Malaysian Journal of Sport Science and Recreation
Vol. 18. No. 2. 150-160, 2022.
DOI: https://doi.org/10.24191/mjssr.v18i2.19553

ASSOCIATIONS BETWEEN SPEED, POWER AND ENDURANCE PERFORMANCE IN SUPER LEAGUE SOCCER PLAYERS

Nur Fatihah Saidi
Chee Hian Tan
Raja Mohammed Firhad Raja Azidin
Hashbullah Ismail
Geik Yong Ang
Faculty of Sports Science and Recreation, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia.

Raja Mohammed Firhad Raja Azidin
Selangor Football Club, Shah Alam, Selangor, Malaysia.
UiTM-MOHE-FAM Football Academy, Shah Alam, Selangor, Malaysia.

Choo Yee Yu
Institute of Bioscience, Universiti Putra Malaysia, Selangor, Malaysia.

Received: 13 April, 2022 **Accepted: 22 June, 2022** **Published: 15 Sept, 2022**

Corresponding Author

Ang Geik Yong, *PhD*
E-mail: geikyong@uitm.edu.my
Faculty of Sports Science and Recreation,
Universiti Teknologi MARA,
Shah Alam, Selangor

Malaysian Journal of Sport Science and Recreation
Vol. 18. No. 2. 150-160, 2022.
DOI: https://doi.org/10.24191/mjssr.v18i2.19553

ASSOCIATIONS BETWEEN SPEED, POWER AND ENDURANCE PERFORMANCE IN SUPER LEAGUE SOCCER PLAYERS

Nur Fatihah Saidi[1], Raja Mohammed Firhad Raja Azidin[2], Chee Hian Tan[3], Hashbullah Ismail[4], Choo Yee Yu[5], & Geik Yong Ang[6]*

[1,2,3,4,6]Faculty of Sports Science and Recreation, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia

[3]Selangor Football Club, Shah Alam, Selangor, Malaysia

[3]UiTM-MOHE-FAM Football Academy, Shah Alam, Selangor, Malaysia

[5]Institute of Bioscience, Universiti Putra Malaysia, Selangor, Malaysia.

ABSTRACT

The physical characteristics favourable for soccer players includes high level of speed, explosive jumping power, and aerobic fitness which highlights the importance of assessing these characteristics for strength and conditioning training program development. The aim of this study is to examine the associations between speed, power and endurance performance of Malaysia Super League soccer players. Twenty-four male soccer players (age = 24.50 ± 3.11 years, height = 176.12 ± 8.11 cm, body mass = 70.86 ± 9.07 kg) were recruited in this study and all the players were tested for explosive lower body power (vertical jump, VJ), speed (30meter sprint), and endurance (Yo-Yo Intermittent Endurance level 2, YYIEL2). A statistically significant correlation was found between 30-meter sprint time and distance covered in YYIEL2, but contrary to previous findings reported in the literature, sprint time and VJ height were not correlated. Therefore, VJ training may not necessarily improve speed and an improvement in VJ performance may not reflect an improvement in speed. In addition, no significant correlation was found between VJ height and the distance covered in YYIEL2. Given the intermittent nature of the game, the negative moderate correlation between sprint time and distance covered in YYIEL2 ($r = -0.43$, $p < 0.05$) indicated that specific aerobic and anaerobic performance could be enhanced simultaneously through the appropriate training programme.

Keywords: *football, elite, anaerobic power, aerobic capacity*

Malaysian Journal of Sport Science and Recreation
Vol. 18. No. 2. 150-160, 2022.
DOI: https://doi.org/10.24191/mjssr.v18i2.19553

INTRODUCTION

Soccer is the most popular sport in the world and classified as a high intensity intermittent team sport (Bangsbo, 1994). The physiological demands of soccer requires the players to be competent in several aspects of fitness including high level of speed, muscular strength, agility, explosive jumping power, anaerobic and aerobic fitness (Bangsbo, 1994; Gaurav et al., 2015; Hoff et al., 2002). These characteristics are repeated many times over 90 minutes in an official match (Rampinini et al., 2007). For this reason, several different tests in both laboratory and field have been conducted to assess the physical performance of soccer players (Svensson and Drust, 2005). Among these tests, the assessment of sprint ability, power, and aerobic fitness are popular among coaches and applied sports scientists (Rampinini et al., 2007; Stolen et al., 2005; Svensson and Drust, 2005). Implementation of these tests requires little equipment and includes common movement skills, thus requiring minimal instructions on how to perform them properly (Vescovi and Mcguigan, 2008).

Sprint speed is an essential component of being successful in the sport of soccer as the ability to accelerate can decide the different outcome of the game (Svensson and Drust, 2005). Soccer players require the ability to quickly accelerate to meet the physical, tactical, and technical demands of the game (Svensson and Drust, 2005). Typically, the 30 meter sprint test is widely used in soccer as it represents the distance representative of soccer play and is easy to execute (Stolen et al., 2005). Furthermore, single-sprint tests can differentiate between different standards of play and positional roles between the teams (Kollath and Quade, 1993) while change-in-direction sprints seem to be of less importance when scoring a goal (Faude et al., 2012).

Speed and explosive lower body muscular power are two high-intensity, interrelated, physiological capacities which contribute to soccer performance (Stolen et al., 2005). Strength and conditioning coaches often direct soccer players to perform explosive exercises as a part of their training program in efforts to improve these parameters, and hence improve sport performance (Erin, 2009). In addition, soccer requires players to perform activities such as striding, turning, and jumping (Stolen et al., 2005). Therefore, muscular power is one of the components that is commonly assessed in soccer players (Rampinini et al., 2007). Vertical jump (VJ) is a short-term measurement reliability of lower limb muscular power and has been reported to have a close relationship with performance in the league (Castagna and Castellini, 2013). Thus, it is shown to be related to competitive success in elite-standard club teams in soccer (Arnason et al., 2004).

In a sport like soccer, which is characterized by intermittent efforts, aerobic capacity is an essential ability (Hoff, 2005; Rampinini et al., 2009). Bangsbo (1993) designed the Yo-Yo test to measure the ability to perform bouts of repeated intense intermittent exercise (Yo-Yo Intermittent Endurance). The Yo-Yo tests have been used extensively in the assessment of the soccer specific endurance capacity of players (Krustup and Bangsbo, 2001; Krustup et al., 2003). High intensity running covered by players during a game was correlated to yoyo test performance, but not to VO2max (Stolen et al., 2005). The performance is also significantly correlated to the amount of high intensity running (>15km/h, r = 0.71), sum of high speed running and sprinting during a game, and the total distance covered during a soccer match (Stolen et al., 2005).

Malaysian Journal of Sport Science and Recreation
Vol. 18. No. 2. 150-160, 2022.
DOI: https://doi.org/10.24191/mjssr.v18i2.19553

The assessment and determination of the physical characteristics are essential to a successful achievement of a soccer team not only during a game, but also along the whole sportive season, and such information can and must be used by the coach to change the player's function or even the tactical formation of the whole team with the purpose to maximize the performance, once each positioning presents specific features (Shephard, 1999). Despite the attention given to performance assessment by sports performance professionals and sports scientists, there is a paucity of research examining the relationships between fitness components, such as sprinting, jumping, and endurance capacity. Several studies have been performed abroad to determine the relationship between these components but obtained conflicting results (Little and Williams, 2009; Wisloff et al., 2004).

Small and moderate correlations were found between 20- and 35-meter sprinting speed and Yo-Yo Intermittent Recovery (YYIR) 1 performance ($r = -0.289$ and -0.321, respectively, $p \leq 0.05$), whereas 35-meter sprinting speed correlated moderately to Yo-Yo IR2 performance ($r = -0.371$, $p \leq 0.05$) (Ingebrigtsen et al., 2014). Furthermore, numerous studies have indicated the possible associations between sprint ability and various jumping performance (López-Segovia et al., 2011; Wisloff et al., 2004). Wisloff (1998), showed moderate to strong relationships between squat performance and 10-meter sprint times (r= 0.94), 30-m sprint times (r= 0.71), and jumping height (r= 0.78). Similarly, the countermovement jump (CMJ) has been shown to demonstrate moderately strong correlations to maximal sprint velocity (Shalfawi et al., 2014). In contrast, Cronin and Hansen (2005) reported weak associations (r ¼70.43 to 70.66) between CMJ and squat jump performance with 5-, 10-, and 30-meter sprint times. Erin (2009), has also reported that high jump results of collegiate female soccer players are associated with 20- and 40-meter sprints but not statistically significant.

The results from these studies illustrate the difficulty in identifying how performances on various field tests can be related to one another (Vescovi and Mcguigan, 2008). The understanding of these associations may offer valuable information for players and coaches to improve the strength and conditioning training process in soccer players and may be a standardized and relevant practice for tracking development of physical capacities in football players (Pedersen et al., 2021). Therefore, the present study aims to examine the associations of speed, power, and endurance performance of Malaysian soccer players from Super League.

METHODOLOGY

Subjects

Twenty-four (n = 24) male soccer players from UiTM FC were selected to participate in this study. In addition, all participated players need to be free from any injury that would prevent maximal effort during performance testing. Before the testing, all players were informed about the aim and methodology of this study. All the players gave their written informed consent before participating and completing this study. All players had been familiarized with the selected tests as the team also used the same tests at the beginning of their pre-season training. Thus, this action would reduce measurement errors caused by learning effects. They were required to undergo anthropometric measurement, and physical fitness tests, for two consecutive days. Selected fitness testing was vertical jump, 30m sprint, and Yo-Yo

Malaysian Journal of Sport Science and Recreation
Vol. 18. No. 2. 150-160, 2022.
DOI: https://doi.org/10.24191/mjssr.v18i2.19553

Intermittent Endurance Level 2 (YYIE2). All the testing started in the morning until all the tests are complete.

Procedures

On the first day, anthropometric measurement including weight and height, and vertical jump test were conducted in FSR Physiology Lab. The standing height (cm) of each player was recorded by using a stadiometer. The players need to take off their shoes and stand still to get the best measurement. Weight was attained using a weight scale. The result of height and weight measurements were recorded to the nearest 0.1 cm and 0.1 kg, respectively.

The vertical jump test was used to measure the explosive leg power. The test was tested using a Vertec device (Sports Imports, Hilliard, OH, USA). Before performing the test, players were instructed to do the warm up consisting of low intensity running. The participants performed the vertical jump test by keeping their hands on the iliac crests, bending their knees, stopping for 1 – 2 seconds, and then jumping as high as possible without knee or trunk countermovement (Rampinini et al., 2007). At the peak of the jump, participants will use the fingers of their dominant arm to displace horizontal vanes of a Vertec device. The standing reach of each participant with the dominant arm fully extended upward will be recorded and the jump score will be derived from subtracting the maximal jump height and the standing height (Miller et al., 2011). The best of two trials (with 1 min rest between each jump) measured to the nearest 0.1 cm was used for the final statistical analysis.

The 30-meter sprint and YYIE2 were held on the second day of testing. These tests took place on the university facility on turf composed of rubber-pellets and artificial grass. A standardized warm up of 10 – 15 minutes was performed that included jogging, shuffling, sprinting, and dynamic stretching exercise.

Speed was evaluated over a 30-meter sprint with a set of electronic timing gates. Participants will start the sprint when they feel ready from a standing start that will be set at 0.3 meter behind the first timing gate. This test was conducted from a standing start, with timing started immediately after the player passed the starting line (Miswan and Sulaiman, 2017). Participants will complete two maximal 30-meter sprints trial and the best performance recorded to the nearest 0.001 seconds will be selected for subsequent analysis (Loturco et al., 2015).

Aerobic capacity was estimated from the YYIE2. The maximal version of the YYIE2 test lasts for 6–25 minutes and consists of repeated 20-meter shuttle runs at progressively increasing speeds dictated by an audio bleep emitted from a CD player. Between each shuttle the players had a 5 seconds period of jogging around a marker placed 2.5 meter behind the finishing line. Failure to achieve the shuttle run in time on two occasions resulted in termination of the test and the distance covered in the last complete successful shuttle was recorded and represented the test result. The testing sessions was performed on an artificial field on a 2 920-meter running lane marked by cones (Bradley et al., 2011).

Statistical Analysis

Malaysian Journal of Sport Science and Recreation
Vol. 18. No. 2. 150-160, 2022.
DOI: https://doi.org/10.24191/mjssr.v18i2.19553

The results were analyzed using standard descriptive statistics and were presented as mean ± standard deviation (SD). Pearson correlation coefficients were used to determine the interrelationships between variables. The following criteria were adopted for interpreting the magnitude of the correlation ® between the measures: trivial ($r \leq 0.1$), small ($r = 0.1$-0.3), moderate ($r = 0.3$-0.5), large ($r = 0.5$-0.7), very large ($r = 0.7$-0.9), nearly perfect ($r > 0.9$), perfect ($r = 1.0$) (Hopkins et al., 2000). All data were analyzed using version 20 of IBM SPSS Statistics and the significance level was set at $p<0.05$.

RESULTS

Table 1 shows the demographic data of male Malaysian soccer players. The mean age of the players (N= 24) was 24.50 ± 3.11 years. Meanwhile, the height and weight of players averaged 176.12 ± 8.11 cm and 70.86 ± 9.07 kg, respectively.

Table 1: Demographic Data of Malaysian Soccer Players

Variables	Mean ± SD	Range
Age (years)	24.50 ± 3.11	20 – 30
Height (cm)	176.12 ± 8.11	163 – 194
Weight (kg)	70.86 ± 9.07	53 -88

Results regarding the relationship between variables which are power, speed, and endurance of players were presented in Table 2.

Table 2: Correlation between Vertical Jump, 30m Sprint, and YYIE2

Variables	Vertical Jump	30m Sprint	YYIE2
Vertical Jump	-		
30m Sprint	-0.29	-	
YYIE2	0.22	-0.43*	-

*p < 0.05 (2-tailed).

There was no significant correlation between VJ and the 30-meter sprint. No relationship also was found between VJ and YYIEL2. However, data shows that there is statistically significant correlation between 30-meter sprint time and distance covered in YYIEL2 of the players ($r = -0.43$, $p <0.05$).

DISCUSSION

The main aim of this study was to assess the relationship between speed, power and endurance performance of Malaysia Super League soccer players. Study findings demonstrated that there is a negative moderate correlation between 30-meter sprint time and distance covered in YYIEL2. The present result was consistent with the results of Pyne et al. (2008). Pyne et al.

also studied male football players and found modest correlation between sprint testing and endurance fitness. Furthermore, the finding from Ingebritsen et al., (2014) also discovered similar results. The study observed small to moderate correlations between sprinting speed and YYIR test performances. However, this finding is contrary to previous research conducted by Krustrup et al. (2006) who observed no significant correlation between YYIR2 and sprint performance (30 meter and 50 meter). Both speed and endurance performances rely on different physiological capacities, therefore, both tests should be assessed when investigating the soccer players' physical capacity (Ingebritsen et al., 2014).

The other main finding of this present study discovered that there were no correlation sprint time and vertical jump height. This finding, however, showed interesting results when most of previous studies reported in literature found the contrary results. Chaleh et al. (2012) showed a significant relationship between power and speed. Erin (2009) also reported correlation between power and speed, but the relationship was not statistically significant. However, both of this research studied female soccer players. In terms of male soccer players, still the same significant results have been reached in several studies (Lopez-Segovia et al., 2014; Wisloff et al., 2004). VJ was used to assess the lower body explosive power, and in terms of performance, the highest jumping performance is better, especially soccer players who always engage in the highball situation to get a positional advantage during offensive and defensive tactics of plays (Miswan and Sulaiman, 2017). The significant correlation between VJ performance and sprint time should be expected since both are derivatives from maximal strength (Wisloff et al., 2004). Furthermore, single sprint is associated with relatively lower body power in soccer players (Lopez-Segovia et al., 2014). Hence, it is suggested that future research can be conducted with larger samples to verify these findings.

Muscular power can be defined as the muscle ability to generate as much force as possible in the shortest possible time (Miswan and Sulaiman, 2017). Power in the form of vertical jumping has been deemed to be functional to optimal performance in soccer and shown to be related to competitive success in elite-standard club teams (Arnason et al., 2014; Castagna and Castellini, 2013; Mujika et al., 2009). The present study found no correlation between VJ height and distance covered in YYIEL2. Considering that endurance is traditionally an important component of performance in soccer, somehow, it has been proved that lower limb power did not relate to the endurance performance. In team sports, endurance refers to the ability to continuously carry out moderate to high intensity activities (Bangsbo et al., 1995). Correlation between these variables was not widely studied by the sports scientist in the past. Therefore, little is known about the existing relationship between power and endurance. Further, studies are, therefore, needed to establish the association between power and endurance performance in order to assist the team coach in constructing the training program.

CONCLUSION

In this cross-sectional study, sprint time, but not power, was associated with endurance in Malaysian Super League soccer players. 30-meter sprint was moderately associated with YYIEL2 performance. These findings indicated that specific aerobic and anaerobic performance could be enhanced simultaneously through the appropriate training programme. Also, considering the importance of each variable in the performance of soccer, development of such characteristics in soccer players should be paid more attention by coaches and experts.

Contribution of Authors

Geik Yong Ang – Corresponding Author and lead the research at all parts and Interpretation the data.

Nur Fatihah Saidi - Lead the research, Interpretation and the data Collection.

Chee Hian Tan – Contributing to the idea of the research and interpretation of data

Raja Mohammed Firhad Raja Azidin – Contributing to the idea of the research and the flow of thought.

Hashbullah Ismail- Contributing to the idea of the research.

Choo Yee Yu – Contributing to the idea of the research, analysing and proof reading of write out.

Declaration of Interest

All co- authors declared that there was no self- interested in the publication

Acknowledgement

Authors would like to thank the fund from the Ministry of Higher Education Malaysia through the FRGS grant (FRGS/1/2018/SS06/UITM/02/1)

REFERENCES

Arnason, A., Sigurdsson, S. B., Gudmundsson, A., Holme, I., Engebretsen, L., & Bahr, R. (2004). Physical fitness, injuries, and team performance in soccer. *Medicine & Science in Sports & Exercise*, *36*(2), 278-285.

Bangsbo, J. (1993b). Yo-Yo testene. Bro¨ndby: Danmarks Idraetsfo¨rbund.

Bangsbo, J. (1994). The physiology of soccer--with special reference to intense intermittent exercise. *Acta Physiologica Scandinavica. Supplementum*, *619*, 1-155.

Bangsbo, J., Aagaard, T., Olsen, M., Kiens, B., Turcotte, L. P., & Richter, E. A. (1995). Lactate and H+ uptake in inactive muscles during intense exercise in man. *The Journal of Physiology*, 488(1), 219-229.

Bradley, P. S., Mohr, M., Bendiksen, M., Randers, M. B., Flindt, M., Barnes, C., ... & Krustrup, P. (2011). Sub-maximal and maximal Yo–Yo intermittent endurance test level 2: heart rate response, reproducibility and application to elite soccer. *European journal of applied physiology*, *111*(6), 969-978.

Castagna, C., & Castellini, E. (2013). Vertical jump performance in Italian male and female national team soccer players. *The Journal of Strength & Conditioning Research*, *27*(4), 1156-1161.

Chaleh, M., Fatemi, R., & Shahsavar, A. (2012). Relationship between speed, agility and anaerobic power of 14-16 years elite soccer players. *Int J Appl Basic Sci*, *3*, 127-432.

Cronin, J. B., & Hansen, K. T. (2005). Strength and power predictors of sports speed. *The Journal of Strength & Conditioning Research*, *19*(2), 349-357.

White, E. C. (2009). *The association between power and sprint performance in collegiate female soccer players* (Master's thesis, Humboldt State University).

Faude, O., Koch, T., & Meyer, T. (2012). Straight sprinting is the most frequent action in goal situations in professional football. *Journal of sports sciences*, *30*(7), 625-631

Hoff, J., Wisløff, U., Engen, L. C., Kemi, O. J., & Helgerud, J. (2002). Soccer specific aerobic endurance training. *British journal of sports medicine*, *36*(3), 218-221.

Hoff, J. (2005). Training and testing physical capacities for elite soccer players. *Journal of sports sciences*, *23*(6), 573-582.

Hopkins, W. G. (2000). Measures of reliability in sports medicine and science. *Sports medicine*, *30*(1), 1-15.

Gaurav, V., Singh, A., & Singh, S. (2015). Comparison of selected physical fitness components among male football players of different playing positions. *Turkish Journal of Sport and Exercise, 17*(2). doi:10.15314/tjse.68533

Ingebrigtsen, J., Bendiksen, M., Randers, M. B., Castagna, C., Krustrup, P., & Holtermann, A. (2012). Yo-Yo IR2 testing of elite and sub-elite soccer players: performance, heart rate response and correlations to other interval tests. *Journal of sports sciences*, *30*(13), 1337-1345.

Kollath, E., & Quade, E. (1993). Experimental measures of professional and amateur soccer players' sprinting speed. *Science and Football II*, 31-36.

Krustrup, P., & Bangsbo, J. (2001). Physiological demands of top-class soccer refereeing in relation to physical capacity: effect of intense intermittent exercise training. *Journal of sports sciences*, *19*(11), 881-891.

Krustrup, P., Mohr, M., Amstrup, T., Rysgaard, T., Johansen, J., Steensberg, A., ... & Bangsbo, J. (2003). The yo-yo intermittent recovery test: physiological response, reliability, and validity. *Medicine & Science in Sports & Exercise*, *35*(4), 697-705.

Krustrup, P., Mohr, M., Nybo, L., Jensen, J. M., Nielsen, J. J., & Bangsbo, J. (2006). The Yo-Yo IR2 test: physiological response, reliability, and application to elite soccer. *Med Sci Sports Exerc, 38*(9), 1666-1673. doi:10.1249/01.mss.0000227538.20799.08

Little, T. Williams, AG. (2009). Specificity of acceleration, maximum speed and agility in professional soccer players. Journal of Strength Conditioning Research. 19(1),76-87.

Loturco, I., Pereira, L. A., Kobal, R., Zanetti, V., Kitamura, K., Abad, C. C. C., & Nakamura, F. Y. (2015). Transference effect of vertical and horizontal plyometrics on sprint performance of high-level U-20 soccer players. *Journal of sports sciences*, *33*(20), 2182-2191.

Miller, D. K., Kieffer, H. S., Kemp, H. E., & Torres, S. E. (2011). Off-season Physiological Profiles of Elite National Collegiate Athletic Association Division III Male Soccer Players. *The Journal of Strength & Conditioning Research*, *25*(6), 1508-1513

Miswan, M. S., & Sulaiman, N. (2017). Selected Physiological Profile among Malaysian 3rd Tier Fam League Football Players. *International Journal of Asian Social Science*, *7*(5), 372 380.

Mujika, I., Santisteban, J., Impellizzeri, F. M., & Castagna, C. (2009). Fitness determinants of success in men's and women's football. *Journal of sports sciences*, *27*(2), 107–114. https://doi.org/10.1080/02640410802428071

López-Segovia, M., Marques, M. C., van den Tillaar, R., & González-Badillo, J. J. (2011). Relationships between vertical jump and full squat power outputs with sprint times in u21 soccer players. *Journal of human kinetics*, *30*, 135.

Pedersen, S., Welde, B., Sagelv, E. H., Heitmann, K. A., B. Randers, M., Johansen, D., & Pettersen, S. A. (2021). Associations between maximal strength, sprint, and jump height and match physical performance in high-level female football players. *Scandinavian Journal of Medicine & Science in Sports*.

Pyne, D. B., Saunders, P. U., Montgomery, P. G., Hewitt, A. J., & Sheehan, K. (2008). Relationships between repeated sprint testing, speed, and endurance. *The Journal of Strength & Conditioning Research*, *22*(5), 1633-1637.

Rampinini, E., Bishop, D., Marcora, S. M., Ferrari Bravo, D., Sassi, R., & Impellizzeri, F. M. (2007). Validity of simple field tests as indicators of match-related physical performance in top-level professional soccer players. *Int J Sports Med, 28*(3), 228-235. doi:10.1055/s 2006-924340

Rampinini, E., Sassi, A., Morelli, A., Mazzoni, S., Fanchini, M., & Coutts, A. J. (2009). Repeated sprint ability in professional and amateur soccer players. *Applied Physiology, Nutrition, and Metabolism*, *34*(6), 1048-1054.

Shalfawi, S., Enoksen, E., & Tonnessen, E. (2014). The relationship between measures of sprinting, aerobic fitness, and lower body strength and power in well-trained female soccer players. *International Journal of Applied Sports Sciences*, *26*(1), 18-25.

Shephard, R. J. (1999). Biology and medicine of soccer: an update. *Journal of Sports Sciences*, *17*(10), 757-786.

Stølen, T., Chamari, K., Castagna, C., & Wisløff, U. (2005). Physiology of soccer. *Sports medicine*, *35*(6), 501-536.

Svensson, M., & Drust, B. (2005). Testing soccer players. *Journal of sports sciences*, *23*(6), 601-618.Vescovi, J. D., & Mcguigan, M. R. (2008). Relationships between sprinting, agility, and jump ability in female athletes. *Journal of sports sciences*, *26*(1), 97-107.

Wisløff, U., Castagna, C., Helgerud, J., Jones, R., & Hoff, J. (2004). Strong correlation of maximal squat strength with sprint performance and vertical jump height in elite soccer players. *British journal of sports medicine*, *38*(3), 285-288.

Wisløff, U., Helgerud, J., & Hoff, J. (1998). Strength and endurance of elite soccer players. Medicine and Science in Sports and Exercise, 30, 462 –467.