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Examining the Relationship Between Dynamic Balance Skill and Reactive Agility Performance in Karate Athletes

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Abstract

The aim of this study is to examine the relationship between dynamic balance ability and reactive agility performance in karate athletes. A total of 53 karate athletes, 19 females (35.8%) 34 males (64.2%), (mean age: 18.02 ± 1.60 years, mean height 172.13 ± 7.59 cm; mean body weight 64.83 ± 9.75 kg) were included. Dynamic balance ability was tested in three directions: anterior, posterolateral and posteromedial using the "Y Balance Test" platform. Reactive agility performance was evaluated in a SpeedCourt ™ system in a closed space. Pearson or Spearman correlation analysis was used according to the distribution status to examine the relationship between the variables. Statistical error level was determined as p<0.05. It was determined that there was a positively weak and moderate correlation between the dynamic balance ability of the athletes and their reactive agility performance (r = 0.273 / 0.565, p <0.05). As a result of our study, it was determined that karate athletes with good dynamic balance ability had good agility performance. Having good dynamic balance skill indicates that the athlete has less postural oscillation and more stabilization. We think that this situation will contribute to better reactive agility activities that require constant change of direction. As a result of our study, it is recommended to consider dynamic balance elements in improving reactive agility performance in karate athletes.

Key Words: Speedcourt, Sport, Y Balance.

Karate Sporcularında Dinamik Denge Becerisi ile Reaktif Çeviklik Performansı Arasındaki İlişkinin İncelenmesi

Özet

Bu çalışmanın amacı karate sporcularında dinamik denge becerisi ile reaktif çeviklik performansı arasındaki ilişkiyi incelemektir. Çalışmaya 19'u kadın (%35,8) 34'ü erkek (%64,2), toplam 53 karate sporcusu (yaş ortalaması: 18,02±1,60 yıl; boy uzunluğu ortalaması 172,13±7,59 cm; vücut ağırlığı ortalaması 64,83±9,75 kg) dâhil edildi. Dinamik denge becerisi "Y Balance Test" platformu kullanılarak anterior, posterolateral ve posteromedial olmak üzere üç yönde test edildi. Reaktif çeviklik performansı kapalı bir alanda SpeedCourt ™ sisteminde değerlendirildi. Değişkenler arasındaki ilişkiyi incelemek amacıyla dağılım durumuna göre Pearson veya Spearman korelasyon analizi kullanıldı. İstatistiksel hata düzeyi p<0,05 olarak belirlendi. Sporcuların dinamik denge becerisi ile reaktif çeviklik performansı arasında pozitif yönde zayıf ve orta derecede ilişki olduğu belirlendi (r=0,273 / 0,565, p<0.05). Çalışmamız sonucunda dinamik denge becerisi iyi olan karate sporcularının çeviklik performansının iyi olduğu belirlendi. Dinamik denge becerisinin iyi olması sporcunun postüral salınımın daha az, stabilizasyonunun ise daha fazla olduğunu göstermektedir. Bu durumun sürekli yön değiştirmeyi gerektiren reaktif çeviklik aktivitelerinin daha iyi olmasına katkı sağlayacağını düşünmekteyiz. Çalışmamız sonucunda karate sporcularında reaktif çeviklik performansının geliştirilmesinde dinamik denge unsurlarının dikkate alınması önerilir.

Anahtar kelimeler: Speedcourt, Spor, Y Dengesi.

INTRODUCTION

Kinesiologically, balance is defined as the body's ability to withstand internal and external forces without impairing body integrity (27). In sports sciences, balance is defined as a skill that a movement performs in harmony with the central nervous system and musculoskeletal system (13). Balance, which includes many neurological pathways and aims to keep the body posture by working together with all body systems, is divided into two as static and dynamic balance (8,12). Static balance is defined as maintaining or continuing balance in a less mobile or inactive environment, while dynamic balance is defined as maintaining or continuing balance during movement or on moving ground (8,12).

Balance is important not only in daily life activities, but in almost all sports (29). Static balance plays an important role in the performance of shooting and archery, while dynamic balance plays an important role in the performance of freestyle sports such as snowboarding, skateboarding, windsurfing or aerobatic cycling (29). In sports branches such as karate, tai-chi, yoga, ballet or gymnastics, the aim is to control the balance in sports-specific positions that degree of difficulty can be varied depending on the expertise (29).

Agility, defined as the ability to change direction quickly while maintaining balance and without losing speed, is an important component of sports performance (11, 28). During agility performance, it is very important to remain in balance during rapid changes in direction to make the desired movement (4). Agility is defined as planned agility (closed skill agility, direction change speed) and unplanned agility (reactive agility, open skill agility) (10, 20). Planned agility enables athletes to perform better than their competitors in situations where they can predefine their movement pattern (18, 25). Reactive agility, on the other hand, is the response of athletes to external stimuli by using whole body movements such as speed and direction change (22). Planned and reactive agility are considered to be independent of each other (22). Sekulic et al. (2017) stated that there is a low correlation between planned and reactive agility tests and therefore planned and studies on reactive agility should be evaluated separately (20).

Ağaoğlu et al. (2017) stated in their study that there is a significant relationship between dynamic and static balance skill and agility performance in athletes (2). Altınkök et al. (2012) found a significant relationship between static and dynamic balance and agility performance in their studies with 10-year-old tennis athletes (3). Again, Miller et al. (2006) suggested that improved balance and postural control are associated with improved agility performance (16). Studies in the literature generally examined the relationship between balance skill and planned agility (2, 3, 16). And It is noticeable that the studies between dynamic balance ability and reactive agility in athletes are limited. Hovever, There have been no studies examining the relationship between dynamic balance ability and speedcourt reactive agility performance in karate athletes. Therefore, the aim of this study is to examine the relationship between dynamic balance skill and reactive agility performance in karate athletes.

MATERIALS AND METHODS

A total of 53 karate athletes, 19 women (35.8%) 34 men (64.2%) with mean age 18.02 ± 1.60 years, mean height 172.13 ± 7.59 cm; mean body weight of 64.83 ± 9.75 kg, were included in the study. Inclusion criteria in the study; not having upper and lower extremity injuries, being a licensed athlete in the field and volunteering to participate in the study. Athletes who met the study criteria were measured within two days. After receiving the demographic information of the athletes on the first day, dynamic balance skill measurements were made. On the second day, reactive agility performance measurements were made. Athletes were informed about the study before measurements and signed a consent form. In order to conduct the study, the date / numbered decision ethics committee approval was obtained from the Ankara Yıldırım Beyazıt University Ethics committee (number: 2021/44).

Evaluation of Dynamic Balance Skill

The "Y Balance Test" platform was used to evaluate the dynamic balance skill. Measurements were made with bare feet and in comfortable clothing. Measurements were made in 3 directions for each foot, namely anterior (anterior-ANT), posterior-outer side (posterolateral-PL) and posterior-inner side (posteromedial-PM). The distance between the farthest point where the athlete could reach from the tip of the toe in the center in ANT reach, and the distance between the farthest point where the athlete could reach from the heel in the center in PL and PM reach were measured. Before measurements, each athlete was given a test trial, and after the trial was completed, each athlete was given a 2-minute rest period. Then the test protocol was carried out by making 3 stretches in each direction. All reachs were recorded in centimeters, and three measurements were averaged for evaluation. During the measurement, the condition that athletes transfer their body weight to the lying foot, separate the heel of the posture foot from the floor, or touching the tip of the toe on the ground was considered an error, and the measurement was repeated after the athlete was verbally warned and informed. After the measurements were completed, the mean of the sum of the three measurements extended in the ANT, PL and PM direction was used in calculating the combined balance score. Combined balance score calculation was done to eliminate the leg length advantage (19).

The combined balance score was calculated separately for the right and left legs of each athlete using the formula ANT reach + PL reach + PM reach / (Leg length × 100). A high combined balance score is interpreted as a good dynamic balance of the athlete (19).

Evaluation of Leg Length

Each athlete's leg length was measured bilaterally in the supine lying position with a tape measure, and the measurements were recorded in cm. The distance between the spina iliaca anterior superior point on the same side and the medial malleolus was measured as leg length.

Evaluation of Reactive Agility Performance

All tests were performed in a closed area on the SpeedCourt ™ system (Globalspeed GmbH, Hemsbach, Germany). The Speedcourt ™ system has been developed to improve and evaluate the speed of change of direction and agility, and it has been proven to be useful, valid and reliable in determining versatile direction changing movements (6).

Speedcourt system; It consists of a screen, a square area (6.20 x 6.20 m) with 10 pressure sensors and a computer. Pressure sensors are arranged in 50 x 50 cm squares in the field. The entire area and 10 pressure sensors are shown on the screen. Each of the pressure sensor detects a minimum force of 150 N and detects contact times in milliseconds. The test starts with the countdown and a random one of the square areas (pressure sensor) turns white on the screen. The athletes must run towards the square with a white light on the screen and touch the floor with one of their feet. Athletes must watch the screen and follow the white square area, both running on the field and touching the appropriate square area. As soon as the athlete touches a square, another square turns white. And in the meantime the athlete has to touch the other square as soon as possible. The test ends after the ten squares turn white and the athlete touches these 10 squares. Before the test, all athletes were provided with dynamic warm-up for 10 minutes, then passive rest for three minutes. Two measurements were taken from each athlete and the good result was recorded. After the test; the test time, mean turn time, mean left-turn time, and mean right-turn time were recorded in seconds. The shortness of the test time, mean turn time and mean right-left turn time are interpreted as being good of the athlete's agility performance.

Statistical Analysis

The statistics of the study were made using the SPSS 20.0 package program. The definition of whether the variables are normally distributed or not was analyzed using the analytical method (Kolomogrov-Smirnov). It was determined that the PL right-left difference value from the Y balance dynamic balance test values and the mean turn time and the right-left difference% value from the Speedcourt reactive agility test values did not comply with the normal distribution, while the other data showed a normal distribution. In order to examine the relationship between variables; Pearson correlation analysis was used for numerical variables with normal distribution and Spearman correlation analysis was used for variables that did not show at least one normal distribution. Statistical error level was set as $p < 0.05$.

RESULTS

The physical characteristics of 53 karate athletes, 19 female (35.8%) and 34 male (64.2%) included in the study, and descriptive information about the Y balance dynamic balance test and Speedcourt reactive agility test are given in Table 1.

When the relationship between the athletes' Y balance dynamic balance test and Speedcourt reactive agility test was examined, It was determined that there was a weak and moderate positive correlation between the athletes' dynamic balance ability and reactive agility performance (r = 0.273 / 0.565, p <0.05) (Table 2).

DISCUSSION

As a result of our study we conducted to examine the relationship between dynamic balance skill and reactive agility performance in karate athletes, it was determined that the agility performance of karate athletes with good dynamic balance skill was good.

Balance ability and agility performance depend on the timing of skeletal muscles and the ability to coordinate the impact force correctly (1, 15). The fact that both balance skill and agility performance are related to the same parameters constitutes the infrastructure of the expected relationship between balance skill and agility performance (1, 15).

There is a variety of information about the relationship between agility performance and balance ability (7, 9). Erdem et al (2015) reported that there is no significant relationship between balance and agility in adult football players (7). Erkmen et al (2010) reported that sprint acceleration performance is not related to balance skill (9). Sibenaller et al. (2017) suggested that there is no significant relationship between the static and dynamic balance measurements of healthy high school athletes and their agility performance (23). In contrast, Sekulic et al (2013) found that balance ability in women is not associated with agility performance, but is significantly associated with men (21). In our study, we did not evaluate the relationship between balance and agility performance on a gender basis. But in our study, in which both sexes were evaluated together, we found that there is a relationship between dynamic balance and reactive agility, and as dynamic balance skill increases, reactive agility performance increases. Similar to our study, Okudur and Sanioglu (2012) reported that there is a relationship between balance scores and agility performances in 12-year-old tennis athletes, and that agility performance also increases as balance skill increases (17). In the study of Bloomfield et al. (2007) evaluating dynamic balance skill with Bass test and agility performance with T test, it was determined that there was a relationship between dynamic balance skill and agility performance, and as dynamic balance skill increased, agility performance increased in parallel to this (7). In another study conducted on young soccer players, it was stated that the decrease in agility performance, which requires high-intensity sprint performance, may be due to a decrease in balance performance (14). The results of our study have parallels with this information that exists in the literature.

There are also studies in the literature examining the effects of balance training on agility (24,26). In the Sporis et al. (2010) study which they aimed to investigate the effect of the balance and coordination exercises on improving agility, stated that football players could move quicker and faster in sudden changes of direction, and some of the goals of agility training are the development of speed, coordination, strength and balance (26). In another study, it was observed that balance training improved agility performance (24). This information reveals the relationship between balance and agility.

In the studies published on agility, it is seen that the running and turning directions are known by the athlete, that is, planned agility is examined (21,24). But the efficiency of agility movements varies depending on the perception and decision-making process in the training environment. From this point of view, the study of the relationship between dynamic balance ability and reactive agility performance makes our study different.

The weaknesses of our study are that it is not an impact study, that it is a cross-sectional study, and that regression analysis cannot be performed due to the distribution state. However, the fact that it was performed in a certain sports branch and that reactive agility was evaluated with a new system including cognitive factors make our study strong. We think that there is a need for studies that will investigate the effects of developing agility performance with speedcourt reactive agility training on balance skill and the effects of balance exercises on reactive agility.

CONCLUSION

As a result of our study, it was determined that there is a relationship between balance and reactive agility in karate athletes, and agility performance increases as balance performance increases. Having good dynamic balance skill indicates that the athlete has less postural oscillation and more stabilization. We think that this situation will contribute to better reactive agility activities that require constant change of direction. We believe that dynamic balance elements should not be ignored in the development of reactive agility performance in Karate sport.

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TABLES

Table 1. Demographic Caracteristics of athletes, Speedcourt agility test, T-balance test, leg length data

N=53		X±SS	Median (IQR25-75)
Age (years)		18,02±1,60	18,00 (17,00-19,00)
Height (cm)		172,13±7,59	172,00 (167,00-178,00)
Body weight (kg)		64,83±9,75	64,00 (58,10-70,00)
BMI (kg/m2)		21,80±2,26	22,04 (20,10-23,46)
Speed Court Agility Test Values (sec)	**Test time(sn)**	25,26±2,47	24,38 (23,49-26,73)
	Mean Turn Time	0,38±0,08	0,37 (0,31-0,43)
	Mean Left Turn	0,38±0,09	0,36 (0,32-0,43)
	Mean Right Turn	0,38±0,09	0,39 (0,32-0,42)
	Right-Left Difference %	20,32±17,84	15,12 (8,38-25,09)
Y balance Balance Test Values (cm)	**ANT Right**	66,57±5,77	67,00 (62,00-70,00)
	Antreior Left	66,08±6,07	66,00 (62,00-70,00)
	ANT Left	0,49±3,89	1,00 (-2,00-3,00)
	Right Posteromedial	103,66±7,31	104,00 (97,00-109,00)
	ANT Right Left difference	103,28±8,06	103,00 (97,00-110,00)
	Difference	0,38±4,69	1,00 (-2,00-4,00)
	PM Right	100,15±7,69	101,00 (96,00-106,00)
	Right Posterolateral	100,00±7,26	100,00 (94,00-106,00)
	PM Left	0,15±4,99	-1,00 (-4,00-3,00)
Leg length values (cm)	**Right Leg Length**	82,06±5,05	83,00 (78,00-85,00)
	Left Leg Length	82,02±5,15	82,00 (78,20-86,00)

Table 2.Relationship between Y Balance dynamic balance test and Speedcourt reactive agility test of athletes

			Speed Court Reactive Agility Test Values				
			Test Time (sn)	**Mean Turn Time(sn)**	**Mean Left Turn (sn)**	**Mean Right Turn (sn)**	**Right-Left Difference%**
Y-balance Dynamic Balance Test values (cm)	**ANT Right**	r	-0,195	-0,217	-0,171	-0,237	0,002
		p	0,161	0,118	0,221	0,088	0,99
	ANT Left	r	-0,249	-0,284*	-0,191	-0,262	0,095
		p	0,072	0,04	0,172	0,059	0,497
	ANT Right Left difference	r	0,099	0,121	0,068	0,057	-0,167
		p	0,482	0,39	0,63	0,685	0,232
	PM Right	r	0,351**	-0,240	-0,226	-0,273*	-0,015
		p	0,011	0,084	0,103	0,048	0,914
	PM Left	r	0,540**	-0,300*	-0,274*	-0,243	0,055
		p	0,000	0,029	0,047	0,080	0,696
	PM Right Left difference	r	-0,377**	0,137	0,117	-0,008	-0,090
		p	0,006	0,329	0,402	0,954	0,524
	PL Right	r	0,438**	-0,095	-0,071	-0,164	-0,007
		p	0,001	0,499	0,612	0,241	0,958
	PL Left	r	0,565**	-0,323*	-0,298*	-0,261	0,061
		p	0,000	0,018	0,030	0,060	0,666
	PL Right Left fark	r	-0,043	0,198	0,297*	0,139	-0,041
		p	0,761	0,156	0,031	0,322	0,768