Proceeding

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Soccer differences in order to explosive strength and rapidity among defenders, midfielders and forwards during COVID-19

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ABSTRACT

Problem statement. The aim of the study is to verify if the same protocol brings the same results towards the three roles of soccer, in terms of explosive power and speed, and if the COVID-19 affected the performance during the period September-December. Methods. Eighteen (n = 18) Italian élite soccer players, without goalkeepers, participated in this study (age 24.5 ± 5.9; body weight 75.2 ± 6.0; height 181.2 ± 7.1) from July to December, a period in which the whole team was infected by COVID-19. The players were monitored through two specific tests, CMJ and Speed test on 10 meters, detected in three different periods and in relation to three different playing positions: (D) defenders, (M) midfielders and (F) forwards. Soccer players have been trained following the same program training. A 3x3 Mixed-design analysis of variance was used to verify differences between the three roles and the results of the three measurements taken in July, September and December for each test. Results. The results is statistically significant ($p < .05$) for the within factor in the two tests, but there is no significant effect between groups ($p > .05$). Conclusion. In relation to the protocol used, we noticed that in terms of speed the forward role had the greatest improvement, while in terms of power in the lower limbs the role of the midfielder. Therefore, it is not possible to use the same training protocol for all roles, but to program your own personalized training plan based on the results of the match analysis and the performance model of each role.

Keywords: Training protocol; Speed; Power; Sports performance; Roles.

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INTRODUCTION

Soccer is a multi-performance sport (Bangsbo et al., 2006) in which explosiveness, endurance and high intensity racing are considered the key points of training (Izzo, 2020abc). Speed is one of the physical skills of fundamental importance and of great interest for the work of the athletic trainer (Luhtanen, 1994). Speed is essentially linked to neuromuscular, genetic, sensory, biochemical; strength, mobility and motor coordination factors and it can be improved in a percentage of about 20% compared to the initial potential and it is applicable for all sports disciplines (D'Elia et al., 2021ab). This premise is necessary to understand that some skills required to practice team sports at the highest levels, are substantially not trainable, or better, significantly improved. In soccer, as in all "*acyclic*" sports, which do not require continuous and repeated movements, it is important that the athlete "*develop adequate responses to complex stimuli in the fastest possible time*". For the characteristics of performance, the ability to accelerate is of great importance, which allows you to reach high speeds in a short time (Bishop & Girard, 2013), for example sprints on 10 meters. To train the speed of a single gesture, you must first "*clean*" a movement, improving muscle and tendon elasticity. In addition, for this reason it is very important to use the stretching in an adequate way, to make the movement more adequate. Explosive is the ability to sprint and jump in the shortest possible time (Altavilla. 2019). In football, it is present, as the players always make sudden accelerations or decelerations and changes of direction (Altavilla, 2020; Esposito & Raiola, 2020; Raiola, 2020ab, 2019ab). The elements to consider are the static starting position and the goal of moving the load very quickly, which is influenced by the type of fibre, age, training state. Explosiveness in football is a prerequisite for speed. It is very important to play this sport to acquire general and specific motor skills (Altavilla et al., 2015). Soccer is classified as a high intensity intermittent sport (Di Salvo et al., 2009; Miranda et al., 2021) with high demands on aerobic endurance, strength and the strength derivatives of speed and power.

Speed is one of the main forms of motor solicitation that is influenced both by conditional skills (strength and endurance) and by coordination skills. In sport, by speed we mean the ability to reach, under certain conditions, the maximum possible reaction and movement speed. If you want to refer to soccer instead, it can be considered as a capacity that includes many aspects, as it includes not only the ability to react quickly, to sprint and to run quickly, but also to deal with the ball quickly and more congenially. Speed, more than a basic elementary quality, is considered a "*derived*" quality, because it is determined by the application of a force, which is capable of modifying the state of rest or motion of the athlete's body. The means of training must be oriented mainly towards the development of acceleration skills. In fact, the soccer player has few opportunities to launch over sufficiently long distances to acquire maximum speed, while, commonly, his movements take place in short spaces. Therefore, short sprints with high frequencies of decelerations, changes of direction and sudden stops, exercises are not to be missed because they stimulate the most of the neuro-muscular system. Speed is one of the fundamental qualities of the player: it is considered as a kinematic quantity obtained from the ratio between the distances covered (meters) and the time taken to cover it (seconds). The ability allows you to perform motor actions in the shortest possible time. Speed tests are characterized under two main aspects:

1. Energetic, which depends on the intervention of aerobic and anaerobic metabolism;
2. Biomechanical, which is linked to the mechanical characteristics of the proposed exercise (for example running in line with respect to running with changes of direction).

Speed tests in soccer are carried out on courses that can be completed in times ranging from a few seconds to about 90 seconds. In all these tests, maximum speed is sought and since the distances are relatively short, anaerobic metabolism is always used. The subject of the speed tests will be: the anaerobic qualities (alactacid and lactacid) of the player, without forgetting that the energetic mechanisms of ATP resynthesis (aerobic and

anaerobic) are always involved during an exercise and especially in those at high intensity typical of the game of football (Bangsboo 1994). Therefore, the evaluation of anaerobic qualities should not be separated from the evaluation of aerobic metabolism and stamina. In speed tests, information on the intervention of lactate metabolism can be obtained directly by means of a capillary blood sample and subsequent analysis to determine the blood lactate concentration.

Explosive force is the ability of our neuromuscular system to express high gradients of force in the shortest time possible (Maffiuletti et al., 2016). It allows you to develop the power and the ability to respond more quickly to an action such as in small side game (Sannicandro, 2020ab) . The explosive force capacity of each limb affects the acceleration capacity in soccer players. In fact, according to a study, a correlation between the results of the three strength tests and sprinting performance was found (Sannicandro et al., 2014). The CMJ is a specific test for athletes who play sports in which high explosive strength is required (Altavilla et al., 2018a) such as, for example, football. An important element for the execution of the test is the environment. It must be coherent so that the test is protected from atmospheric conditions and with a suitable surface that is not affected by wet and / or slippery conditions. If this environment is not adhered to, the tests, even if repeated on subsequent dates, can provide worthless data.

The COVID-19 pandemic has had a huge impact on both people's performance (D'Andrea et al., 2021; Raiola & Di Domenico, 2021) and lifestyle (Raiola & Aliberti, 2021; Raiola et al., 2021). Until now, only a few studies have analysed the effects of COVID on professional football in particular (Drewes et al., 2021). According to a study, during the pandemic, there was an increase in attention on social media for clubs that remained open, with a consequent decrease in attention once professional football leagues around the world were revitalized (Weimar et al., 2021). In terms of performance, however, training at home was useful for improving aerobic fitness, although it did not allow players to maintain the power levels of their competitive period (Rampinini et al., 2021). Players may encounter the greatest challenges in relation to maintaining training status (Christensen et al., 2011), especially during the COVID-19. For this reason, many expect reduced fitness, match fatigue and risk of injury, longer recovery times (Mohr et al., 2020). During the period of the pandemic, specifically from July 2020, the players were subjected to the same training protocol, with the aim of improving the speed and power of the explosive limbs. This protocol was developed based on the general framework of the assessment tests submitted in July.

The aim of the study is to verify if the same protocol brings the same results towards the three roles of soccer, in terms of explosive power and speed, and if the COVID-19 affected the performance during the period September-December.

METHODS

Design and Participants

Eighteen (n = 18) Italian élite soccer players, without goalkeepers, participated in this study (age 24.5 ± 5.9; body weight 75.2 ± 6.0; height 181.2 ± 7.1) from July to December, a period in which the whole team was infected by COVID-19.

Test procedure

The soccer players were monitored through two specific tests (Counter Movement Jump and Speed test on 10 meters), detected in three different periods and in relation to three different playing positions: (D) defenders, (M) midfielders and (F) forwards.

The CMJ test consists of making a jump as high as possible, starting from a platform, and attempting to land in the same position on the platform from which it took off. The athlete must perform a minimum of three jumps to calculate performance averages. The test taker must decide in advance whether to use the swing arm as it can improve performance by 10% or more. If arm swing is prohibited, athletes must keep their hands on their hips during the test.

The 10-meter speed test, on the other hand, consists of making a straight path at maximum speed. The start can be stationary or in motion. For the speed one, the scatter chronometer at the moment in which the athlete is at the starting line previously traced. Three tests are carried out, each interspersed with extensive recovery so as not to influence the subsequent ones. The person administering the test times each of the three tests and takes the best time obtained as valid, then compares it with a special table.

Training program

Soccer players have been trained following the same program training. Following the detection of the test data to which the players are periodically subjected, the technical staff can observe the physical condition of each individual athlete; he can compare them with the general situation of the team and he can relate the results obtained based on the specialization of the role. Finally, the technical staff, starting from the collected data, can organize the subsequent training sessions. Taking as an example an Italian Serie C men's football team, from the results of the July tests, the technical staff considered it appropriate to continue the training sessions according to the "*typical*" week shown below:

- Sunday: competition day (match), the reference form for which is 1-3-5-2.
- Monday: rest day granted to the whole team group.
- Tuesday: the team group engaged during the match (for more than 75 minutes) performs aerobic power work, for example 4 series of 5 repetitions on 50 meters or 30 + 30 meters with changes of direction. The team group not engaged during the match plays three mini-matches at 8 vs 8 wide spaces, with playing times equal to 8 minutes and with recovery times equal to 3 minutes.
- Wednesday: the entire team group works on explosive strength, alternating training sessions in the gym with repetitions uphill and / or on the pitch; performs a work of RSA (Repeated Sprint Ability), with maximum shuttle sprints with short breaks. Wednesday is the first day of the training week in which the team works with different loads based on the role played by the individual players: the midfielders carry out rapid work over distances of 500 meters, while the defenders and forwards carry out work speed over distances of 300 meters. The training session ends with 3 vs 3 and / or 4 vs 4 pressure matches.
- Thursday: the entire team group works alternately on individual tactics and collective tactics, with four games of four minutes each.

Statistical analyses

Descriptive statistics were used to summarize the results of the two tests, and improvements or worsening were expressed as a percentage. After verifying normality of the data with Shapiro Wilk test ($p > .05$) and homogeneity of variance with Levene test ($p > .05$), a 3x3 Mixed-design analysis of variance was used to verify differences between the three roles and the results of the three tests administered in July, September and December, which assessed the power of the lower limbs and the speed. Statistical significance was set at $p < .05$. Data was analysed by using SPSS Statistics for Windows, Version 23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp).

RESULTS

A detailed description of the CMJ results was shown in Table 1.

Table 1. CMJ results.

Roles	*CMJ July (Mean ± SD)*	*CMJ September (Mean ± SD)*	*CMJ December (Mean ± SD)*	*Improvement Means (July to Sept) %*	*Improvement Means (Sept to Dec) %*
Defenders	48.6 ± 6.31	45.8 ± 4.71	48.8 ± 4.63	-5.2	6.6
Midfielders	42.8 ± 3.13	40.6 ± 6.57	44.4 ± 6.47	-5.3	9.9
Forwards	48.9 ± 3.66	45.7 ± 5.04	47.5 ± 5.50	-6.6	4.4

A detailed description of the Speed test results was shown in Table 2.

Table 2. Speed test results.

Roles	*Speed test July (Mean ± SD)*	*Speed test September (Mean ± SD)*	*Speed test December (Mean ± SD)*	*Improvement Means (July to Sept) %*	*Improvement Means (Sept to Dec) %*
Defenders	1.75 ± 0.08	1.58 ± 0.05	1.56 ± 0.04	-9.3	-1.1
Midfielders	1.77 ± 0.10	1.65 ± 0.06	1.60 ± 0.05	-6.8	-2.5
Forwards	1.81 ± 0.07	1.61 ± 0.05	1.58 ± 0.05	-11.0	-2.1

A 3x3 mixed design analysis of variance was used to verify differences between the three roles and three CMJ test measurements. The analysis carried out highlighted the following aspects:

- A significant effect of the factor within "*the administered protocol to improve CMJ*" emerges ($F = 5.254$; $p < .05$);
- There is no significant effect of the factor between "*groups*" ($F = 2.291$; $p > .05$);
- There is no significant effect of the interaction between the within factor and the groups factor ($F = 0.371$; $p > .05$).

A detailed description of Roles*CMJ was shown in Figure 1.

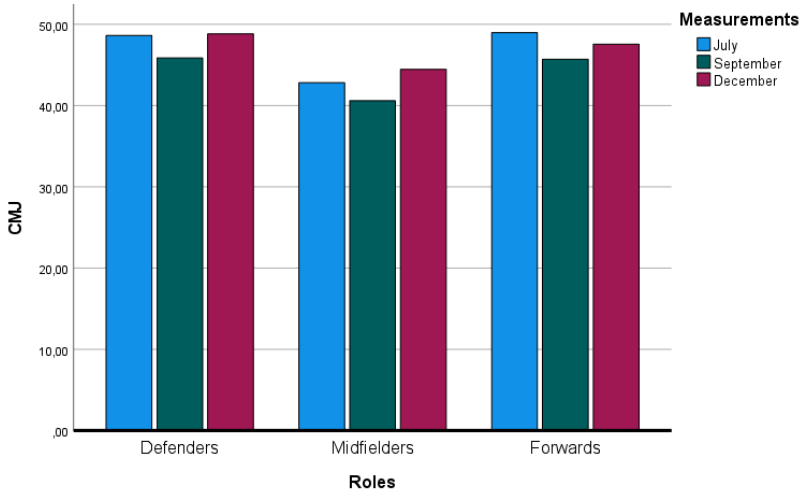

Figure 1. Roles*CMJ.

A 3x3 mixed design analysis of variance was used to verify differences between the three roles and three speed test measurements. The analysis conducted highlighted the following aspects:

- A significant effect of the factor within "*the protocol administered to improve* speed" emerges ($F = 60.342$; $p < .05$);
- There is no significant effect of the factor between "*groups*" ($F = 1.357$; $p > .05$);
- There is no significant effect of the interaction between the within factor and the groups factor ($F = 0.943$; $p > .05$).

A detailed description of Roles*Speed was shown in Figure 2.

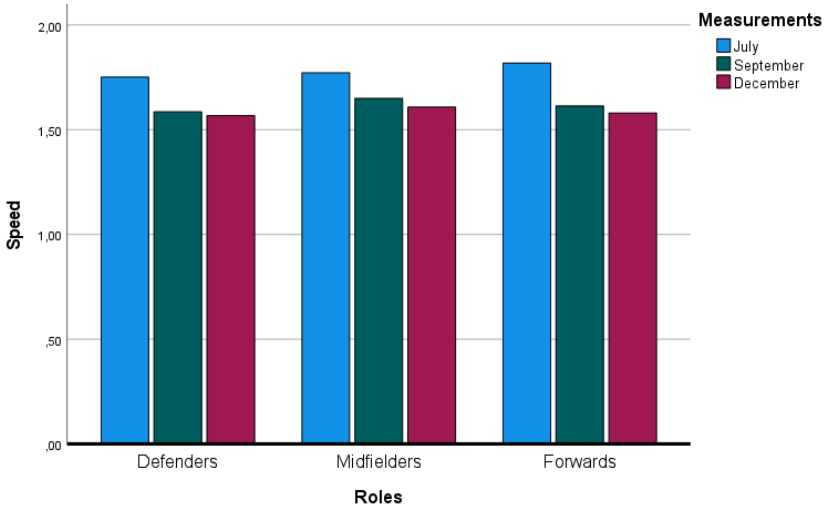

Figure 2. Roles*Speed.

DISCUSSION

The results showed us that it is not possible to adopt a single training protocol without diversifying by roles. The players all started from the same starting point as the Levene test showed us that there was no difference between groups in terms of both the CMJ and the speed test. Between July and September, there was a significant worsening of the power of the explosive limbs. The forwards are the role that has worsened the most, followed by the midfielders and the defenders. From September to December, a period in which the boys were stopped for a while due to the infection from COVID-19, there was a significant improvement. Specifically, the midfielders, followed by defenders and forwards. Overall, the role that benefited most from the training protocol in relation to the power of the lower limbs was that of the midfielder, followed by defender and forward (Tab 3) However, there is no significant difference between roles. As for speed, the situation is different. There was a significant improvement both in the month between July and September, and between September and December. Specifically, the role that had the greatest improvement in the first phase was the forward, followed by the defender and midfielder. In the second phase, however, the midfielder had the greatest improvement, followed by the forward and defender. Overall, the role that benefited most from the training protocol towards speed was that of the forward, followed by the defender and midfielder (Tab 4). In fact, the forwards run meters at high intensity equal to the full backs and midfielders, but sprint significantly longer. However, not even in this case is there a significant difference between roles. For this reason, it is not possible to use the same training protocol for all roles, but to program your own personalized training plan based on the results of the match analysis.

In terms of percentage, the figure of the forward has improved speed more than others, while in terms of power of the lower limbs the figure of the midfielder. The position on the pitch, that of teammates, opponents, the tactics of the team and the opponent all influence your movement pattern (Mohr et al 2003). The results of other studies (Altavilla et al, 2017; Di Salvo et al., 2007) have shown that physical needs are influenced by the playing position. To achieve this goal, it is necessary to establish what the physical needs of the players in relation to the playing position are (Rampinini et al., 2007). It is important to know about the specific work to be done for the different roles and at different times of the year in order to achieve significant individual and, consequently, team improvements (Altavilla et al., 2018b). To verify improvement or worsening, it is very important to carry out evaluation tests (Ceruso et al., 2019; Esposito et al., 2019a). The results of the tests can have important implications at the beginning of the activity, in itinere or post, to identify the gaps to work on and to verify the effectiveness of the work performed (Esposito et al., 2019b).

COVID-19 influenced the performance of players, in fact, according to a study (Rampinini et al., 2021), players have reduced the power of the lower limbs compared to the starting situation, while they have improved their speed, albeit to a smaller measure in the second phase. It would be interesting to investigate other aspects relating to the effects of COVID-19 on performance.

CONCLUSION

In relation to the protocol used, we noticed that in terms of speed the forward role had the greatest improvement, while in terms of power in the lower limbs the role of the midfielder. Physical needs are influenced by the playing position. For this reason, it is not possible to use the same training protocol for all roles, but to program your own personalized training plan based on the results of the match analysis and the performance model of each role. COVID-19 influenced the performance of players, in fact, players have reduced the power of the lower limbs compared to the starting situation, while they have improved their speed. Future research could investigate other effects of COVID-19 on the psychological or performance aspect of the soccer player.

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