

Development of Agility Test Construction: Validity and Reliability of Karate Agility Test Construction in *Kata* Category

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Abstract Background: *Kata* is a series of moves competed in karate that require agility in its movements. **Purpose:** This research aimed to determine the validity and reliability of karate agility test in *kata* category. **Method:** This was a developmental research. The data were collected using the Delphi technique, involving 7 experts and test-retest. The participants were 20 karate aged at least 20 years old who have practiced karate for 6 years and have won regional competitions. This was to determine the test of empirical validity and reliability. The content validity was calculated using the Aiken formula, the empirical validity was calculated using Pearson Product Moment, while the reliability was calculated using the Cronbach Alpha. **Results:** The results showed that the karate agility test in *kata* category had high validity and reliability. The Aiken results were as follows: Item (1) size has fit the karate in *kata* category with a value of V 0.85; Item (2) distance between cones has fit with a value of V 0.80; Item (3) equipment has fit with a value of V 0.80; Item (4) number of test repetitions has fit with a value of V 0.80; Item (5) test procedure has fit with a value of V 0.80; Item (6) safe instrument has fit with a value of V 0.85; Item (7) agility has fit with a value of V 0.85; Item (8) score taking has fit with a value of V 0.80. The results of Pearson

product moment r-table were 0.444, r-count (test 1) was 0.927, r-count (test 2) was 0.903, significance was $0.000 < 0.05$. **Conclusion:** It can be concluded that the agility test can be used to measure the karate agility in *kata* category.

Keywords Agility Test, Karate, *Kata* Category

1. Introduction

Agility is one of the important aspects in achievement sports, especially sports that require a rapid change of direction [1][2]. For years, agility can be defined as a rapid body movement by changing direction quickly, accurately without losing balance [3][4][5]. However, the current definition of agility has become more complex. Agility is now defined as ability to perform body movements rapidly with changes in speed or direction in response to an action[4][6][5]. This definition has three meanings, namely movement to execute, perception of stimulus, and response selection [4]. Agility is not only applied to game sports, but martial arts also require agility to perform attacks, defense and interact with match

situations [2], one of those martial arts is karate.

Karate is a Japanese martial arts which is now competed in the olympics [7]. Karate has three important components to learn: *kihon*, *kumite* and *kata* [8][9]. *Kihon* is a basic movement, *kumite* is a fight, while *kata* is a series of moves or an imagery fighting movement [10][7]. Karate has the characteristics of fast and dominant movements performed with high intensity and utilizing the anaerobic energy system [11][12]. This can be explained that agility has a vital role to gain victory in a karate match [3]. Agility in game sports and karate is very different. In karate, the agility used is to step and change direction forward and backward after making punches and kicks quickly [3]. In order to determine the increase in the agility aspect, an agility test is needed. So far, based on a literature review, there are only general field-based agility tests such as the T-test, Illinois Agility Test, Edgren Side Step Test, Lane agility drill, shuttle run, zig-zag test, 505 agility test, hexagon, quadrant jump. test, 10 meter shuttle, quick feet test, 20 yard shuttle, side step test, agility cone drill, box drill, AFL agility test, arrowhead drill, 20 yard agility, shuttle cross pick-up, balsom agility run [5][13][14]. On the other hand, the aforementioned test is good to be used to determine the initial ability. This is in line with the literature which states that at this time, tests to measure agility in field-based sports are less relevant to the characteristics of movement in competitions. [15].

So far, there has been very little in-depth study related to tests developed specifically for karate in *kata* category which resemble movements in actual matches. This is in line with the literature which states that tests related to agility interventions carried out in the form of special competitions in individual sports are still not widely found [16].

Recently, a development of the karate agility test in the *kumite* category was discovered. However, in this study, the test was designed to have determined the movement and the testor only provided a stimulus at the beginning of the movement with a whistle sound. Then, the test only tested the validity of the content, and did not test the empirical validity and reliability. On the other hand, *kumite* and *kata* also have different move characteristics, so that test was only suitable for *kumite* athlete. Furthermore, there was a research on the agility of karate at the age of 5-11 years. That research aimed more at developing motor skills because in the test, there were still movements such as jumping, running and doing basic techniques. Therefore, it is necessary to develop a special test that has measured the validity and reliability. There are several types of validity, namely criterion validity, construct validity, and content validity. Content validity is used to refer to the extent to which the content of the measuring instrument is considered to be able to measure things that represent the entire material to be evaluated [17][18][19][20]. Meanwhile, construct validity indicates

the extent to which the instrument reveals a construct to be measured, then reliability is the level of accuracy and accuracy of the measuring instrument of a measurement procedure [17]. This research aimed to test the validity and reliability of the karate agility test in *kata* category which have been designed by the authors.

2. Materials and Methods

This research used developmental method supported with qualitative and quantitative approaches in order to create an in-depth research [20][21][22]. The data collection was approved by the karate coach. The participants involved to test the empirical validity and reliability were karate athletes specializing in *kata* category who have the following criteria: male, 20 years old, 20 athletes, at least 6 years of practicing karate and have won the word at the regional level and in prime condition do not experience fatigue or pain. Prior to conducting the test, the athletes were given instructions on the test procedure to be performed. Validity evaluation of the agility test used empirical and content validities. Content validity has three steps: First, the authors collected relevant sources of research, and conducted a preliminary participatory observation study to develop a test, then evaluated the data obtained; Second, using the delphi technique [23][24], where the researchers met 7 experts directly to assess the contents of the instrument. The third step was analyzing the data obtained in the form of quantitative results from the assessment of 7 experts with a scale of 4 and qualitatively in the form of suggestions from 7 experts. The assessment of empirical validity and reliability consisted of two steps. The first step was conducting test-retest. The agility test instrument was tested on 20 athletes 2 times on different days. The second step was after obtaining data from 2 experiments, the empirical validity will be calculated, followed by calculation of the reliability. The data were analyzed using Aiken formula [25][26], where it was used to calculate the coefficient of content validity as a as a basis for the results of the assessment of several experts on an item to what extent the item represents the construct that has been measured. The data analysis technique for empirical validity used statistical calculations for the Pearson product moment test. Then, reliability was measured using Cronbach's alpha.

3. Results

Based on data collection by observing and reviewing several documents in the form of journal articles and relevant textbooks, the authors created a karate agility test construction in *kata* category as seen in the following figure.

3.1. Karate Agility Test Construction in *Kata* Category

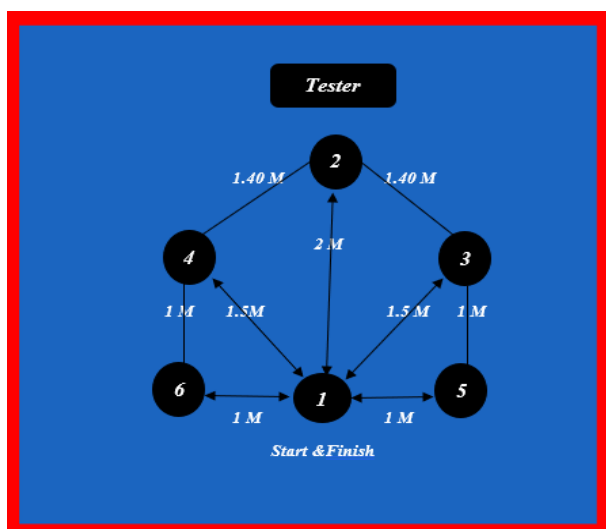


Image 1. Agility Test Construction

Distance between cones for the test

- the distance between cone 1 and cone 2 is 2 meters
- the distance between cone 1 and cone 3 is 1.5 meters
- the distance between cone 1 and cone 4 is 1.5 meters
- the distance between cone 1 and cone 5 is 1 meter
- the distance between cone 1 and cone 6 is 1 meter

Test equipments

- 1 stopwatch
- 6 cones
- 1 roll meter
- karate mattress sized 8x8 meters

Number of testers

- 1 tester prepares the equipment and measured the distance between the cones
- 1 tester holds the whistle to stop the test when the athlete has finished the test
- 1 tester holds the stopwatch
- 1 tester gives instruction to stimulate movement
- 1 tester observes and recorded the test results

Test Procedure

- Cone 1 was the start position, the athlete stands with feet shoulder width apart and knees slightly bent facing cones 2
- The athlete waits for the stimulus from the testor
- The testor provides a sound stimulus in the form of numbers 2 to 6 randomly
- When the testor provides a sound stimulus with sound 2 at the same time he turns on the stopwatch, the athlete steps forward towards cone 2. Arriving at cone 2, the athlete performs *maegeri* kicks with the right foot. Then, the athlete steps back to cone 1 and gets ready to perform the movement instructed by testor

- When the testor provides a sound stimulus with sound 3 at the same time he turns on the stopwatch, the athlete steps forward towards cone 3. Arriving at cone 3, the athlete performs *gedanbarai* block along with *gyakutsuki* punch and a stance with right foot at the front. Then, the athlete steps back to cone 1 and gets ready to perform the movement instructed by testor
- When the testor provides a sound stimulus with sound 4 at the same time he turns on the stopwatch, the athlete steps forward towards cone 4. Arriving at cone 4, the athlete performs *gedanbarai* block and *gyakutsuki* punch and a stance with left foot at the front. Then, the athlete steps back to cone 1 and gets ready to perform the movement instructed by testor
- When the testor provides a sound stimulus with sound 5 at the same time he turns on the stopwatch, the athlete steps sideways towards cone 5. Arriving at cone 5, the athlete performs *kekomi* kick with right foot, and then step sideways back to cone 1 and gets ready to perform the movement instructed by testor
- When the testor provides a sound stimulus with sound 6 at the same time he turns on the stopwatch, the athlete steps sideways towards cone 6. Arriving at cone 6, the athlete performs *kekomi* kick with left foot, and then step sideways back to cone 1 and gets ready to perform the movement instructed by testor
- The testor will stop the test with a whistle when the athlete has completed 6 random moves
- The finish position is at cone 1 and with initial stance
- In the event where the athletes fail to perform a move, the athlete should redo the test on his next turn
- The test is done in 3 repetitions where the best result is taken
- The athlete is given a break time of 5 minutes after performing 1 test

3.2. Content Validity

The analysis using Aiken formula leads to the following results: Item (1) size has fit the karate in *kata* category with a value of V 0.85; Item (2) distance between cones has fit with a value of V 0.80; Item (3) equipments have fit with a value of V 0.80; Item (4) number of test repetitions has fit with a value of V 0.80; Item (5) test procedure has fit with a value of V 0.80; Item (6) safe instrument has fit with a value of V 0.85; Item (7) agility has fit with a value of V 0.85.

Item (8) score taking has fit with a value of V 0.80. The Aiken value of 0.81 to 1.00 indicated that the agreement between the experts was high [26]. This is in line with the literature review which shows that if the coefficient value is more than 0.78, the test instrument that is made can be categorized as good [27]. Based on data and opinions from the literature, the karate agility test construction in *kata* category can be said to be good and has high content validity.

Table 1. The analysis results of Aiken Formula

Jury	Item 1		Item 2		Item 3		Item 4		Item 5		Item 6		Item 7		Item 8	
	Score	S	Score	S	Score	S	Score	S	Score	S	Score	S	Score	S	Score	S
A	4	3	3	2	4	3	4	3	3	2	3	2	4	3	4	3
B	3	2	3	2	4	3	4	3	3	2	3	2	3	2	3	2
C	3	2	4	3	3	2	3	2	3	2	4	3	4	3	3	2
D	4	3	4	3	4	3	3	2	4	3	4	3	4	3	4	3
E	4	3	4	3	3	2	3	2	4	3	3	2	3	2	4	3
F	3	2	3	2	3	2	3	2	4	3	3	2	3	2	3	2
G	4	3	3	2	3	2	4	3	3	2	3	2	3	2	3	2
Σs	18		17		17		17		17		17		18		17	
V	0.85		0.80		0.80		0.80		0.80		0.80		0.85		0.80	

3.3. Empirical Validity

Table 2. Results of Pearson Product Moment Analysis

N	R-table	R-count (test 1)	Significance 2 tailed	Status
20	0.444	0.927	0.000	Valid
N	R-table	R-count (test 1)	Significance 2 tailed	Status
20	0.444	0.903	0.000	Valid

Based on the empirical validity test of the Pearson moment product, the r-table is 0.444, r-count (test 1) is 0.927, r-count (test 2) is 0.903, significance value is 0.000. If the r-count is bigger than the r-table and the significance value is <0.05, it can be concluded that the result is valid. Thus, the karate agility test instrument in *kata* category can be said to be valid.

3.4. Reliability

Table 3. Cronbach alpha analysis results

N	R-table	Cronbach Alpha	Status
20	0.444	0.802	Reliable

Based on the reliability test using Cronbach alpha, the r-table is 0.444, Cronbach alpha is 0.802. If the Cronbach alpha value is greater than the r-table, the result can be said to be reliable. Thus, the instrument of karate agility test in *kumite* category has high reliability because it has a value of more than 0.7.

4. Discussion

Karate is a sport related to physical contact. The physical aspects of karate are very important. If the athlete has adequate physical condition, the moves performed will be effective and efficient in both attacking and defensive conditions [3]. Agility is one of the physical aspects in karate. Agility is defined as the speed at which the body changes direction after a stimulus is given

without failure and loss of balance [28]. The selection of training methods must be tailored to the needs of each sport. Some literature explained that agility-based physical training can improve cognitive function and cardiovascular capability [29].

Kata and *kumite* in karate have different characteristics of moves. *Kumite* has the characteristics of fast attacking and defending, while *Kata* has the characteristics of a steady stance of power and consistency [30]. By knowing the characteristics of each movement, the coach must apply the appropriate approach. *Kata* athletes have bimotor components of strength and power, while *kumite* athletes are more dominant in agility [30]. However, based on the authors' observations, agility also plays an important role for *kata* athletes. For example, agility plays a very important role when the said athlete performs movements forward, sideways and backward by performing techniques. According to literature, agility is a combination of speed, strength and flexibility [31][32]. Therefore, the movement to change direction quickly becomes an important point for *kata* athletes. This is supported by some literature which states that the movement to change direction quickly is a multi-factor movement that is needed at high intensity which functions to improve motor skills, posture stability, the ability to make decisions quickly and contribute to improving sports performance[33][34][35]. However, there needs to be a test in accordance with the characteristics of the *kata* category of karate to find out the improvements. A simulated agility test should be prioritized on young athletes in order to improve their skills and motivation [5]. Some literature explained that martial arts and games have different characteristics of agility [34][1]. Several facts explain that the agility training parameters with specific skill movements can improve the athlete's performance better than general skill training [36]. A sport-specific agility test can help determine the athlete's performance. Since agility is an important component in physical fitness, it requires a test that is in accordance with the characteristics of each branch [37].

The Aiken analysis used to measure the content validity got the following results: Item (1) size has fit the karate in *kata* category with a value of V 0.85; Item (2) distance between cones has fit with a value of V 0.80; Item (3) equipments have fit with a value of V 0.80; Item (4) number of test repetitions has fit with a value of V 0.80; Item (5) test procedure has fit with a value of V 0.80; Item (6) safe instrument has fit with a value of V 0.85; Item (7) agility has fit with a value of V 0.85; Item (8) score taking has fit with a value of V 0.80. The Aiken value of 0.81 to 1.00 indicated that the agreement between the experts was high [26]. Based on data and opinions from the literature, the karate agility test construction in *kata* category can be said to be good and has high content validity.

Based on the reliability test using Cronbach alpha, the r-table is 0.444, Cronbach alpha is 0.802. If the Cronbach alpha value is greater than the r-table, the result can be said to be reliable. Thus, the karate agility test instrument in *kata* category is considered valid. This is in line with the literature review which mentioned that if the coefficient value is more than 0.78, then the instruments made are considered to be good [27]. From the Cronbach alpha test, the of r-table is 0.444, and the Cronbach alpha is 0.802. If the Cronbach alpha value is greater than r-table, it can be said to be reliable. Thus, the karate agility test instrument in *kata* category is considered to have high reliability because its value is more than 0.7. This is supported by the literature that it is suggested that the Cronbach alpha value should have a value of 0.60 to 0.71 in order to show stability and have a fairly high agreement. [38][39][40][41]. Therefore, the construction test is considered feasible to measure the karate agility test in *kata* category. The test developed is an agility test with a combination of techniques in karate because this test is similar to the real match. It is hoped that the creation of this test can be used to measure the agility of *kata* karate athletes in a special periodization. There were only 20 participants in the empirical validity test. In fact, to conduct a reliability test, the proposed participants amounted to 40 people. However, in implementation, it will be difficult to achieve a homogeneous amount. Thus, this study used a reliability test with fewer participants, namely 20 athletes [42]

5. Conclusions

Based on the results of data processing and discussion, the construction of karate agility test in *kata* category is considered valid and reliable. Thus, the construction of karate agility test in *kata* category test has been fit and proper to be used to measure the karate agility test in *kata* category.

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