia and Herzegovina. According to the results of study, we can see that a medium correlation was achieved at a high statistically significant level in players of both clubs in the tests S30m and agility T-test, r = ± 0.66 (HŠK Zrinjski), ± 0.49 (FK Velež), sig = 0.00 - 0.0 as with S30m and CMJ, r = - ± 0.45 (HŠK Zrinjski), - ± 0.57 (FK Velež). Low correlation was founded of both clubs between the T-test agility and CMJ, r = - ± 0.34 (HŠK Zrinjski), r = ± 0.25 (FK Velež), sig = 0.11 - 0.21 . From these results we see that this correlation is not statistically significant.

Based on these results of our research (medium correlation between sprint and agility, and sprint and vertical jump), we can say that the speed and agility share common physiological and biomechanical characteristics, just as speed and vertical jump, which we can't say for agility and jump performance because they are low correlated.

In introduction of this article we explained the importance of sprint, agility and vertical jump in soccer (in one game players make an average of 30 sprints, about 600 changes of direction, and 10-15 jumps). Many authors agree that the level of innate of speed and explosive power is largely genetically defined and that sensitive phases are best for developing these abilities. Adequate resources can greatly improve the level of these abilities (Bompa, 1999). To improve the ability of sprinting, agility and jumping, we suggest SAQ method, (The SAQ training program seems to be an effective way to improve some segments of power performance in soccer players. Jovanović, M., Sporiš, G., Omrcen, D., Fiorentini, F. 2011), The results of this study and the results of the studies in this field of previous authors will help us with periodization, planning and programming in soccer.

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