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# GENDER-SPECIFIC INFLUENCES OF BALANCE, SPEED, AND POWER ON AGILITY PERFORMANCE OF KARATE PLAYERS

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## **ABSTRACT**

The quick change of direction is the most important physical quality in Karate. Scholars found that the development of speed, balance, and power is a result of the development of agility performance. This experimental study was aimed to determine the gender-specific influence of balance, speed, and power on the agility performance of Karate players. 25 female and 30 male national level Karate players participated in this study. Mean age of the participants' females (23.81) and males (23.13). Three agility tests (a T-Test, Zig Zag test, Illinois test), two balance tests (Flamingo balance test, standing stock-blind test), two power tests (vertical jump test, standing board jump test), two-speed tests (30 m and 60 m sprint) were tested. Data were analyzed using the Spearman correlations analysis. There was a moderate positive relationship between male and female players in speed and agility ( $r = 0.654$ ,  $p = 0.000$ ) while the male and female players showed a weak positive linear relationship between Agility and Balance ( $r = 0.336$ ,  $p = 0.015$ ). Male and female players had a negative linear relationship between Agility and Power ( $r = -0.483$ ,  $p = 0.000$ ). Interestingly, male and female players had a significant difference in Speed and Balance. Female Karate players had shown a stronger relationship between Agility and Speed, Agility and Balance than the male Karate players. This study concludes, there was a significant influence from speed and balance towards

the agility performance of both male and female players whereas there was no significant influence on power towards the agility performance of both male and female players.

Keywords: Agility performance, Speed, Balance, Power

## **INTRODUCTION**

In today's world, all the works are depending on the scientific knowledge of the human, now it is a base for sports similarly. At the present, the athletes are trained with a scientific line with using technology to achieve higher sports performance in their specific sports to minimize the energy expenditure and time (Jothi, Vinu, and Eleckuvan, 2010). Physical abilities are affecting athletes to reach the highest sports performance from competitions (Gabbett and Sheppard, 2015). Literature acknowledges that physiological factors of Speed, Power, Balance, Strength, and Coordination are the most important factors for every athlete. Most of the scholars are focused on Agility as a factor potentially influencing sports performance. Sheppard and Young (2006), defined agility as a "rapid whole-body movement with change of speed or directions in response to a stimulus". Agility is the ability to quickly change direction to start and finishing immediately is a fundamental parameter of performances in sport such as football, rugby, handball, karate, etc (Spasic et al.,

2013). It is not a single ability but a difficulty of several abilities.

National Strength and Conditioning Association (NSCA) states Agility is the “ability to explosively brake, change direction, and accelerate again” agility, Speed, Power, coordination, and strength are among them any major factors assessed to determine athletic ability which helps to show the highest performance in the main competition (Beekhuizen et al., 2009). Additionally, this ability is predicted of the highest sports performance in the team and individual sports evidenced by time prediction for elite and non-elite athletes (Sekulic et al., 2013).

Davaran, et al., (2014) states that martial arts require high fitness levels. Karate sport is dependent on the highest levels of strength, Speed, Power, and Agility. Futhermore, Marjani, et al (2013) predict successful performance in karate sports need to top level of Agility that supports the karate athlete to avoid the opponent’s attacks and to accept the optimal position for enhanced performance of karate techniques. Pauole, et al (2000) states Agility is an important characteristic to maintain the top level in karate. Moreover, concluded Speed, Balance, and Power can influence different Agility in men and women. In the situation of Sri Lanka, there is a lack of studies conducted about the Agility performance of karate players. According to previous studies Miller, et al., (2006) identify the extremely different and complex movement character of different Agility performances has allowed the conclusion that an improvement in Balance should be considered one of the key factors of Agility enhancement therefore their Agility performance was naturally developed.

Sekulic and Spasic (2013), mention the Balance, Speed, Power, and strength influence for Agility performance and determined that Balance is more vigorous

for Agility but only in males. Karate is a quick movement changing sports; therefore, to increase the players' performance trainers should have to focus on the Agility performance of Karate players. When planning training sessions for players trainers should have to emphasize the Gender influence and relationship of Balance, Speed, and Power on the Agility performance of karate athletes.

In the Sri Lankan context, it cannot be observed that the trainers are use balance, speed, and power exercises to develop the agility of athletes. However, trainers do not consider the athletes' gender while developing agility performance. Therefore, researcher studied “Is there a gender-specific influence of Balance, Speed, and Power on Agility performance in national-level karate players”?

The following research questions were posed for study:

- o Is there a gender-specific influence of Balance, Speed, and Power on the Agility performance of the national level Karate players?
- o Is there a relationship between agility and speed in male and female karate players?
- o Is there a relationship between agility and balance in male and female karate players?
- o Is there a relationship between agility and power in male and female karate players?

## ***LITERATURE REVIEW***

Karate means “Empty Hand” (Chaabène et al., 2012) self-defense martial art with extremely rooted in Chinese body culture and fighting techniques originated from the southern Ryūkyū Kingdom (currently Okinawa) in Japan (Manzenreiter, 2020), Kata and Kumite are the main sections of Karate (Chaabène et al., 2012). Karate is a

competitive sport with high levels of temporal and spatial constraints, which require rapid reactions (Chaabène et al., 2012). The success of the game depends on many factors including bio motor abilities. “Mastering motor skills (techniques) in karate and their efficient use in fight require longstanding, strenuous Training”. Karate players need a high level of motor ability and functional abilities such as speed, strength, and coordination. To achieve a higher level of Karate performance the speed reaction is vital (Blažević, Katić and Popović, 2006). Scholars are suggested that Agility is one of the most important factors to athlete achieve high performance (Aurencelle and Astagna, 2009).

Agility is a significant condition for success in numerous sports (Hammami et al., 2017). The ability to sprint frequently and change direction while sprinting has a major effect on achieving sports performance for field and court sports athletes. Agility is the change of movement direction ATES 2018 quoted in Sheppard and Young, 2006. Agility can implement a variety of abilities from the simple frequency of leg movement to a fast change of running direction while running (Šimonek, Horička, and Hianik, 2016). Agility is a change of direction or performs the movement to start and finish as quickly as possible (Šimonek, Horička, and Hianik, 2016 cited Gambetta, 1996; Parsons & Jones, 1998). Agility is a change in the direction rapidly or the change of direction as well as quickly change a movement (Gabbett and Sheppard, 2015). Well-developed change of direction skills helps athletes to create a better space away from their opponents letting athletes perform their goals with less interference and more time (Hammami et al., 2017). When running in a straight line, agility is relatively self-governing from the reaching speed (Little and Williams, 2005). “Acceleration and deceleration are parts of the movements

with alterations of direction, which form the essence of the manifestation of agility, and therefore they are specific qualities and must be developed in this way” Šimonek, Horička, and Hianik cited by Jeffreys, 2006. According to Sporis, et al., 2010 Agility is the ability to maintain and control correct body positions and quickly changing direction through a series of movements. Agility is the ability to move the body quickly and change the directions speedily and change the position effectively while under control quoted ATES 2018 by citing Twist and Benicky 1996. Several sub-factors are connected to agility performance, such as muscle strength, power, and reactive strength. It was evident from cross-sectional studies conducted by scholars that indicate a significant association between muscle strength and power, balance, speed, and agility (Hammami et al., 2017). Furthermore Sheppard and Young, 2006 identify strength; Speed, Balance, Power, and flexibility are the abilities that affect the agility performance. Sporis, et al., (2010) state Speed, balance, strength, power are one of the key features of Agility improvement. Meylan et al., 2009 by conducting a study on interrelationships of Single-leg lateral, horizontal, and vertical jump to predict sprint and change-of-direction performance to men and women physical education students found that influencing factors to change of direction are the muscle strength, power, speed, and balance.

Additionally, Agility tests are best used for investigative determination to which karate players are the most active and which one needs more extra practice to perform well. A good Agility test depends on strength, Speed, Power, coordination, and Balance (Jalilvand, 2015). The Illinois Agility Test (IAT) and T-test are the most effective test to measure agility performance ATES 2018 by citing Hachana et al., 2013. Agility is a change in

the movement direction in a fast way Šimonek, Horička, and Hianik,2016 quoted by Altug et al.,1987. For the test, the agility needs to consider an unexpected change of direction movements, mostly used in sports games and martial arts. (Šimonek, Horička, and Hianik, 2016 quoted by Sayers, 2000).

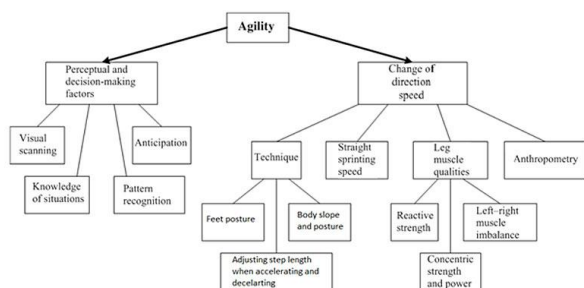


Figure 1: Classification of Agility

Source:

<https://images.app.goo.gl/ttAycbUSec6RhsF37>

Young, 2002 existing a comprehensive classification of agility. There are two main components of agility 1) Perceptual and decision making factors 2) change of direction speed. Based on these two components there are have sub-components showed in figure 1.

Balance is a skill-related physical fitness component, that relates to the maintenance of stability while the immobile or moving balance is typically measured using a balance beam and tests that need holding an immobile posture after changing body positions (Caspersen, C.J., Powell, K.E., and Christenson, 1985). Balance is one of the important motor ability for sports performance (D, 2004) Hrysomallis (2008) identify that balance ability was significantly related to achieving high performance in various sports. Abichandani and Hule (2017) predicted static and dynamic balance, assistance players to improve their sports-

specific movements with developing basic motor abilities. Dynamic Balance needs the ability to maintain equilibrium during a transition from a dynamic to a static state, therefore it is a most challenging ability.

Speed is the main fitness competent for athletes as well as non-athletes because to perform day to day activities every person needs speed to complete an activity successfully. For Track and field sprinters, sprint swimmers, speed skaters speed is the most important motor ability. (IES Joan Miró – Physical Education Department,2014). Speed ability is a complex psychomotor ability that involves fast body movement in sports performance. “Speed abilities are usually defined as the movement of an object (athlete’s body) to cover the specified distance in the shortest possible time, similarly to cyclic speed”(Šimonek, Horička, and Hianik, 2016). Speed is a skill-related physical fitness component to perform different types of speed such as running Speed, swimming Speed, Speed of hand, or foot movement. (Caspersen, C.J., Powell, K.E., and Christenson, 1985).

Sprinting and directional changes were strongly related and Speed had a strong relationship with agility Speed. Most strength and conditioning instructors believe that there is a strong relationship between straight sprinting Speed and agility Speed as therefore training sessions tend to address both abilities simultaneously (Sheppard and Young, 2006). Slaj and Markovic (2011) by conducting a study on the national football team athletes found there is a positive relationship between Agility with 10 m Speed running and there is no significant relationship was found between Agility and 20 m Speed running.

Power ability combines with speed and strength and to power fitness explosive skills are required. (Young, James, and Montgomery, 2002). Literature attempted

to define relationships with predictors of agility, suggested that improving agility is a timed task involving a change of direction speed. Scholars confirm that coaches are believed that there is a strong relationship between straight sprinting speed and change of direction speed (Sheppard and Young, 2006). Moreover, Young, et al., 2001 quoted Sheppard and Young, 2006, if the sprinting and directional changes were powerfully related then speed had a strong relationship with change of direction speed over the sprint training intervention. The relationship between power and Agility depends on the type of sports. By conducting the study on the relationship between Power and Agility in athletes involved in short distance sports like soccer-goal keeping and badminton Djevalikian (1993) found that there is no significant relationship between Power and Agility ( $r = 0.15, p > .05$ ). However examined the relationship between asymmetrical leg Power and change of running direction, and reported a significant correlation between Power and Agility ( $r = 0.42, p < .05$ ) (Djevalikian, 1993). Moreover there is a moderate correlations ( $r = -0.49, p < .05$ ) for males and ( $r = -0.55, p < .05$ ) for females between Power and Agility (Pauole et al., 2000). The relationship between Power and Agility depend on deferent Agility test. Furthermore Young, et al., (2002) founded that there is a correlation between Power and Agility time ( $r = -0.47, p > .05$ ).

Gender is affected by Agility performance (Sekulic et al., 2013). Age and gender are the two elements that affect Agility performance. Moreover, the Power of the lower limb was more related to Agility in female junior players compared with males, and gender differences in Agility performance decreased with age (Mujika et al., 2009). Power and Speed are not evidenced as strong predictors of the Agility in trained men (Markovic, et al., 2007). Furthermore, researchers noted that

there is a higher correlation between Speed and Power concerning Agility among women (Nimphius, McGuigan and Newton, 2010)

## ***METHOD***

### **Subjects:**

Fifty-five elite national level Karate players (mean age  $9.86 \pm 1.81$  years) were used based on the census sampling method. All the test procedures, testing reasons, benefits of the study, and risk factors were verbally explained before starting the test. The inclusion criteria as follows; a) participants are agreed to participate in the study, b) participants had no existing medical problems before two weeks of the study, c) participants had no existing injuries before one-month of the study. All participants were in good physical condition during the testing dates. After consultation with administrators of the Karate Federation of Sri Lanka, Karateka, and team managers decided the testing dates.

### **Training Maturity**

All the subjects were involved in systemic training sports training for at least 2 years and regularly participated in 4-6 training sessions per week.

### **Procedures**

Three agility tests were performed namely T-Test, Zig Zag test, Illinois test. Other tests including two balance tests (Flamingo balance test, standing stock-blind test), two power tests (vertical jump test, standing board jump test), two-speed tests (30 m and 60 m sprint). All tests were performed at Sri Lanka Foundation indoor stadium. All the tests are conduct based on standardizes test in the 101 performance evaluation tests book of Brian Mackenzie, 2008. The participants have performed all tests wearing their running shoes except for balance tests. Informed subjects to get

their foods before one hour, accurately hydrated, and get 07-hour sleep before the testing date. All tests were conducted from 8.30 am to 11.30 am in all three testing dates, in September 2019. On the first day completed a T-Test, standing stock blind test, and vertical jump test, the second testing day was used for the Zig Zag test, 60 m test, and standing broad jump test, and on the third testing, day completed the Illinois Agility Test (IAT), 30 m sprint test and flamingo balance test. In testing, days provide the same diet to all the participants (Morning to the night) and advice to stop the exercises and individual training. Before starting the test, Karateka performs the 15 minutes dynamic stretching Warm-up. Give two attempts from each test and the best result was used for further analysis.

### Agility Tests

#### T-Test

The t-test was conducted based on Raya et al., 2013, measurement marks from meters, creating a 10m × 10 m course. Participants started the test with the command of “Go” given by the tester and by the time start the stopwatch. Participants were run forward to the centre cone (Cone 01), sidesteps to the right cone (cone 02), sidestep to the left cone (cone 03) then participants run backward as possible to the finishing line (Figure1). Based on Raya et al., 2013 article instructs participants to not to touch the cones. Once the participants cross the finishing line stopped the stopwatch and record the time. Time was measurement by seconds.

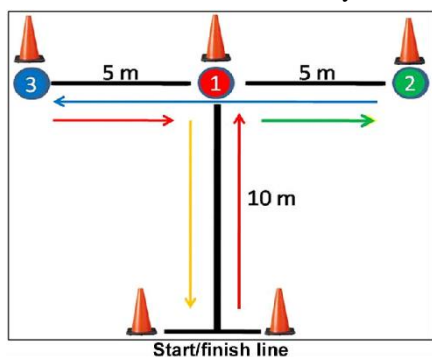


Figure 1: T-Test

Source:

<https://images.app.goo.gl/gQGfZEqMGnRDrXgH8>

#### - Illinois Agility Test

The length of the IAT is 10 meters and the width distance between the start and finish points is 5 meters. Cones are used to marking the start, finish, and the two turning points. The four center cones placed with space 3.3 m apart. The participants started the test lying prone on the floor behind the starting line. On the command “Go” the participant jumps to his/her feet and negotiates the course around the cones to the finish and the tester records the total time taken from command to complete the test. The time to complete the test was recorded in seconds. Participants were required to touch the tape mark with the foot. The disqualification was called based on follows, and give another chance to complete the test, a) if the participant failed to run the course as instructed, b) failed to reach the end lines, c) failed to complete the course, d) moved any cones (Figure 2).

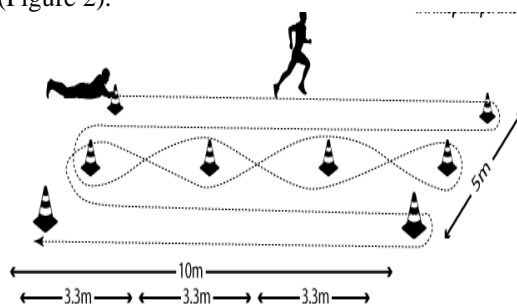


Figure 2: Illinois Agility Test

Source:

<https://images.app.goo.gl/pbEDFejMsRF GedY2A>

#### - Zig Zag Test

The Zig Zag agility test course was designed with three 100° degree of rotation between the starting point to the

finishing point and containing four 5-m sections (Figure 3). With the command “Go” participants have started the test at a distance of 01 meters from the starting point and the tester starts the stopwatch. When participants are breaking the finishing line stop the stopwatch and record the time in seconds.

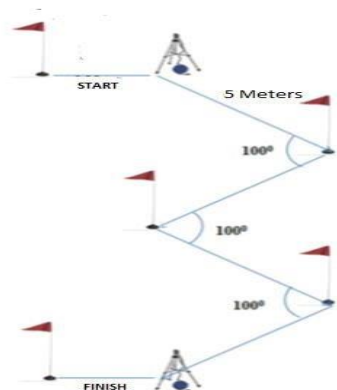


Figure 3: Zig Zag Agility Test

Source:

<https://images.app.goo.gl/xpBLGo6uGU58jiVL8>

#### Power Tests

##### - Vertical Jump Test

Measure the difference between participants standing reach height and height which participants can jump and touch. Participants are stand facing a smooth wall with feet are flat on the floor and toes should have to touch the wall, then touch the as high as possible with both hand and marks the touches position from chalk, then participants jump as high as possible and make another mark on the touches point (Figure 4). Recorded a difference between two marks in centimeter.

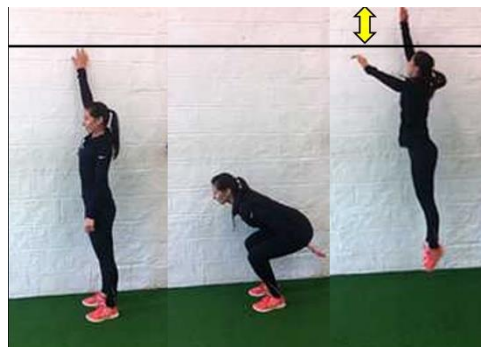


Figure 4:Vertical Jump Test

Source:

<https://images.app.goo.gl/EBvx6oquiAxDJpBa8>

##### - Standing Board Jump

Participants stand with feet slightly apart behind the line marked by tester on the stadium. Two-foot lading is used, instant participants to swinging the arms and bend the knees and attempt jump as far as possible and land on both feet without falling to back (Figure 5). Record the measurement from the take-off line to the nearest point of contact when landing. Recorded the best score from two attempts in meters.



Figure 5 Standing Board Jump

Source:

<https://images.app.goo.gl/G6daLcWKTv7QZZB69>



### Speed Tests

#### - 30 m Sprint

Measure the 30m distance and put a mark on the starting and finishing line. Instruct participants to start with standing start with their preferred foot in forward, placed on the marked on the floor. With the command “Go” participants start to run and the tester recorded the time while participants break the finishing line.

#### - 60 m Sprint

Measure the 60m distance and put a mark on the starting and finishing line. Instruct participants to start with standing start with their preferred foot in forward, placed on the marked on the floor. With the command “Go” participants start to run and the tester recorded the time while participants break the finishing line.

### Balance Tests

#### - Flamingo balance test

Instruct participants to perform the test barefoot, stand on the beam with the preferred leg the free leg is flex at the knee, and place the foot on the buttocks. Start the stopwatch with the command given by the tester and stop the watch when the participant loses the balance, recorded a balancing time in seconds (Figure 6)



Figure 6: flamingo balance test

Source:

<https://images.app.goo.gl/YiX7SwpWtkW5LnLq9>

#### - Standing Stroke blind test

Instruct participants to stand on the preferred leg with placed the hands-on hip and lift the other leg and place the foot in buttocks. On the command from the tester, participants should have to close their eyes and the tester start the stopwatch. The watch is stopped when participants are a) open their eyes b) move the hands c) move the standing foot d) take off the foot placed in the knee. The tester recorded time in seconds as participants maintain their balance as far as possible



Figure 7: Standing Stroke blind test

Source:

<https://images.app.goo.gl/WkWK4rD8GrEh16LC7>

### Statistical Analysis

Descriptive statistical parameters were asses for all applied tests. (Mean and Standard Deviation (SD). Spearman correlation coefficient (rs) was used for finding out associations between speed, balance, and power on agility performance in male and female karate players. For the verification of the null hypothesis the value  $p < .05$  was used. Data were processed using Microsoft Excel (Version

2010) and The SPSS 23.0 version is used for data analysis.

## RESULTS

Tables 1 and 2 illustrate the mean values ( $\pm$ SD) of the variables of the characteristics and performance tests of the players according to gender.

Table 1 physical characteristics of the Karate Players involved in the study

Variables	Female	Male
Age (y)	23.81 $\pm$ 3.43	23.13 $\pm$ 2.91
Height (m)	1.82 $\pm$ 0.04	1.65 $\pm$ 0.04
Weight (kg)	77.0 $\pm$ 5.7	56.8 $\pm$ 5.7

Table 2: Parameters of Physical Test

Variables	Female Mean $\pm$ SD	Male Mean $\pm$ SD
S 30m (s)	5.32 $\pm$ 0.65	4.63 $\pm$ 0.49
S 60m (s)	9.25 $\pm$ 0.85	8.30 $\pm$ 0.59
FBT (s)	6.37 $\pm$ 0.77	5.72 $\pm$ 1.84
SSBT (s)	2.35 $\pm$ 1.38	4.85 $\pm$ 1.29
SBJT (m)	2.28 $\pm$ 0.23	3.01 $\pm$ 0.10
VJT (m)	0.32 $\pm$ 0.06	0.45 $\pm$ 0.05
IAT (s)	18.76	16.30
T-T (s)	$\pm$ 0.98	$\pm$ 1.36
ZZT (s)	9.96 $\pm$ 0.95	8.27 $\pm$ 1.23
	5.89 $\pm$ 0.91	4.87 $\pm$ 0.81

*SD: Standard deviation; S30m: Sprint 30m; S60m: Sprint 60m; FBT: Flamingo Balance Test; SSBT: Standing Strovk Balance Test; VJT: Vertical Jump test; IAT: Illinois Agility Test; T-T: T-Test; ZT: Zig Zag Test*

Table 3: Relationship between speed, power, and balance on agility performance

	ZZT (s)	
	<i>p</i>	<i>r</i>
Total Sample		
S 30m (s)	0.000*	0.654
VJT (m)	0.015	0.336
FBT (s)	0.000*	- 0.483
Male		
S 30m (s)	0.000*	0.656
VJT (m)	0.020	0.916
FBT (s)	0.022	0.416
Female		
S 30m (s)	0.000*	0.801
VJT (m)	0.589	- 0.114
FBT (s)	0.000*	0.785

*S30m: Sprint 30m; VJT: Vertical Jump test; FBT: Flamingo Balance Test; \*p < 0.05*

Association between speed, power, and balance on agility performances is presented in Table 3. To analyze the agility performance of players with speed, power and balance used Zig Zag test, 30 m speed test, Vertical jump test, Flamingo balance test respectively. The reliability analysis demonstrated that used Zig Zag test, 30 m speed test, Vertical jump test, Flamingo balance tests were reliable. Men performed better than women in agility tests while women performed better than men in balance tests (Table 2).

Men are taller and heavier than women and performed better than women in power and speed (Table 2).

Both Male and Female Karate players are shown a strong positive significant correlation between agility and speed ( $r=0.654, p=0.000$ ). Female karate players have a very strong positive significant correlation ( $r=0.801, p=0.000$ ) and male players showed a strong positive linear relationship ( $r=0.656, p=0.000$ ) between agility and speed. Both female and male karate players showed there is no significant correlation between agility and power ( $r=- 0.48, p=0.015$ ). Female karate

players had a strong positive linear relationship ( $r=0.785, p=0.000$ ) between agility and balance, and male players show a weak positive linear relationship ( $r=0.416, p=0.022$ ) between agility and balance (Table 3).

## **DISCUSSION**

The purpose of this study was to assess the gender-specific influence of Balance, Speed, and Power on Agility performance in national-level karate players. The results of this study demonstrate that a) speed and balance are more significantly related to agility performance among female karate players than male players b) power is found not an important predictor of agility among men and women karate players.

A previous study found that speed and power among women and balance among men was the most significant predictor of agility (Sekulic et al., 2013). Balance measures were significantly related to the agility performance for men but not for women. In addition to signifying a significant relationship between speed and agility in both genders and statistically significant relationship between power and agility in women. These results indicate that balance should be considered as a potential predictor of agility in trained adult men (Sekulic et al., 2013). The result found by the study the speed is more significantly related to agility performance is supportive of the findings of speed are more significantly related to agility performance among female collegiate athletes than among their male peers (Sekulic et al., 2013). However, Studies suggest that agility is not just one of the speed abilities (Horicka, Hianik, and Šimonek, 2014). Little and Williams (2005) by conducting a study on the Specificity of acceleration, maximum speed, and agility performance of Professional soccer players found that

speed and agility have specific qualities and unrelated to one another. The findings of Sekulic et al, 2013 supportive the study finding of there is a low influence of power on the agility performance of athletes. Power qualities are a poor predictor of the agility performance of active men (Marković, Sekulić, and Marković, 2007). By conducting the study on the age-related effect of speed and power on the agility performance of Soccer players Ates (2018) found that speed and power should not be considered as important predictors of agility performance among young players. Vescovi and Mcguigan, 2008 suggest that Liner sprinting, agility, and power are independent skills for female athletes. This study finds a balance is higher in women than men it was supportive of finds of Sekulic et al., 2013. The relationship between balance and agility measures was higher in men than in women (Sekulic et al., 2013).

## **CONCLUSION**

This study results showed that female karate players had a very strong positive linear relationship between agility and speed while male karate players had a strong positive linear relationship. The female karate players had a strong positive linear relationship between agility and balance while male karate players had a moderate positive linear relationship. The result showed that there was a significant correlation between the agility and speed of both males and females. The result showed that there was a significant correlation between agility and balance between male and female. Finally, results showed that there was no significant correlation between agility and power based with gender. Based on study findings researchers recommended karate players and coaches, fitness coaches who work to improve agility in karate players should be aware of the speed and balance

developing exercises during the training sessions. Speed and Balance are the most important components for developing a karate player's agility skills. Therefore, the researcher suggests conducting workshops and training programs aiming at players at the national level, though relevant authorities such as the ministry of sports, Karate-Do Federations authorizes. Limitations of the current study are focused only on the national level karate male and female athletes which therefore limit the generalization of the study to entire karate players in Sri Lanka. Future studies can conduct on a different sample from different sports. Studying other components to improve agility performance to develop karate performance (Strength, endurance, flexibility, coordination).

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