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Reactive Agility Instruments in Karate Kumite: Aiken Validity

Danardono[1], Agus Kristiyanto[1], Sapta Kunta Purnama[1], Tomoliyus[2,*], Nevita Ariani[2]

[1]Faculty of Sport, Sebelas Maret University, Indonesia

[2]Department of Sport Science, Yogyakarta State University, Indonesia

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Abstract **Background:** Reactive agility test has become one of the most important issues in improving karate skills. Therefore, an instrument is needed to develop the reactive agility test for karate. This study aimed to develop the construction of a reactive agility karate instrument. **Methods:** This research used mixed qualitative and quantitative methods. The participants are ten experts determined by the evaluation expert and a karate expert or both criteria. The research procedure was divided into three stages. The first stage, document analysis (international journals), was used to develop the construction of reactive agility karate instruments. The second stage was expert validation using the Delphi technique. The third stage was qualitative analysis. It consisted of the suggestion from the expert judgment. Then, the expert analyzed and revised those results until there was no revision of the reactive agility karate instrument, resulting in a coefficient value. This research instrument uses a questionnaire scale of 1 to 4, namely very relevant, relevant, less relevant, and irrelevant. Then, the data analysis used the Aiken formula. This research resulted in the construction of reactive agility karate instruments, namely, the suitability of the test material with foot movements in the karate game has a coefficient value of V **1**. The relevant construction for each element of karate agility has a coefficient value of V**0.962**. The implementation procedure has a coefficient value of V **0.851**. The relevant cone distance to the karate foot movement has a coefficient value of V **1**. **Conclusions:** Those items above resulted in a coefficient value of more than 0.70. Indeed, it can be concluded that all experts have very high agreement on the reactive agility karate test items.

Keywords Karate, Content Validity, Reactive Agility, Instruments

1. Introduction

Karate is a type of combat sport. Japanese martial art is widely practiced worldwide. Literally karate means "bare hands". It refers to the combat that uses bare hands without weapons to defeat the opponent [1]. Karate matches are categorized into *kata* and *kumite*. *Karateka* (karate practitioners) have 60-80 seconds to complete a *kata*, and every second over or under the duration will be penalized [2]. On the other hand, Kumite means a real match/fight between two players under strict rules. They are free to move, kick, and hit by defending and attacking as fast as possible. It is also similar to Soykan et al. [3] statement that attack movements in the karate category of *kumite* contain sudden acceleration, change direction, fast, and explosive. In addition, fighting (*kumite*) can also be interpreted as an attack and defense strategy studied in previous techniques (*kata*). Practically, kumite has an aggressive nature with the aim of getting points from the opponent during a match [4,5,6]

There are two types of *kumite* training which are paired and unpaired. Those training types can form a good

moving structure and improve technique and physicality in matches if systematically trained [6,7]. Karate, especially *kumite*, is a physical contact sport. Therefore, the physical aspect is one of the most important aspects of improving athlete performance. When the athlete has a good physique condition, the athlete's technical movement will automatically be more effective and efficient both in attack or defense. Karate, especially kumite, has the characteristics of sudden movements and explosive attacks [8]. Therefore, good physical aspects are needed to support these sudden and fast movements. One of the most important aspects is reactive agility.

Some research results state that maximum sports performance is determined by four factors: physical preparation, technical preparation, tactical preparation, and mental preparation [9,10,11]. Physical preparation with systematic training can increase the physiological potential [12,13] and the athlete's biomotor skills to reach the highest standard [14]. Therefore, karate coaches must pay attention to general and specific physical preparation so that the performance of karate athletes can reach optimal performance. Then, the athletes who have good physique conditions will benefit from mastery of technique and tactics. Indeed, a good physique will support technique and tactics and prevent an athlete from getting injured.

One important physical biomotor in karate is agility [13,15,16] balance [17]. Then, in the anaerobic energy system used to make a short and high-intensity attack, the anaerobic system supplies the required energy [18]. Meanwhile, the aerobic system is required during the resting period [19]. Agility can be described as controlling body position and changing the moving direction as quickly as possible [20]. Although, in general, agility is defined as a movement to change a direction quickly in responding to a stimulus [21]. In agility, there is perceptual decision-making or making movements according to stimulus and producing changes in direction and speed [21]. Indeed, the statement informs that karate athletes' agility characteristics are categorized as reactive agility [22].

Reactive agility can be described as changing the motion as quickly as possible in response to a stimulus [23]. Reactive agility contains both changes in the movement direction, perceptual, and decision-making components because the changes in direction and speed are often carried out in response to opposing actions [23]. In the game of karate, reactive agility affects making a decision when receiving the ball (stimulus) and moving as quickly as possible. Therefore, to find out one component of reactive agility ability, a particular reactive agility instrument is needed for karate

Several results from prior studies found that reactive agility instruments are considered expensive, impractical, and complicated. Then, the field observations show that the reactive agility instruments still use standard instruments such as T-test, Zig-zag runs, Suttle runs, and Side step. In particular, field-based tests only measure common agility. It does not focus on the specific sport [5,24,25,26,27]. It consists of various tests such as the 505 agility test, T agility test, Illinois agility test, and 10 x 5 agility test meters [5,24,25,26,27]. So far, reactive agility instruments specifically do not focus on developing karate movements. Moreover, individual sports such as self-defense or one-on-one ball games typically become competitive sports. Therefore, the test must be similar to the real match [28]. Whereas in assessing the strengths and weaknesses of an athlete, physical instruments are needed as an evaluation of the training achievement [29,30]. Content validity relates to how capable the instrument can fully assess or measure a particular achievement. [31], or it is described as a measuring tool for a particular sport. The design and construction of test instruments considered the characteristics of the sport, goals, and objectives. Therefore, the content validity test of the instrument can be determined to measure the ability of reactive agility karate. Due to the lack of research on reactive agility karate, this study aims to develop a reactive agility karate instrument and determine the validity of instrument content. Besides, it also can be used to measure karate agility tests.

The research that has been done shows that the reactive agility test in kumite category karate has not been found. Content Validity is a measuring tool where content is an instrument or construction used to measure a sports activity. The construction of measuring devices must be precise and careful. It also refers to the relevance, completeness, goals, and objectives to design a good construction [32,33,34]. Therefore, the valid instrument means that instrument can be appropriately used to measure reactive agility in the kumite category of karate. Designing a test achievement in particular sports must be adjusted to a certain sport. Although there are two categories in karate, namely kata (jutsu) and kumite (combat), the movement patterns are very different. Therefore, it must be adapted to the movement pattern due to the lack of a study that focuses on the karate branch of the kumite category, especially specific reactive agility instruments. Therefore, this research focused on developing a kumite category of reactive agility karate instruments and seeking content validity. This research is expected to help measure reactive agility in the kumite category in karate sport.

2. Materials and Methods

This research used mixed methods, namely qualitative and quantitative methods. It is used to obtain complete and valid data. Mixed methods combine qualitative and quantitative research methods into one concept or are carried out sequentially or simultaneously to do an in-depth review [33,34]. The participants in this study were documents and ten experts. The ten experts have qualifications: 1 expert in sports evaluation, 3 expert karate lecturers, and 6 nationally certified trainers.

This study consists of three stages. The first stage is a qualitative approach with the literature reviews method

with type *narrative review* [35] articles, journals, and textbooks related to existing reactive agility karate instruments. It is used to develop conceptual and operational definitions of reactive agility karate and construct reactive agility karate instruments.

The second stage is conducting a content validity test using the Delphi technique [36,37,38]. This technique allows each expert judgment not to meet in assessing the construction of reactive agility karate design. The third stage is qualitative analysis, namely input from expert judgment. Then, the results are analyzed to be revised and returned to the expert until they are accepted without further improvement [39] the reactive agility karate instruments by giving coefficient values. This research instrument uses a questionnaire scale from 1 to 4, namely very relevant, relevant, less relevant, and irrelevant. The formula for data analysis used Aiken's V [40] as follows:

$$V = (r\text{-}lo) / n(c\text{-}1)$$

Where,

V = index of rater agreement regarding item validity

r = number given by rater

l_0= the lowest score of validity (1 for the lowest scale, it spread from 1-4)

c = the highest score of validity (4 for the highest scale, it spread from 1-4)

n = the number of experts who do the assessment

3. Results

The results of the document analysis found the definition of reactive agility karate. Reactive agility in karate is responding to stimuli. The speed of footsteps and the changes in the direction of each movement.

This reactive agility karate kumite instrument requires supporting equipment, namely, a large space to install a 10x10 meter mat, six cones, one whistle, and one stopwatch. At the same time, the required testers are 3 people with their respective jobs, namely one person as an instructions giver and a whistleblower, one person as a stopwatch holder, and one person as a recorder of the implementation results.

The measuring distance of the reactive agility karate kumite instrument that has been developed is as follows: 1) the distance from the start to the whistle is 1.5 meters; 2) the distance between the start to the center point is 2 meters; 3) the distance between the center point to cone ABCD is 2 meters each, and 4) the angle between cone A.B. and cone CD 45^o. The construction of the reactive agility karate kumite instrument is as shown in Figure 1 below:

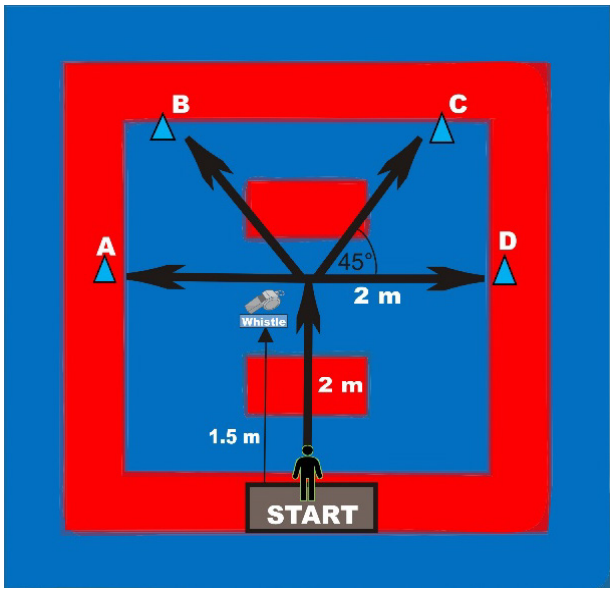

Figure 1. Reactive agility Karate Instrument Construction

Implementing the reactive agility karate kumite instrument starts with the testee running from the starting line. Stopwatch begins when the tests are at the whistle line. When the testee hears the whistle, the tester mentions 1 from the 4 cones. Then the testee pays attention to the direction and runs to a certain cone that the tester mentioned. The testee has to touch the cone and return to the starting line as quickly as possible. Time is stopped when the sample passes the whistle point. The implementation will be carried out three times by assessing the time and taking the best time due to the three experiments.

Content Validation Test Results with Aiken Formula

Based on the Aiken's calculations analysis for the reactive agility karate kumite instrument by experts, the value of V is obtained as shown in Table 1.

Table 1. Content Validity Test Results

Evaluator	Aspect 1		Aspect 2		Aspect 3		Aspect 4	
	Score	S	Score	S	Score	S	Score	S
A	4	3	4	3	3	2	4	3
B	4	3	4	3	4	3	4	3
C	4	3	4	3	4	3	4	3
D	4	3	4	3	3	2	4	3
E	4	3	4	3	4	3	4	3
F	4	3	4	3	4	3	4	3
G	4	3	4	3	3	2	4	3
H	4	3	3	2	3	2	4	3
I	4	3	4	3	4	3	4	3
J	4	3	4	3	3	2	4	3
∑s	27		26		23		27	
V	1		0.962		0.851		1	

Based on Table 1, the results of the content validity test from ten experts on the reactive agility karate kumite instrument design were obtained. The first point is the suitability of the test material with foot movements in karate sports, with a coefficient value of 1 (perfect). The second point or the relevant construction for each element of agility has a coefficient value of 0.96. The third point, or the implementation procedure, has a coefficient value of 0.85, and the fourth point, the distance between the cone and the starting line, has a coefficient value of 1 (perfect)

4. Discussion

Physical is one of the important components that support karate athletes to reach the peak of achievement [43]. An athlete's success needs to be built with the right and continuous program [44]. In karate, there are two categories: moves (kata) and fights (Kumite), which have different characteristics. In the kumite category, karate is a sport that has the characteristics of attacking quickly and involves good strategic tactics [45]. *Kata* and *kumite* have different match conditions. Therefore, coach must apply a different approach in training and assessing activities to get a maximal result. In the physical element of athletes, the *Kata* is more on the physical aspect of power and strength, in contrast to the *kumite* category [45]. The kumite category needed the physical aspect of reactive agility. Reactive agility is a combination of several biomotor components. In general, karate in the kumite category has a similar motion to tennis, which requires explosive movements. Tennis requires an explosive motion characteristic accompanied by the accuracy of punches and changes in movements [46]. Therefore, karate optimizes the reactive agility to respond to the stimulus in the form of a signal accompanied by a movement as quickly as possible. If karate athletes have good reactive agility, athletes can defend and attack optimally.

Reactive agility is very important in karate because all the movements made while playing require speed to make decisions and take moves as quickly as possible. Athletes with good reactive agility will more easily receive stimuli, anticipate opponent attacks, and attack quickly without losing balance. Therefore, it is necessary to measure the ability of reactive agility in karate. However, no instrument has the characteristics of karate. Consequently, it is necessary to carry out a karate athlete test instrument to determine the increase in achievement.

However, the researcher found several studies on general agility instruments suitable for several sports but did not focus on reactive agility. The instrument is only suitable for a few sports and is not ideal for the karate category of kumite. In karate, research on agility test instruments already exists. However, this instrument was carried out for kumite karate and only focused on agility, but it was not found for the reactive agility instrument. From these problems, researchers want to develop a construction of a reactive agility instrument for karate that resembles the characteristics of karate's motion. It is used to determine the increase in reactive agility when receiving a stimulus and making movements as quickly as possible. This instrument can be useful for coaches as a guide to measure their athletes' ability and create a directed training program.

Reactive agility in karate is the ability to perform sideways, forward movements and change direction quickly in response to a stimulus [47]. Reactive agility is generally a rapid whole-body movement with changes in speed in response to the stimulus [21]. Reactive agility is

also needed in some sports games, such as karate, table tennis, badminton, and others, to perform movements as quickly as possible and ease the move. The athlete's ability to change direction quickly and stop suddenly is a fundamental parameter for achievement in sports such as football, basketball, rugby, martial arts, and others [48].

Based on the research analysis results, it can be concluded that reactive agility is the ability to start, stop or change direction as quickly as possible after receiving a stimulus.

The findings of the document analysis on the construction of the reactive agility karate kumite instrument are the results of the content validity test from ten experts on the design of the reactive agility karate kumite instrument. The first item, the suitability of the test material with foot movements in karate sports, produces **1** a coefficient value (perfect). The second item or the relevant construction for each element of agility has a coefficient value of **0.96**. The third item, or the implementation procedure, has a coefficient value of **0.85**; and the fourth item, or the distance between the cone and the starting line, has a coefficient value of **1** (perfect).

Based on the results of the explanation above, it has been found that the validity of the content of the kumite category of karate agility tests has been found. It can be explained that a coefficient value of more than 0.78 can be concluded as a good test instrument [49]. Then, according to Hendryadi, the Aiken V value of 0.41 to 0.60 is said to have moderate agreement results. When the Aiken V value is 0.81 to 1.00, it can be said that it has a high agreement result [50]. Based on this opinion, it can be said that the karate agility test in the kumite category has high validity. In other words, all experts have a high agreement.

5. Conclusion

Based on the results and discussion above, it can be concluded that the reactive agility karate instrument has high content validity. A construction test instrument document for the reactive agility karate kumite instrument shows that the instrument has high content validity. Therefore, it can help ensure construct validity and give confidence to readers and researchers about this instrument.

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