INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES
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ISSN: 2222-6990

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To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v12-i4/13063 DOI:10.6007/IJARBSS/v12-i4/13063

Received: *06* February 2022, ***Revised:*** *10* March 2022, ***Accepted:*** *29* March 2022

Published Online: 04 April 2022

In-Text Citation: (Kosni et al., 2022)

To Cite this Article: Kosni, N. A., Sanuddin, N. D., Sidi, M. A. M., Azam, M. Z. M., Rahman, S. A. A., & Kamalrulzaman, S. A. (2022). Relationship between Explosive Strength With Speed and Agility among U-12 Football Athletes. *International Journal of Academic Research in Business and Social Sciences*, *12*(4), 279–288.

Vol. 12, No. 4, 2022, Pg. 279 – 288

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Abstract
To excel in football, speed and agility are the key elements of fitness. Thus, some combinations of strength, power and plyometric training have been applied in order to enhance both components. There are some studies that found the positive correlations between explosive strength with both speed and agility components that led to the finding which suggested that improving muscle strength and power may help to turn these changes into reducing in time for sprinting and the ability to change direction for athletes. However, the studies about this relationship on youth football athletes have been limited especially for youth football athletes in Malaysia. Thus, this study aimed embarking to discover the correlation between explosive strength with speed and agility among U-12 football athletes in Malaysia. This study was divided into three tests which included standing broad jump, 30m sprint and 10m agility shuttle test. Twenty-six U12 elite football players were equally assigned in this study. This study uses a correlational test design which is Pearson Correlation to evaluate the relationship between standing broad jump with 30m sprint and 10m agility shuttle test. The result for correlation between standing broad jump and 30m sprint shown a non-significant correlation, (r=-.368, p=.064) while the result for correlation between standing broad jump and 10m agility shuttle test shown a significant correlation, (r=-.570, p=.002). Overall, this research highlighted that agility was affected by explosive strength while sprint was not affected by explosive strength among U12 football players in Malaysia.
Keyword: Agility, Explosive Strength, Football Athletes, Speed

Introduction

Football can be considered as one of the most popular sport worldwide as FIFA World Cup is ranked as the most viewed sporting tournament. In Malaysia, football is played by large numbers of people as it is one of the most popular sports in this country. Football involved 2 teams with 11 players. One of the players played as a goalkeeper and the game is played by kicking a ball and aiming to score by putting the ball inside the opponent's goal. The objective of the game is that each teams need to score goals by shifting the teams to the opposing end of the field and either to a target area or to a line (Pandey & Chaubey, 2015)

According to Beni et al (2017), football has gone through many changes and innovations from a simple game to become a popular football game that the public enjoys. Lepschy, Hagen & Woll (2018) added that the sport has the elements of probability and likelihood, but this does not mean the winning team is luckier than the losing team. Football is considered as one of the most difficult sports as a player needs a lot of physical conditioning to do well during the match to help the team achieve a successful result.

To excel in football, speed and agility are the key elements of fitness. Thus, some combinations of strength, power and plyometric training have been applied to enhance both components (Kobal, et. al., 2016). These two elements generally influence the performance of a player in football games as both components are essential to gain and to maintain ball possession (Doyle, 2016; Afyon et al., 2017). Moreover, high intensity and explosive movement that is full of technical demand like change of direction, tackling, jumping, kicking, and sprinting will determine the result of the match (Zago, Giuriola & Sforza, 2016). Thus, this actively demonstrates that in order to enhance these skills, it is believed that particular activities and training must be performed.

The use of some combinations of strength, power, and plyometric training to enhance speed and agility has led to some studies that investigated the relationship between explosive strength with speed and agility among field sport athletes. There are some studies that found the positive correlation between explosive strength with both speed and agility components. This led to the suggestion that improving muscle strength and power may help to reduce the time for sprinting and the ability to change direction for athletes (Ibrahim Hamed Ibrahim Hassan, 2018). However, the studies on this relationship on youth football athletes are limited especially for youth football athletes in Malaysia. Thus, this study aimed to investigate the correlation between explosive strength with speed and agility among U-12 football athletes in Malaysia.

Materials and Methods

Participants

This study used a correlational test design to evaluate the association between standing broad jump with 30m sprint & 10m agility shuttle test. Correlational analysis is often viewed as descriptive research which explains in quantitative terms the degree to which these variables are linked–This study included observational research utilizing secondary evidence. A one-shot case study is a research method in which a particular population is studied following an incident, diagnosis, or action on a specific instance. This study is a one-shot experiment because only one test is needed to measure the data analysis outcome. One-shot research is conducted when the set of subjects being evaluated does not have a pre and post-test trial. The result of the experiment was evaluated to determine if the higher explosive strength measure resulted in better sprint and agility performance.

Test Protocol

The lower limb strength and power were assessed with standing broad jump (Hassan, 2018). To perform standing broad jump, subjects were asked to stand at the starting line and start jumping as further as possible with maximum effort. The results were recorded in centimeter.

To assess the speed of subjects, 30m sprint test-was used (Christopher Bellon, 2016; Chan, 2016; Hassan, 2018). Starting and finishing line was marked using-markers. Prior to the test, the subjects stood-at the starting line and were told. Sprint to the finish line as fast as possible with maximum efforts. Time taken for the subjects to finish the test was recorded in second.

The agility test was performed by using 10meter agility shuttle test (Nimphius et. al., 2017). The subjects were showed a demonstration prior to the testing. To perform the test, markers were put at the starting and the finishing line with 10m distance between each marker. During the test, the subjects were instructed to stand behind the starting line and, run towards the finishing line and then run back to the starting line. Time taken for the subjects to finish the test was recorded in second.

Statistical Analysis

In this study, data gathered was analysed using descriptive statistics. To analyse the data, the researcher applied the use of IBM SPSS 26 software. Pearson Correlation Coefficient was conducted to analyse the relationship between explosive strength with speed and agility of the subjects. The data of all the results were-analysed from this software.

Result and Discussion

Table 1 shows the descriptive statistics for a total number of 26 participants who participated in this study with mean and std. deviation of height (153.92 ±7.66) in centimetre, while the mean and std. deviation of weight (43.65±9.89) in kilogram, the mean and std. deviation of body mass index (18.35±2.98), the mean and std. deviation of 30m sprint (4.22±0.22) in second, the mean of 10m agility shuttle test (10.75±0.44) in second and lastly, the mean and std. deviation for standing broad jump (1.81±0.20) in meter.

Table 1: Descriptive Statistics on Height, Weight, Body Mass Index (BMI), 30m Sprint, 10m Agility Shuttle Test, Standing Broad Jump of U12 Football Athletes.

Variables	N	Mean	Std. Deviation
Height (cm)	26	154.22	7.69
Weight (kg)	26	43.65	9.89
BMI (kg/m^2)	26	18.35	2.98
30m Sprint (s)	26	4.22	0.22
10m Shuttle (s)	26	10.75	0.44
SBJ (m)	26	1.81	0.20

Table 2 shows the-correlation analysis between standing broad jump with 10m agility shuttle test and 30m sprint with the number of non-missing observation was (n=26). The correlation between standing broad jump and 10m agility shuttle test was (r=-.570). There was a large negative correlation between the two variables, r=-.570, n=26, p=.002. The correlation between standing broad jump and 30m sprint was (r=-.368). There was a medium negative correlation between the two variables, and the result indicated no significant relationship between the two, r=-.368, n=26, p=.064.

Table 2: Pearson Correlation Analysis between standing broad jump with 10m Agility shuttle test and 30m Sprint

		10m Agility Shuttle Test	30m Sprint
Standing Broad Jump	Pearson Correlation	-.570**	-.368
	Sig. (2-tailed)	.002	.064
	N	26	26

Figure 1 shows that standing broad jump and 10m agility shuttle test had a significant linear relationship as the r^2= 0.325. Based on the result on linear relationship (r^2= 0.325), to calculate the r^2 (-.570x-.570) which is the result from the correlation table above and to convert the variance percentage from the result, multiply by 100 and the result of variance percentage from the table correlation above became 32.49%. This indicated that there was a strong relationship between these two variables which are the standing broad jump and 10m agility shuttle test. The relationship was negative because as the distance for standing broad jump increased, the shorter the time taken to finish 10m agility shuttle test became.

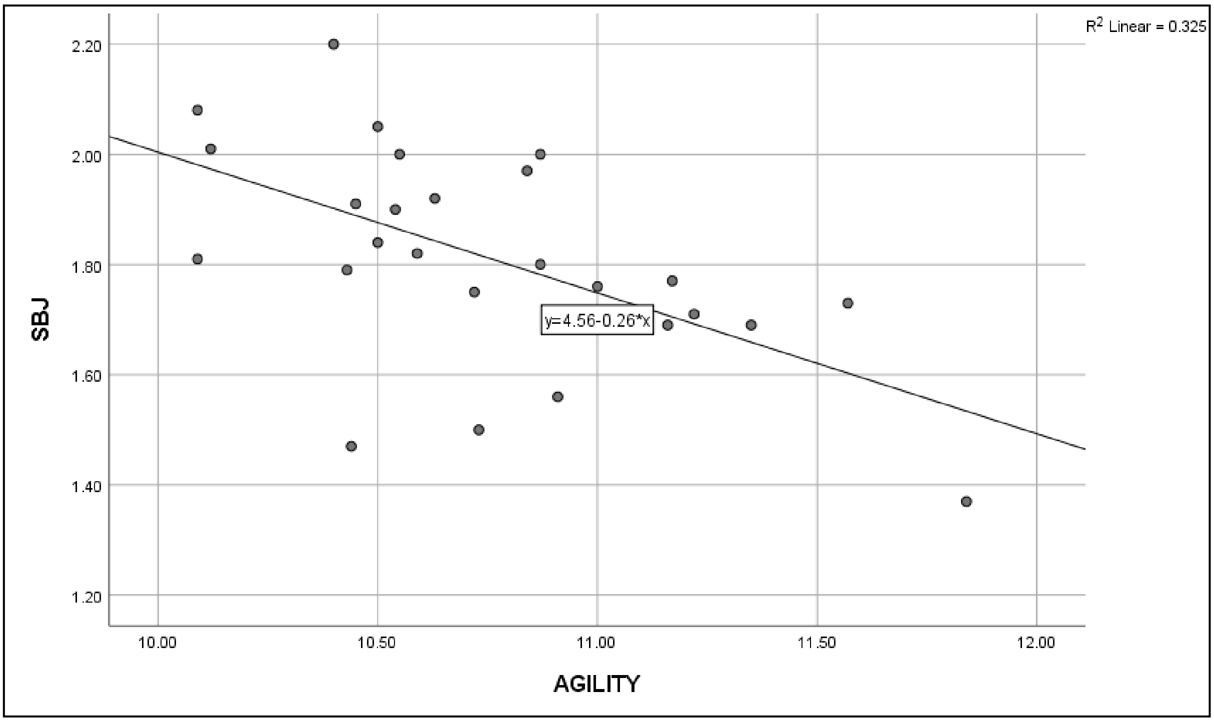

Figure 1: Scatterplot Graph of Correlation between Standing Broad Jump and 10m Agility Shuttle Test

Figure 2 shows that standing broad jump and 30m sprint showed–a week negative relationship as the R^2= 0.135. Based on the result on linear relationship (r^2= 0.135), to calculate the r^2 (-.368x-0.368) which is the result from the correlation table above and to convert the variance percentage from the result, multiply by 100 and the result of variance percentage from the correlation table above became 13.54%. This indicated that there is a strong relationship between these two variables which are standing broad jump and 30m sprint. The relationship was negative because as the distance for standing broad jump increased, the shorter the time taken to finish the 30m sprint became.

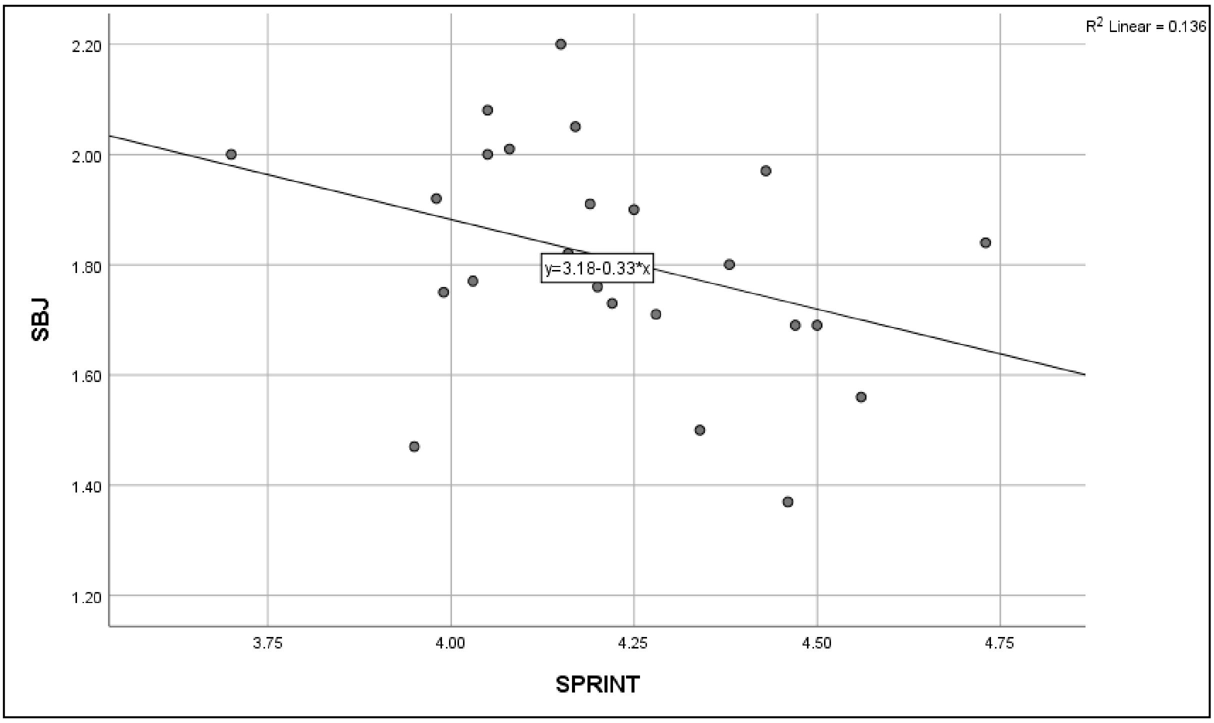

Figure 2: Scatterplot Graph of Correlation between Standing Broad Jump and 30m Sprint

Discussion

The data derived from the current study indicated that the analysis between standing broad jump and 30m sprint test among U12 football athletes showed a low negative correlation (r=-0.368). The analysis also showed a non-significant correlation (p=0.064). Doyle (2016) had conducted a study about the relationship between speed, agility and measures of strength and power among 16 males who participated in field game sports and had at least six months of' resistance training experience including football athletes. The opposite result was found as the researcher discovered that countermovement jump correlated significantly with 15-25m (r=-0.57), 25m speed (r=-0.53). In addition, the researcher also found significant correlation between vertical jump height and all split sections of speed. The most significant correlation found was between vertical jump and 10m sprint test (r=-0.73) (p<0.01).

Previous study by Bellon (2016) found that sprint velocity, step length, step frequency, and flight time were statistically greater at 12m in comparison to 6m and 2.5m, while ground contact time was statistically shorter at 12m compared to 6m and 2.5m. Additionally, sprint characteristics at 6m also displayed the same relationships when compared to 2.5m, with sprint velocity, step length, step frequency, and flight time being statistically greater at this distance, and ground contact time being statistically shorter as well. Based on the differences, these appear to be congruent with distances of approximately 2.5m, 6m, and 12m, respectively. A study by Hassan (2018), found the opposite result from the current study as the analysis between the level of vertical jump height performance showed a moderate correlation with the 20m sprint time (r=- 0.66, p<0.01), 30m sprint time (r=- 0.63, p< 0.01). In contrast, the result supported the current research when the researcher analysed the correlation between standing broad jump with all sprint tests as there were no significant correlation found between speed variables times with standing long jump values.

Based on existing research, the researchers seem to suggest that explosive strength is associated with early acceleration phase of speed which results in the decrease in time in sprinting for football athletes. These could be the reason as the result from current study showed no significant as the test used was 30m sprint since the longer the sprint distance, the less influence explosive strength brings towards athlete's sprint ability. Previous research indicated that the research been done to older athletes, since U12 athletes have not fully reached their peak physical abilities. This had been supported by Paul, et al., (2011), as the researchers stated that in long-term athlete development (LTAD) model, 12 years old athletes are in the phase called training to train which means that the athletes are building the engine to reach peak physical ability and basic components which includes stamina, strength, speed, skill, and agility. Furthermore, compared to the change of direction movement, when athletes perform linear sprint, the athletes only use the explosive strength during the acceleration phase. This is the reason why certain studies found a correlation between explosive strength with speed during early phase of sprinting (Bellon, 2016; Doyle, 2016). The reason that leads to this is due to the average time for athletes to finish 30m sprint is 4 second while explosive strength test such as standing broad jump and vertical jump only need less than 1 second to complete. In addition, another possible assumption from Young et al (2015), is that the result from this current study may be because speed is an independent component. This means that no other variables influence the athlete's performance during linear sprinting.

The second analysis which includes the correlation between standing broad jump and 10m agility shuttle test demonstrated that those variables had a significant relationship (p=0.002). The data obtained also indicated a negative correlation between those variables (r=-0.57). The result form this current study is supported by previous study from Shantanu et al (2015), the researchers found negative correlation between explosive strength and agility (r=-.618) (p=.000). Another study from Alfonso (2012), also supports the finding of current research as the researchers found negative and significant correlation in change of direction and jump test variables (r2 =0.483) (p=0.004). Based on Pandey (2015), the researcher stated a significant difference between explosive strength and agility of male football players. Findings also showed negative correlation between explosive strength and agility of male football players (r =-0.537). A study by Hassan, (2018) found that peak power from vertical jump correlated with zig zag run (r= -0.61).

According to the data derived from the previous studies and the result of the current study, the researcher can conclude that the explosive strength is the most influential variable for developing the agility of the individual. In addition, peak ground reaction lets athletes experience better grip during changing of direction process. To explain, the change in direction of performance is affected by such a range of physical factors. First, the exogenous structure of the motion, which is the acceleration-break-turn-acceleration capacity, which must be related to the nature of the muscle contraction. Second, the dominance which must be ascertained in the first stage of maturation, and which factors that influence the preference and speed of rotation. As far as muscle contraction factors are concerned, a sequence of concentric contractions that are recognized as stretch-shortening cycles is preceded by musculoskeletal contraction factors (Alfonso et al., 2012). Consequently, the assessment of the stretch-shortening cycle is the primary concern for approximating the capacity to perform a change of direction with high efficacy. Sonoda, (2018) also indicated that the change in directional ability has been shown to consist of several factors, such as straight sprint, leg muscle strength, and running technique, demonstrating that agility requires muscle power to move quickly and move efficiently. The explosive strength of the lower limb, measured by the standing broad jump, is a crucial component of competitive success in football and other team sports. Various parameters contribute to muscle power including strength development rate, speed strength, stretch-shortening cycle as well as intra-and inter-muscular coordination (Gustavo, et. al., 2013).

Furthermore, this may be due to the nature of football, as players usually use their body ability to jump as far and as high as they could to get the ball so–the players implemented the lower limbs explosive strength during agility performance. In several sporting events, jumping seems to be a more common aspect of performance indicator or training (Nimphius et al., 2010). Moreover, 10m agility shuttle test is also similar to the other soccer activities, such as dribbling and shifting from attacking to defending as a change of direction during the soccer game. Contrasting with linear sprinting, change of direction movement require more acceleration phase where each time athletes change direction, athletes will require a large force which means that explosive strength is implemented each time change of direction occurs. Compared to result from some previous research and current study, Doyle (2016) found opposite result as the researcher found a non-significant correlation between explosive strength with 25m agility test (r=-0.18). The reason for this circumstance could be that the U12 football players involved were not familiar with this test compared to 10m agility shuttle test. Doyle (2016), clarified that agility is a very complex and difficult skill for players to learn. Athletes may find it very difficult when presented with a difficult course, which the athletes have not experienced beforehand. This is especially true for young athletes as stated in the LTAD model (Lloyd, 2011), that 12 years old athletes are in the phase called training to train in which the athletes are building the engine to reach peak physical ability and basic components. It may be difficult to accurately assess agility performance, but any test of agility should include the essential elements such as acceleration, deceleration, stopping and changes of direction (Doyle, 2016).

Conclusion

The findings of the study in general indicated–that there is a significant difference between explosive strength and agility among U12 football athletes in Malaysia. Findings also showed–negative correlation between explosive strength and agility among those athletes. In contrast, the current study found a non-significant with negative moderate correlation between explosive strength and speed among U12 football athletes in Malaysia. These findings have answered all research questions in this current study.

Acknowledgement

This research was funded by *Geran Penyelidikan MyRA* (600-RMC/GPM ST 5/3) from Universiti Teknologi MARA (UiTM).The authors would like to acknowledge and thank all of the participants for their valuable contribution to this project.

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