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Original Article

Is there a relationship between horizontal jump and sprint performance in professional amputee football players?

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Abstract

Aim: Although amputee football is not a Paralympic branch, it is growing in popularity. It has some differences compared to regular football, and it also requires high levels of flexibility, endurance, strength, power, speed and, agility as normal football. However, the relationship between sprint and jumping performance in amputee football players has not been fully revealed. The aim of this study is to determine the relationship between one leg hop and sprint performance in professional amputee football players.

Material and Methods: Twelve Amputee Super League football team players participated in the study. One leg hop performance of the players was evaluated with the one leg hop test, and the sprint performance was evaluated with 10m, 20m and 30m sprint tests. The relationship between the performances was examined with Spearman's Correlation.

Results: The study revealed that there is a significant relationship between the one leg hop and 20m (p=0.001), 30m sprint performances (p=0.001), but no relationship with the 10 m sprint test (p=0.117).

Conclusion: The results of the study showed that 20m, 30m sprint and horizontal jump performances of the amputee football players were correlated and the other not. Given that amputee football is a sport with different dynamics, new studies are needed to shed light on the power mechanisms necessary for performance.

Keywords: Amputees; football; athletic performance, running; crutches.

INTRODUCTION

The term amputation is defined as the partial or total absence of the upper and/or lower extremities (1). It leads to a negative impact on the physical and psychosocial function of the individual by creating a physical disability (2,3). It is generally accepted that participation in a sport or physical activity is one of the basic approaches to achieving a healthy life (3). Studies have shown that sports or physical activity have positive effects on health in individuals with physical disabilities as in healthy individuals (4, 5). For this reason, sports activities are often recommended for people with disabilities (6).

Activities that were initially created for recreational purposes for the disabled turned into professional branches in time. One of these sports branches created by this passion is amputee football. Amputee football, also called amputee soccer, is one of the disabled sports branches that is constantly increasing its popularity although it is not a Paralympic branch (7,8). Even though the pitch measurements and the game rules differ from normal football, high flexibility, endurance, power, speed and agility are required in amputee football as well in order to show adequate performance (9,10).

For most sports branch, sprint is considered as a basic requirement for sportive performance (11, 12) and studies have demonstrated the importance of force generation for adequate sprint performance (11-13). It is known that the presence of lower extremity strength and power requirement is essential for force generation (11,13). Amputee football is a sport that aerobic and anaerobic features are used together, and sudden bursts for power generation play a big role in performance also (12) and as in normal football, it has the similar running activities such as back and forth maneuvering, sudden acceleration,

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stopping, jogging, and tackling (7,12,14). However, amputee football has also different dynamics given that it is played with one lower extremity and crutches, and the studies on other sports branches may not provide evidence about amputee football. Therefore, the performance relationships need to be tested in order to reveal the necessary power mechanisms of the amputee football and to improve the performance of the amputee players.

The findings in the literature have revealed that there are not enough studies on amputee football. Increasing the number of studies on amputee football players may help create normative data from performance values and organize training programs for players. Given that the sport science studies are mostly based on power-based laboratory studies (15), the importance of field studies specific to the nature of sport comes to the fore. As a result of literature review, it was found one study examining the relationship between counter movement jump, squat jump and sprint tests in amputee football players (12). However, there are no studies examining the relationship between the one leg hop and running performance in amputee football players. In this respect, this study would be the first in the literature focusing on this relationship. As both one leg hop and running performances are on the horizontal plane, it is thought that there may be a relationship between them (16,17). Therefore, the aim of this study was to reveal whether there is a relationship between one leg hop and sprint performance in professional amputee football players.

MATERIAL and METHODS

This is a descriptive study. Prior to the study, written permission was obtained from Aydin Adnan Menderes University, Faculty of Health Sciences, Non-Invasive Clinical Research Ethics Committee (Date: 24/04/2019, Number: 92340882-050.04.04, Protocol No: 2019/022). All the participants were informed about the study prior to the tests and their written consent was obtained. This study included the football players aged 18 and over who volunteered to take part in the study. Those who underwent surgery to their upper or lower extremities in the last six months and who had upper extremity amputation (goalkeepers) were excluded from the study.

The study was completed with 12 players of the Ortotek Engelliler (Turkish Super League Amputee Football Team) who met the inclusion criteria. The one leg hop test and the running tests (10m, 20m, 30m) were performed to determine the relationship between one leg hop and sprint performances of the amputee football players. The same physiotherapist performed all the evaluations. The warm-up period of the players before the evaluation included jogging and stretching stages, and there was a 5-minute rest period between the evaluations (7).

One leg hop test

Before the evaluation, the players were informed about the content of the test. First, the participants stood on one foot with their hands on their waist on the starting line. Then, while the players were in this position, they were asked to

Figure 1. One leg hop test

Figure 2. Sprint tests

jump as far as possible without losing their balance and without lowering their hands from the waist and to fall on the same foot. The difference between the start and the finish line was recorded in cm as the one leg hop distance of the participants (Figure 1) (18, 19).

Sprint performance

The sprint performance of the amputee football players was determined with 10, 20 and 30 m sprint tests. For the test, the starting line was created and each 10 m interval was specified. The test was started with command and the duration was recorded in seconds at every 10 m interval. During the test, the participants ran not with their prostheses, but with their crutches as in the real game (Figure 2) (12).

Statistical analysis

The normality analyses of the data were tested using visual (histogram, probability plots) and analytical (Shapiro Wilk's test) methods. The analyses showed that the data did not have normal distribution. The numerical data obtained from the participants were given as mean ± standard deviation and median, and the categorical variables were given as number and percentage. The relationship between the one leg hop and sprint performance was determined with Spearman' Correlation. The values were accepted as weak (0-0.25), moderate (0.26-0.50), strong (0.51-0.75) and very strong (0.76-1.00) (20). The statistical significance level for all the data was determined as $p<0.05$.

RESULTS

The mean age of the twelve professional team players was 28.75 ± 6.61, and the mean height was 175.08±8.36 cm. As a result of the one leg hop test, the horizontal jumping performances of the players were found as 201.08 ± 30.91 cm, and the results for the 10m, 20m and 30m sprint tests were found as 2.20 ± 0.30s, 4.00 ± 0.77s, and 5.64 ± 0.86s, respectively.

Table 1.Demographics of the Amputee Players

	Mean ± SD	Median (Minimum-Maximum)
Age (year)	28.75±6.61	27.00 (19-40)
Height (cm)	175.08±8.36	180.00 (162.00-184.00)
Weight (kg)	69.42±10.19	70.00 (50.00-88.00)
One leg hop (cm)	201.08±30.91	212.50 (132-252)
10m sprint (s)	2.20±0.30	2.15 (1.91-3.06)
20m sprint (s)	4.00±0.77	3.69 (3.43-5.67)
30m sprint (s)	5.64±0.86	5.40 (4.91-8.10)
	n:	
Amputation side	7 left, 5 right	
Amputation reason	congenital 4, acquired 8	

Table 2. Correlation [Rho (p value)] between one leg hop and sprint tests

	10m sprint	20m sprint	30m sprint
One leg hop	-0.476 (0.117)	-0.809 (0.001)	-0.816 (0.001)
10m sprint		0.643 (0.024)	0.713 (0.009)
20m sprint			0.986 (<0.001)

The correlation analysis showed that one leg hop test of the amputee players have very strong correlation between 20m and 30 m sprint tests ($p=0.001$) but no statistically significant relationship with 10 m sprint test ($p=0.117$). Besides, 10m, 20m and 30m sprint tests were statistically significant and had strong-very strong correlation ($p<0.05$) with each other. Table 1 and Table 2 show the detailed demographic information about the players and the results of the correlation analysis, respectively.

DISCUSSION

This study was performed to determine the relationship between the sprint and jump performances. The results of the analyses revealed that there is a significant relationship between the one leg hop distance and 20m, 30m sprint performance of the professional amputee football players but not with 10m sprint test.

Sports for the disabled people play an important role in the development of general health as well as the integration of the disabled into society. Due to these features, the disabled individuals are strongly recommended to participate in physical or sportive activities (3,6,21,22). Amputee football is one of these activities which were created for recreation and rehabilitation purposes. However, amputee football, which continues its development with its rehabilitative and social characteristics, has turned into a sport that focuses on winning as well, and it attracts some professional investments (6,7,10). The literature review on amputee football shows an increasing number of studies in recent years that mostly focus on performance, but the number of studies is still limited. Studies conducted so far suggest that amputee football players should have sufficient strength, endurance, anaerobic capacity and running ability to show good performance in football (7,9,12,21). Based on this, this study was conducted to determine the level of relationship between the relevant performance data and it might be important to fill the gap in the literature.

There are many studies investigating the relationship between one leg hop and running performance in scientifically different populations (16,17,23,24). Maulder et al. investigated the relationship between counter movement jump, squat jump, one leg hop and 10m sprint tests in male sprinters. The results revealed a significant relationship between squat jump and counter movement jump and 10m sprint, while sprint performance was found to have no correlation with one leg hop performance (16).

Habibi et al. examined the relationship between one leg hop and one leg triple hop and 10m sprint and found a strong relationship between them (17). Bishop et al. also examined the relationship between 10m, 20m sprint performances of young women football players and their one leg hop, one leg triple hop and counter movement jump performances and reported a statistically significant correlation (23). Similarly, Maulder and Cronin reported a strong correlation between one leg hop and 20m sprint (24). When the results are examined, it is observed that most of the studies have found a significant relationship between one leg hop and sprint performance. Studies examining the relationship between one leg hop and sprint performance base the possible relationship on two principles in their research design. The first is the similarity between force application direction and take-off angles since both the one leg hop and sprint performances occur on the horizontal plane (16,17). The second is the need for lower extremity strength and power to have a good sprint performance (13,25). From this perspective, the relationship between one leg hop and sprint tests is meaningful and the results of this study are similar with the literature for 20 and 30 m sprint but not for 10m sprint and one leg hop performance relationship. One of the possible reasons of this situation is the difference of sprint dynamics. Basically, 20 m and 30 m sprint tests are used to determine for maximal speed and 10 m for acceleration (26). Another reason may be attributed to population differences. While other studies examining one leg hop and sprint performances were conducted with healthy athletes, the population of this study was amputee football players. Although normal football and amputee football have similar sporting requirements, different dynamics can be decisive due to the nature of the sport. As it is known, amputee football players have a lower extremity amputation and they play football with crutches. It is a sensible thought that the sprint performance of the amputee football players is related with the existing lower extremity power. However, although it is beyond the scope of this study, the results of this study make think that the possible power and strength requirements in amputee football players is not only in the lower extremity, but also be in the upper extremity, back and shoulder girdle because of using crutches. The no correlation between 10m sprint and one leg hop performance suggests that the power and force mechanism needed to acceleration for amputee players may also be influenced by different dynamics, unlike other sports branches. Considering that 90% of all sprint activities take place between 5 and 15 meters in football matches (27), in order to obtain more scientific data about this theory and to clarify the power-performance mechanism of amputee players, more studies need to be carried out.

According to the literature review, this is the first study to measure one leg hop performance in amputee football players. In the study, one leg hop performance was found as 2.01±0.30 m. Maulder et al. found the one leg hop distance of male sprinters as 2.09±0.09 m (16). Habibi et al. stated that the performance of one leg hop in 100m sprinters was 1.97±.02 m (17). Bishop et al. found that the female football players had a one leg hop distance of 1.20±0.14 m (23). In this study the results of sprint tests revealed that sprint values for 10m, 20m and 30m in amputee football players were 2.20±0.30s, 4.00±0.77s, and 5.64±0.86s, respectively. Özkan et al. reported the 10m, 20m and 30m sprint scores of amputee football players as 2.06±0.2s, 3.7±0.4s, and 5.4±0.7s, respectively (12). Maulder et al. found that the 10m sprint duration of the male sprinters was 2.04 ± 0.06s (16). In Habibi et al.'s study, 10m sprint time in 100m sprinters was reported as 1.90±0.07s (17). Brocherie et al. (28) and Koundourakis et al. (29) found that 20m sprint performance of professional football players were 2.95s and 3.02s, respectively. The findings in the literature reveal that the one leg hop performances of amputee and healthy athletes are similar. Performing the test with one lower extremity due to the nature of the test, the one leg performance may have resulted in similar values. As far as sprint performances are concerned, it was observed that the studies performed with amputee football players yielded similar results. In the comparison of amputee and healthy athletes, there is a more than one heterogeneity (amputation, use of crutches, etc.) which may affect the test results and cause the results to be in favor of healthy athletes.

There are some limitations of this study. In this study, it was used only the horizontal jumps test to compare the sprint and hop performances. The combined use of vertical and horizontal jump tests and also the upper extremity power tests can provide more information about the power systems required for performance. Small sample size and narrow population are the other limitations of the study.

CONCLUSION

This study comparing the sprint and one leg hop performances of the professional amputee football players revealed strong correlation between the one leg hop and 20m and 30m sprint tests and no correlation with 10m sprint performance. Amputee football is a complex sport and the power and strength of the lower extremity may not be sufficient to reveal the required performance for players. Due to the use of crutches to reach more tangible results, future studies should include upper extremity strength and power to release the performance mechanism.

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