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Y Agility Test Innovation on Special Badminton Athletes for the Junior Category (U17): Validity and Reliability

Y Innovación en pruebas de agilidad en deportistas especiales de bádminton para la categoría junior (U17): validez y confiabilidad

*Ricky Susiono, * FX. Sugiyanto, *Ria Lumintuarso, Tomoliyus, *Endang Rini Sukamti, *Fauzi, *Awan Hariono, *Trisnar Adi Prabowo
*Department of Sport and Health Sciences, Yogyakarta State University (Indonesia)

Abstract. This study aims to produce innovative badminton agility tests specifically for athletes aged 15-17 years with the Y agility test model. There are three steps in determining an agility test model. The first step is the qualitative analysis of documents, textbooks, research articles related to agility tests. The second step is quantitative analysis using the delphi technique; the results consist of six aspects of assessment, namely the conformity aspect of the definition of agility to the test media, the conformity aspect of the badminton game, the distance aspect of the test, the motion aspect, the test procedure aspect, the construction aspect of the test image. Step three include the Aiken V validity test and Cronbach's Alpha and Intraclass Correlation Coefficients (ICC) reliability test. This study involved nine experts for the validity test and 55 badminton athletes (35 men and 20 women) for the reliability test with a minimum qualification of having been champion at the regional level, athlete characteristics (mean±SD) age 16.15±0.8 years old, height 164.15 ±1.9 cm, weight 53.58±1.7 kg, BMI (body mass index) 19.19±34, training experience 4.71±1.4 years. The results of this study are validity test, the average value of V is 0.824. Cronbach's Alpha 0.817 reliability test and Interclass Correlation Coefficient 0.818. Thus, the Y agility test has a high level of validity and reliability. It is expected in the future that the Y agility test for special badminton sports aged 15-17 years can be used around the world, even we encourage to publish the results of the test scientifically. Thus, the innovation of badminton agility tests can continue to develop for achievement sports and for academics to further develop Y agility tests scientifically. It is recommended to further strengthen the level of accuracy of this test, then an empirical validity test and test-retest are needed.
Keywords: Y agility, Badminton, Validity and Reliability

Resumen. Este estudio tiene como objetivo producir pruebas de agilidad de bádminton innovadoras específicamente para atletas de 15 a 17 años con el modelo de prueba de agilidad Y. Hay tres pasos para determinar un modelo de prueba de agilidad. El primer paso es el análisis cualitativo de documentos, libros de texto y artículos de investigación relacionados con las pruebas de agilidad. El segundo paso es el análisis cuantitativo mediante la técnica Delphi; Los resultados constan de seis aspectos de evaluación, a saber, el aspecto de conformidad de la definición de agilidad con los medios de prueba, el aspecto de conformidad del juego de bádminton, el aspecto de distancia de la prueba, el aspecto de movimiento, el aspecto del procedimiento de prueba y el aspecto de construcción. de la imagen de prueba. El tercer paso incluye la prueba de validez de Aiken V y la prueba de confiabilidad de coeficientes de correlación intraclase (ICC) alfa y de Cronbach. En este estudio participaron nueve expertos para la prueba de validez y 55 deportistas de bádminton (35 hombres y 20 mujeres) para la prueba de confiabilidad con calificación mínima de haber sido campeón a nivel regional, características del atleta (media±DE) edad 16,15±0,8 años. , altura 164,15 ±1,9 cm, peso 53,58±1,7 kg, IMC (índice de masa corporal) 19,19±34, experiencia en entrenamiento 4,71±1,4 años. Los resultados de este estudio son prueba de validez, el valor promedio de V es 0,824. Prueba de confiabilidad Alfa de Cronbach 0,817 y Coeficiente de Correlación Interclase 0,818. Por tanto, el test de agilidad Y tiene un alto nivel de validez y fiabilidad. Se espera que en el futuro la prueba de agilidad Y para deportes especiales de bádminton de edades comprendidas entre 15 y 17 años pueda utilizarse en todo el mundo, aunque animamos a publicar los resultados de la prueba de forma científica. Por lo tanto, la innovación de las pruebas de agilidad del bádminton puede continuar desarrollándose para los deportes de rendimiento y para que los académicos sigan desarrollando científicamente las pruebas de agilidad. Se recomienda fortalecer aún más el nivel de precisión de esta prueba, entonces se necesita una prueba de validez empírica y una prueba-reprueba.
Palabras clave: Y agilidad, Bádminton, Validez y Fiabilidad

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Trisnar Adi Prabowo
trisnaradi.2022@student.uny.ac.id

Introduction

Badminton is a very popular sport, and it is loved by many people. It has been contested up to the Olympic level for a long time ((Supriyanto et al., 2022); (Xu et al., 2023). Thus, many countries are looking for and fostering badminton athletes from childhood to adolescence to become the world's highest ranked badminton athletes

(Milon & Milon, 2019); (Pirak et al., 2021); (Rodríguez et al., 2022). In Indonesia, badminton has been taught to children, and then it has been carried out to foster talented teenager athletes or special badminton schools from the age of 12 (Hasyim & Hasanuddin, 2023); (Wijayanti et al., 2024); Mandan et al., 2024) . In looking for coaching talented athletes or special badminton schools, there is a stage that must be passed by conducting physical fitness tests, basic biomotor ability tests, anthrophometric tests, and badminton skill tests ((Edmizal & Soniawan, 2019); (Phomsoupha & Laffaye, 2020); (Williyanto et al., 2021); (Kusnadi et al., 2022). However, the tests carried out for athletes are still limited to general tests or not yet specific to badminton. Facts in the field, coaches or badminton coaching teams in Indonesia have innovated many special tests on badminton athletes but have not been scientifically analysed and researched. In conducting the badminton athlete test, the basic criteria that must be prioritized include the speed test (Kahar et al., 2022); (Fernandez-Fernandez et al., 2022); (Srinivasan et al., 2022). Speed is the basis for agility and reaction ability.

In badminton, agility is a physical component that must be possessed by badminton athletes if they want to support achievement (Niyati Mukesh et al., 2021); (Guo et al., 2021); (Febby Ardhia et al., 2022); (S. Nugroho et al., 2022); (Chandra et al., 2023); (Labib Siena Ar Rasyid et al., 2023); (Albayati & Kaya, 2023). Agility is described as the

movement to change direction quickly in response to stimuli. Agility involves perceptual decision-making, which requires changing the direction and speed of movement in response to stimuli (Thieschäfer & Büsch, 2022); (Ahmed et al., 2022); (Luna-Villouta et al., 2023). In addition, agility also includes modifications to the speed of movement, perception, and decision-making processes (Živković et al., 2021); (Pamungkas et al., 2023). Therefore, adjustments in direction and speed are often made in response to the opponent's activity. Agility plays a role in badminton when it comes to choosing options and moving as quickly as possible after receiving the ball (stimulus) (S. Nugroho et al., 2021). Agility in badminton is useful for players to be able to move quickly in various directions, either to chase or defend the shuttlecock so as not to fall in their own field area, or to retaliate against attacks (Kuo et al., 2022); (Panda et al., 2022). However, to know and measure the agility of badminton athletes, then, special measuring instruments or agility instruments are needed for badminton accurately, effectively, and efficiently.

In this development, there are many variations of agility tests for badminton athletes. In fact, many badminton coaches in Indonesia still use agility tests such as the shuttle run and 505 agility test. This form of agility test was also found in previous research, badminton agility test by developing or comparing basic agility tests such as badminton agility test "min kai chin", Illinois agility test, side step test, shuttle run, 505 agility test, burpee test, SEMO agility test (Wira Yudha Kusuma, 2015); (De França Bahia Loureiro & De Freitas, 2016); (De França Bahia Loureiro et al., 2017); (Edmizal & Soniawan, 2019). Furthermore, the agility test is modified according to the needs of badminton athletes by changing the distance or direction. Then there are also agility tests that have innovated using sensor technology and communication systems. The technology is to measure the time needed to perform agility movements, the data shows the maximum time taken to complete the test is 25 seconds while the minimum time is only 15 seconds (Marrylin Yalin et al., 2022). The results of other studies explain that the use of artificial technology for agility tests can also be used for agility exercises for eight weeks in the preparation, improvement and special stages (Tan et al., 2023). However, the badminton agility test in previous studies is still based on agility tests in general, so it is not in accordance with the conditions in the field. The use of technology also does not guarantee its accuracy because it still relies on cables that are prone to breakage or network interference. In addition, the use of technology also requires expensive costs, intense maintenance, and not all coaches or athletes understand how to use it.

Therefore, the purpose of this study is to produce innovative badminton agility tests specifically for athletes aged 15-17 years based on a Y-shaped agility test. Y-shaped agility tests have been around for a long time and are commonly used in basketball, football, floorball and handball (Horička & Šimonek, 2019); (Dugdale et al., 2020); (Kaczka et al., 2022); (Paška et al., 2023). Then the development of the Y form of agility test was also developed for field tennis through validity and reliability tests (W. Nugroho et al., 2022). This research method is to test validity and reliability, the validity test is carried out by experts and coaches in the field of badminton, then the reliability test is carried out by badminton athletes directly (Alim et al., 2024). With a high value of validity and reliability, it is expected that it can be used repeatedly and have a high level of test reliability (Yudhistira & Tomoliyus, 2020); (Qowiyyuridho et al., 2021); (Yudhistira et al., 2021)). The importance of this study is to develop the agility test of badminton athletes and increase the innovation of previous agility tests because there have been many innovations in badminton agility tests but they have not been published and their validity and reliability values are not known. In addition, this agility test can be easily carried out, does not require expensive or complicated equipment but remains accurate, effective and efficient. In this study, validity and reliability tests will be used.

Methods

Study Design

This is a development research which combines qualitative and quantitative approaches. Mixed method aims to make the data collected more valid, accurate, and comprehensive. In this study, there are three steps in determining the agility test model. The first step is the qualitative analysis of documents, textbooks, research articles related to agility tests. The first analysis process found that there was no Y form of agility in badminton. It was then discovered that the agility test model was Y-shaped with variations in path or slope angle (Nugroho et al., 2022; Alim et al., 2024). In the age classification, search results found that the beginning of a career in badminton starts from the age of 15 (Williyanto et al., 2021); (Kusnadi et al., 2022); (Rodríguez et al., 2022). The result of the first step is to set the Y agility test for badminton athletes aged 15-17 years.

The second step involves quantitative analysis, namely testing the validity of the assessment using the Delphi technique which aims to ask badminton experts, namely academics and coaches, to assess the construction of the agility test that has been produced in the first stage (Chen et al., 2020); (Gavigan et al., 2022); (Stribing et al., 2022). In the second stage, the experts were not brought together in the assessment of the instrument.

The third step after data collection, data collection from the validity test of the Y-shaped agility test model was analyzed using the Aiken V formula. After the validity test results were determined, the second data collection was by trying out the Y-shaped agility test on experienced badminton athletes as a requirement for the reliability test.

Study Participants

This study involved nine experts for a validity test consisting of 4 lecturers have Doctoral qualifications with the criteria of 2 lecturers being experts in badminton coaching and 2 lecturers being experts in testing and evaluation in sports. Furthermore, 5 badminton coaches with national coach licenses recognized by the *Badminton World Federation* (BWF). Then, the reliability test consisted of 55 badminton athletes (35 men and 20 women) with minimum qualifications who had been champions at the regional level, with athlete characteristics (mean±SD) age 16.15±0.8 years, height 164.15 ±1.9 cm

weight 53.58±1.7 kg, BMI (body mass index) 19.19±34, training experience 4.71±1.4 years. This research involved seven badminton clubs in Jakarta Province and Yogyakarta Special Region province.

The instrument to assess the agility test is in the form of a questionnaire with a score of 1 – 5. The score contains the determination "very appropriate (5)", "appropriate (4)", "sufficient (3)", "not appropriate (2)", "very inappropriate (1)". The content of the statement item consists of six aspects, namely the conformity aspect of the definition of agility to the test media, the conformity aspect of the badminton game, the distance aspect of the test, the motion aspect, the test procedure aspect, the construction aspect of the test image.

Badminton Agility Test Equipment and Procedures

Equipment:

1) 1 whistle
2) 4 cones
3) 1 stopwatch
4) 1 piece of paper to record

Implementation procedure of Y agility test:

1) First, the participant (the athlete) stands behind the starting line,
2) Two, the athlete runs towards the centre in the picture of the plain box, then runs towards cone A1,
3) After arriving at cone A1, the athlete runs towards cone A2 past the plain box image,
4) After arriving at cone A2, the athlete runs towards the picture of a plain box, then run diagonally to cone B1.
5) After arriving at cone B1, the athlete runs towards the picture of a plain box, then run diagonally towards box B2.
6) After arriving at cone B2, the athlete runs towards the image of a plain box,
7) After arriving at the picture of a plain box. In the last step, the athlete runs straight to the finish line.

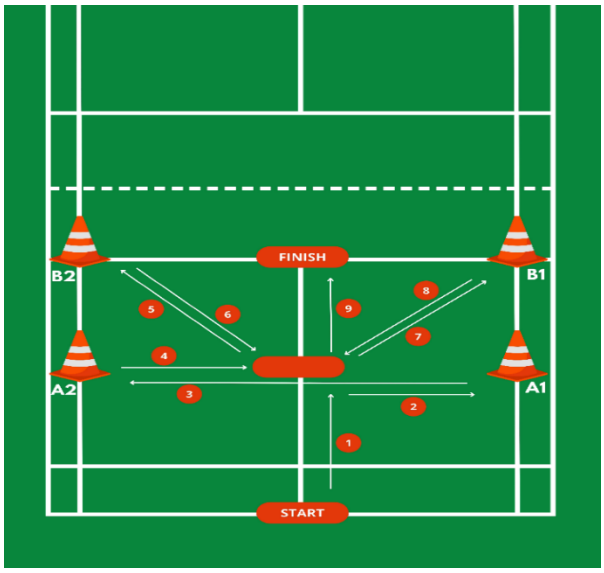

Figure 1. Badminton Agility Test Equipment

Statistical Analysis

According to the assessment data by validator experts and assessment instrument practitioners, the instruments were analysed to determine the results of their validity. The validity of the contents of this assessment instrument uses the Aiken formula as follows (Lewis. R. Aiken, 1985):

V Aiken's: $\frac{\sum S}{n\,(c-1)}$

S : r – lo
Lo : lowest rating score (eg 1)
C : highest rating score (eg 4)
r : the score given by the assessor

Then, the reliability test was carried out using the reliability of Intraclass Correlation Coefficients (ICC). This reliability test shows the level of understanding between assessors in assessing each indicator on the instrument. The ICC will provide an overview in the form of a score on the degree of agreement given by the expert or rater (Martínez Pérez & Pérez Martin, 2023). For this reliability test, it was carried out with the help of SPSS 26.

Results

Aiken Validity Test

Based on the results of the Aiken validity test in table 1, aspect 1) is the suitability of the definition of agility to test media for U-17 badminton athletes is V value 0.805, aspect 2) is the aspect of the suitability of badminton games for U-17 badminton athletes is V value 0.833, aspect 3) is the aspect of test distance for U-17 badminton athletes is V value 0.833, aspect 4) is the aspect of test motion for U-17 badminton athletes is V value 0.861, aspect 5) is the aspect of test procedure for U-17 badminton athletes is V value 0.805, aspect 6) is the aspect of test image construction for U-17 badminton athletes is V value 0.805. Then the average V-value is 0.824, so the special agility test for U-17 badminton athletes is valid.

Table 1.
Aiken Result

Aspects	∑ S	n	C - 1	Aiken	Description
Suitability of the definition of agility to the test media	29	36	36	0,805	Valid
Suitability test for badminton for U-17 badminton athletes	30	36	36	0,833	Valid
Distance in the test for U-17 badminton athletes	30	36	36	0,833	Valid
Movement in tests for U-17 badminton athletes	31	36	36	0,861	Valid
Test procedures for U-17 badminton athletes	29	36	36	0,805	Valid
Image construction on tests for U-17 badminton athletes	29	36	36	0,805	Valid

Reliability Test

The reliability test in this study is based on the value of Cronbach's Alpha and Interclass Correlation Coefficient with the help of SPSS 26.

Table 2.
Cronbach's Alpha Result

Cronbach's Alpha	N of Items
0.817	6

Based on the results of table 2, Cronbach's Alpha score for innovation Y agility test for U-17 badminton athletes obtained a value of 0.817. Thus, the agility test is reliable, because it has a Cronbach's Alpha value > 0.6.

Table 3.
Interclass Correlation Coefficient

Interclass Correlation Coefficient							
	Interclass	95% Confidence Interval		F Test with True Value 0			
	Correlation[b]	Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	0.428[a]	0.312	0.558	5.452	54	270	0.000
Average Measures	0.818[c]	0.732	0.883	5.452	54	270	0.000

Based on the results of table 3, the Interclass Correlation value for innovation Y agility test specifically for U-17 badminton athletes obtained a value of r = 0.818 (excellent agreement) and had a value of 95% confidence interval (CI) between, 0.73 – 0.88. Thus, the innovation of Y agility test specifically for U-17 badminton athletes can be used to measure and analyse the agility of U-17 badminton athletes.

Discussion

The findings of the Y agility test innovation, specifically for badminton athletes aged 15-17 years (U-17), can be explained that the test innovation is valid and has a good level of reliability. From the results of the validity analysis, the average value of the test validity V is 0.824. Based on the results of the validity value, reinforced by the results of other studies regarding the agility variable that the validity value is above 0.8, the test can be used (Danardono et al., 2022). The results of the validity of this test were supported by nine experts from academics in the badminton field and nationally licensed trainers who stated that they supported the six aspects of Y agility test. Then the results of the reliability test using Cronbach's Alpha 0.817 and Interclass Correlation Coefficient 0.818 that these results have a high level of reliability, reinforced from the results of previous studies that are similar to Nugroho and Utama, that the values of Cronbach's Alpha and Interclass Correlation Coefficient above 0.8 can be concluded to have a good level of reliability (W. Nugroho et al., 2022); (Utama et al., 2023). In this reliability test, in order to obtain high reliability results, the involvement of 55 badminton athletes aged 15-17 years is needed. The result is that 55 badminton athletes are also very supportive so that the Y agility test can be used for agility tests by proving the value of Cronbach's Alpha and Interclass Correlation Coefficient above 0.8.

The results of previous studies related to badminton that analysed agility variables showed that innovation from various types of agility tests that have specificity is needed (Wira Yudha Kusuma, 2015); (De França Bahia Loureiro & De Freitas, 2016); (De França Bahia Loureiro et al., 2017); (Yıldız & Fidan, 2018); (Jansen et al., 2021); (Rojas et al., 2022); (Tan et al., 2023). In fact, in the field, badminton agility tests still use general tests such as shuttle runs, T tests, or zigzag runs. Thus, the test is still not enough to measure the level of ability of badminton athletes due to differences in test procedures with the form of badminton games. The advantages of this Y-shaped agility test compared to previous tests are that it is easy to carry out practical tests, affordable costs, and can be used repeatedly. Apart from that, the agility test is specifically tested for badminton athletes aged 15 to 17 years, whereas in the previous agility test there was no age-specific test. Therefore, with various scientific literature studies, various books and journal studies, the chosen innovation is a form of the Y agility test model. The results of scientific publications on the Y agility test were also carried out on handball, basketball, and floorball (Horníková et al., 2021); (Horníková & Zemková, 2022); (Paška et al., 2023). From the results of the analysis of this study, the results of the Y agility test are very dependent on the motor abilities of athletes such as running ability, strength, speed to visual reaction. Then from the analysis of the Y agility test research, it was found that the Y agility test had not yet been studied for its validity and reliability in badminton.

In addition, qualitative analysis was also used in this study by providing responses from athletes who tried this test and as an assessor on the reliability test. The difference between the Y agility test in the previous study and the Y agility test specifically for badminton sports aged 15-17 years is the addition of a pathway in the middle that requires badminton athletes to move sideways. By increasing the path to run, the suitability of the definition of agility can be met (Ojeda-Aravena et al., 2020); (Niyati Mukesh et al., 2021); (Corredor-Serrano et al., 2023). Then, the advantage of this agility test is the addition of a movement path that is in accordance with the condition of the badminton athlete when competing, so that when the athlete tries to do a Y agility test, it can really be like competing. Another response from a badminton coach also explained, the Y agility test is also easy to understand and easy to do, so Y agility can also be used at any time if the coach needs the latest data on the agility of badminton athletes aged 15-17 years. Then the response from badminton academic lecturers was that the Y-shaped agility test design, apart from being valid to use, also had a flexible design. Apart from that, it can be modified from the aspect of the track or add points so that the athlete's running direction can vary, because of the nature of the badminton sport where the direction of the shuttlecock is unpredictable.

The limitation of this study is the lack of several sources from previous scientific research on the use of Y agility tests in badminton and the target of athletes at the age of 15-17 years. However, to overcome this test so that there is no bias, the Y-shaped agility test was carried out by a sample of 55 athletes. Hope in the future, the Y agility test for special badminton sports aged 15-17 years can be used around the world, even we encourage to publish the results of the test scientifically. So that the innovation of badminton agility tests can continue to develop for achievement sports and for academics to further develop Y agility tests scientifically.

Conclusion

Based on the results and discussion of this study, it can be concluded that there are six aspects to the Y agility test, namely the conformity aspect of the definition of agility to the test media, the conformity aspect of the badminton game, the distance aspect of the test, the motion aspect, the test procedure aspect, the construction aspect of the test image. From this aspect, the validity value of Aiken obtained a value of 0.824. Then the results of Cronbach's Alpha reliability test were 0.817 and Interclass Correlation Coefficient was 0.818.

Thus, the Y agility test is feasible to test the agility of badminton athletes aged 15-17 years. It is recommended to further strengthen the level of accuracy of this test, then an empirical validity test and test-retest are needed.

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Datos de los autores y traductor:

Ricky Susiono	rickysusiono.2022@student.uny.ac.id	Autor/a
FX. Sugiyanto	fx.sugiyanto56@gmail.com	Autor/a
Ria Lumintuarso	ria_l@uny.ac.id	Autor/a
Tomoliyus	tomoliyus@uny.ac.id	Autor/a
Endang Rini Sukamti	endang_fik@uny.ac.id	Autor/a
Fauzi	fauzi@uny.ac.id	Autor/a
Awan Hariono	awan_hariono@uny.ac.id	Autor/a
Trisnar Adi Prabowo	trisnaradi.2022@student.uny.ac.id	Autor/a
Resna Suci Nurfalah	-	Traductor/a