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Physical test instrument: a development study for junior Karateka in the kata category
Instrumento de prueba física: un estudio de desarrollo para karatekas junior en la categoría de kata

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Abstract. Good physical condition is very important for the karate martial arts branch, especially the kata category. Where physical condition is the main supporting factor so that the ability of kihon, kumite and kata karateka can develop properly. Therefore, it is necessary to develop a valid and reliable karate physical condition test and measurement instrument for the kata category so that it can be used in karate development. The purpose of this study was to develop tests and compile a norm instrument for junior category karate physical tests aged 16-17 years that can be used as a measuring tool to test the physical condition of karateka. Research and development (R&D) method. This research was conducted at a karate dojo under the guidance of the Indonesian Karate-Do Sports Federation (FORKI). Small-scale trial subjects included 55 respondents and a large trial group included 114 respondents. The karate trial subjects were 16-17 years old (junior) and determined the trial sample with purposive sampling technique. Data analysis techniques using correlation tests, validity tests and reliability tests. The results of this study showed two series of karate physical test instruments for junior karate athletes (aged 16-17 years) male and female consisting of; V Sit And Reach, Hexagonal Obstacle, Stork Standing balance, Throw Catch Ball tennis, Two Hands Medicine Ball Put, Standing Broad Jump, 2 Minute Sit Ups, Multistage Fitness Test. The validity of the eigenvalue of factor analysis > 1 and can be said to be valid. Reliability is done by re-testing or correlation between the same groups for two treatments. Based on the difference significance test, it shows that t-count = 3.617, df = 59 and P-Value = 0.01 <0.05, which means there is a significant difference in the pre-test and post-test results. Based on this information, it can be said that the physical test instrument model developed is effective, so it can be said that the test used is reliable. In conclusion, 8 items of karate physical test instruments have been produced for junior kata karate category athletes, the preparation of karate physical test norms for junior kata category athletes, and 8 items of physical test instruments have been produced that are effectively used to improve the achievements of junior male and female karate athletes. It is recommended that research be carried out on a larger scope of subjects and a wider research location, so that this measuring instrument product is more tested for feasibility.
Keywords: Test Instruments, Condition Physique, Karate juniors, Category Kata

Resumen. Una buena condición física es muy importante para la rama de artes marciales del karate, especialmente en la categoría de kata. Donde la condición física es el principal factor de apoyo para que la habilidad de kihon, kumite y kata karateka pueda desarrollarse adecuadamente. Por lo tanto, es necesario desarrollar una prueba de condición física de karate válida y fiable y un instrumento de medición para la categoría de kata para que pueda ser utilizado en el desarrollo del karate. El propósito de este estudio fue desarrollar pruebas y compilar un instrumento normativo para las pruebas físicas de kárate de categoría junior de 16-17 años que pueda utilizarse como herramienta de medición para comprobar la condición física de los karatecas. Método de investigación y desarrollo (I+D). Esta investigación se llevó a cabo en un dojo de kárate bajo la dirección de la Federación Deportiva Indonesia de Karate-Do (FORKI). Los sujetos de prueba a pequeña escala incluían a 55 encuestados y un grupo de prueba grande incluía a 114 encuestados. Los sujetos del ensayo de kárate tenían entre 16 y 17 años (junior) y determinaron la muestra del ensayo con la técnica de muestreo intencional. Técnicas de análisis de datos mediante pruebas de correlación, pruebas de validez y pruebas de fiabilidad. Los resultados de este estudio mostraron dos series de instrumentos de pruebas físicas de kárate para atletas de kárate júnior (de 16-17 años) de ambos sexos, consistentes en: sentarse y estirarse en V, obstáculo hexagonal, equilibrio de pie de cigüeña, lanzamiento de pelota de tenis, lanzamiento de balón medicinal a dos manos, salto de longitud de pie, sentadillas en 2 minutos y prueba de aptitud física en varias etapas. La validez del valor propio del análisis factorial > 1 y puede decirse que es válido. La fiabilidad se obtiene mediante la repetición de la prueba o la correlación entre los mismos grupos para dos tratamientos. Sobre la base de la prueba de significación de diferencia, muestra que t-cuenta = 3,617, df = 59 y P-Valor = 0,01 <0,05, lo que significa que hay una diferencia significativa en el pre-test y post-test resultados. Con base en esta información, se puede decir que el modelo de instrumento de prueba física desarrollado es eficaz, por lo que se puede decir que la prueba utilizada es confiable. En conclusión, se han elaborado 8 ítems de instrumentos de pruebas físicas de karate para atletas de la categoría kata junior, se han elaborado normas de pruebas físicas de karate para atletas de la categoría kata junior y se han elaborado 8 ítems de instrumentos de pruebas físicas que se utilizan eficazmente para mejorar los logros de los atletas de karate junior masculinos y femeninos. Se recomienda que la investigación se lleve a cabo con un mayor número de sujetos y en un lugar de investigación más amplio, de modo que se compruebe más la viabilidad de este producto de instrumentos de medición.
Palabras clave: Prueba de Instrumentos, Condición Física, Karate juniors, Categoría Kata

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Introduction

Karate is a martial art that not only teaches fighting techniques, but also emphasizes the physical, mental, and spiritual development of its practitioners (Purba et al., 2024). In the kata category, karateka are required to perform a series of movements that demonstrate technical ability, strength, speed, and accuracy. According to Gauchard

et al., (2018) it is said that the basic characteristics of kata movements relevant to dachi (moves) are steady, must master all karate techniques (kihon) and be able to perform them as perfectly as possible. Kata movements must be real in the sense that they are fighting and show concentration, energy, and the potential impact of the techniques performed. Kata must be able to show strength, power, and speed well as well as flexibility, rhythm, and balance (Penov et al., 2020).

Junior karateka are at a dynamic phase of physical development, where growth and adaptation to physical training can have a significant impact on their abilities (Purba et al., 2024). In addition, karate athletes use almost all muscles during training and matches (Kutseryb et al., 2017), but the competitions (kumite and kata) differ significantly in terms of style and muscle usage. In improving sports performance, excellent physical condition is one of the aspects that is needed (Hardinata et al., 2023; Supriatna et al., 2023; Suryadi et al., 2023). To support this process, a physical test instrument is needed that suits the needs and physical characteristics of junior karateka. The right physical test can help coaches evaluate strength, endurance, agility, and balance, which are important components in the kata category.

However, specific physical test instruments for junior karateka, especially in the kata category, are still limited. The development of physical tests for junior karate athletes is the focus of research because there is a wide achievement gap between superior athletes and athletes below them so that development at that age receives more attention (Setiadi et al., 2018). Based on a needs analysis conducted on thirty-one karate coaches in Central Deli Regency, all coaches stated that they did not have literature on test instruments and measurement of the physical condition abilities of kata category karateka, so it is very necessary to develop. Several studies also mention that physical condition is very important to know (Fotynyuk, 2017; Jufrianis et al., 2021). Most existing physical tests are more general and do not fully reflect the specific needs of karateka in kata training and competition. Therefore, this study aims to develop a physical test instrument that focuses on the specific needs of junior karateka in the kata category.

This instrument is expected to be used by karate coaches and teachers as an effective evaluation tool to measure the physical development of junior karateka. Given that the performance factors of the kata category are known, there is valid and reliable evidence in the scientific literature (Augustovicova et al., 2020), it is necessary to develop a test and measurement instrument. With this instrument, coaches can provide a more targeted training program and according to the physical condition of each karateka, so as to improve their performance in the kata category. This study assesses not only strength and endurance but also other important physical components in kata, such as flexibility, balance, and coordination. This comprehensive approach provides a more complete understanding of the athletes' physical condition.

Additionally, this study focused on junior karateka, a group that is rarely prioritized in the development of physical test instruments. Empirical validation within this demographic offers specific data that is important for creating more effective training programs for young athletes. Understanding physical condition standards and the correct sequence of physical tests for karate athletes is expected to facilitate significant physical progress prior to competition, leading to optimal results, especially in the kata category. This highlights the importance and necessity of this research.

Materials and Methods

Study participants

The subjects in this research were karate athletes who were active in dojos or karate colleges in Deli Serdang Regency. The sampling technique in this research used purposive sampling (purposeful sampling). Small trial samples for men were 35 and women 20 and large scale trials for men were 75 and women were 42. The feasibility assessment was obtained from four experts, namely: (1) Sports test and measurement expert by Dr. Mesnan, M.Kes, (2) The expert of the internationally certified physical trainer is Dr. Nimrot Manalu, M.Kes, (3) Expert from Karate Coach in the Kata Category is Siti Asmah Tanjung, S.Pd and (4) Expert from Karate Referee in the Kata Category is Novri Gentawan, S.Kom.

Study organization

Research and development procedures have stages that must be followed before producing a product. According to Borg and Gall (Sugiyono, 2017). The first objective is referred to as the validation function while the second objective is referred to as the effectiveness test. By dividing the development steps into 10 steps, namely: 1) research and data collection, 2) planning, 3) development, 4) initial field trials, 5) revision of trial results, 6) second field trials, 7) field test product refinement, 8) field implementation test, 9) final product refinement, 10) dissemination and implementation. Results can be seen in figure 1.

The research and development procedure has stages, as follows:

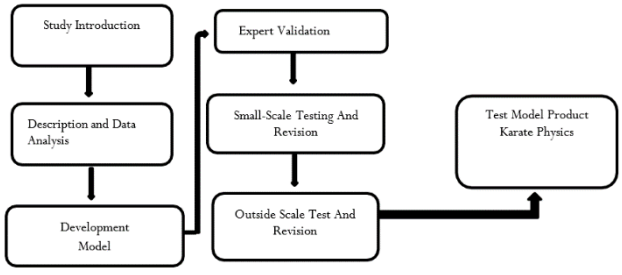

Figure 1. Step Study And Development Test Physique Karate

Considerations in selecting a physical test instrument

for junior karateka in the kata category include several important aspects that must be considered in order for the test to be effective, valid, and relevant. Tests designed to directly affect performance in kata, such as flexibility, balance, core strength, coordination, and aerobic endurance. Consideration should be given to including tests that measure the ability to perform specific movements that occur frequently in kata, such as stances, kicks, punches, and transitions between movements.By considering these factors, the physical tests developed will be more effective in measuring physical abilities relevant to the kata category, assist coaches in designing better training programmes, and improve the overall performance of junior athletes.

If the performance factors across all karate categories are the same, the differences in tests for junior, U21, and senior participants primarily revolve around intensity, complexity, and performance expectations based on the age and developmental stage of the athlete. The initial product series of karate physical tests, including tests; 1) V Sit And Reach Test, 2) Hexagonal Obstacle, 3) Crane Standing Balance Test, 4) Tennis Ball Throw, 5) Two-Handed Medicine Ball Jump, 6) Standing Broad Jump, 7) Sit-Up, 8) Multistage Fitness Test. Considerations When selecting these physical tests to assess the physical condition of karate athletes, several important criteria are considered to ensure that the tests comprehensively evaluate the required physical attributes. Results can be seen in table 1.

Table 1.
Junior Karate Kata Physical Test Grid Instrument

Sub Variable	Indicator	Instrument Test
Flexibility	Ability do room motionWhich as widely as possible in joints.	V Sit and Reach Test
Agility	Ability to change direction And position body with fast without lost balance	Hexagonal Obstacle
Balance	A person's abilities are deep maintain attitude body without lost balance	Stork Standing BalanceTest
Coordination	ability athlete to string a number of motion become One motionWhich intact and harmonious	Throw Catch BallTennis
Muscle PowerArm	Ability usestrength maximum Which deployed in time Whichin short	Two Hands Medicine BallPut
Power Limbs	Ability usestrength maximum Which deployed in time Whichin short	Standing Broad Jump Vertical Jump
Power Stand MuscleStomach	The ability of a muscle group tocarry out continuous contractions continuously when holding a load in period certain time.	Sit-Ups (2 minutes)
Power stand cardiorespiratory	Ability do activitywith range time Which long, amount repetitions Which Lots without feel fatigue	Multistage Fitness Test

Statistical Analysis

Data reliability testing was carried out using test-retest analysis techniques, split-half tests, one-way analysis of variance (intra-class correlation). To test statistical products in test development with validity tests, test reliability tests and normality tests, the validity of these tests is expert judgment and the value calculations use SPSS 25.

The preparation of the norm score for each karateka kata physical condition test item is by changing the raw score or rough number into a standard score with a scale of 5, namely A (very good), B (good), C (fair), D (medium) and E (very less). The preparation of norms with a scale of 5 is as follows:

Table 2.
Formula Categorization Classification Norm

Formula	Category	Mark
>Mean+(1.5 StDev)	A (Good Very)	5
Mean +(0.5 StDev) up to Mean +(1.5 5 StDev)	B (Good)	4
Mean -(0.5 StDev) up to Mean +(0.5 5StDev)	C (Fair)	3
Mean -(1.5 StDev) up to Mean -(0.5 5 StDev)	D (Not enough)	2
< Mean -(1.5 StDev)	E (Very Not enough)	1

Source: (Saputro & Siswantoyo, 2018)

Results

There are three indicators that make up expert assessments of instruments developed by researchers, namely suitability, convenience and eligibility of the instrument. The suitability indicator consists of ten questions, convenience consists of nine questions and suitability consists of eight questions so there are twenty-seven questions to assess the physical condition test instrument for junior karate in the kata category. Explained as follows:

Suitability

The results of the expert assessment on suitability indicators for the physical condition test instrument for junior karate in the kata category from validator I gave an appropriate assessment of 90%, from validator II it was 98%, from validator III it was 94% and from validator IV it was 94%. 96%. Overall, the validator provided a product suitability assessment of 94.5%. The results of the validator assessment can be seen in Figure 2.

The results of the expert assessment on the convenience indicators of the physical condition test instrument for junior karate in the kata category from validator I gave an appropriate assessment of 95.56%, from validator II it was 100%, from validator III it was 95.56% and from validator IV amounted to 97.78%. Overall, the validator provided a product suitability assessment of 97.22%. %. The results of the validator assessment can be seen in Figure 3.

The results of the expert assessment on the instrument suitability indicators (eligibility) for the physical condition test instrument for junior karate in the kata category from

validator I gave an appropriate assessment of 85%, from validator II it was 97.5%, from III is 95% and validator IV is 95%. Overall, the validator provided a product suitability assessment of 93.13%.

The results of the validator assessment can be seen in Figure 4.

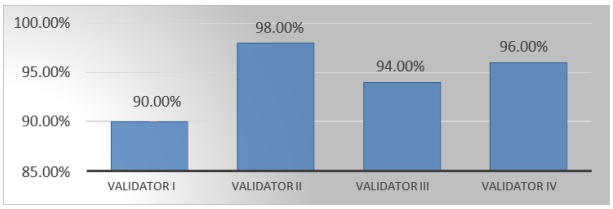

Figure 2. Validator Assessment Results on Suitability Indicators for the Instruments Developed

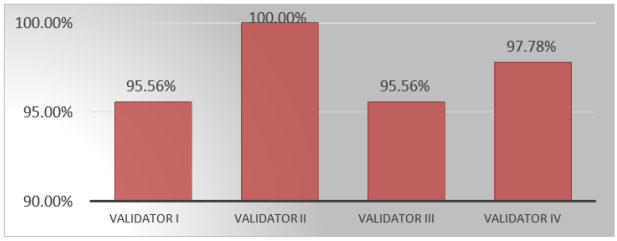

Figure 3. Validator Assessment Results on Convenience Indicators for the Instruments Developed

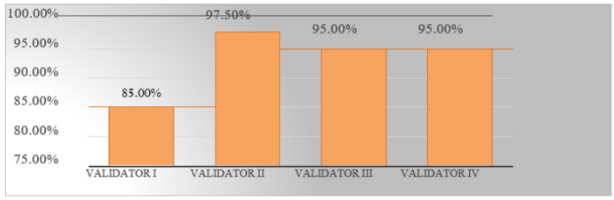

Figure 4. Validator Assessment Results on Instrument Eligibility Indicators for the Instruments Developed

Results of small-scale and large-scale empirical validity calculations

Table 3.
Results Test Calculation Statistics To 8 Item Test Son

Y		Y	Flexibility	Agility	Balance Left	Coordination	Power Arm	Power Limbs	Power Stand Muscle	Power Stand
Y	Pearson Correlation	1	,727 **	,706 **	,703 **	,836 **	,838 **	,773 **	,722 **	,808 **
	Sig. (2-tailed)		,000	,000	,000	,000	,000	,000	,000	,000
	N	75	75	75	75	75	75	75	75	75
V Sit AndReach	Pearson Correlation	,727 **	1	,390 **	,369 **	,534 **	,602 **	,527 **	$1,509 **	,568 **
	Sig. (2-tailed)	,000		,001	,001	,000	,000	,000	,000	,000
	N	75	75	75	75	75	75	75	75	75
HexagonalObstacle	Pearson Correlation	,706 **	,390 **	1	,373 **	,487 **	,543 **	$1,499 **	,485 **	,536 **
	Sig. (2-tailed)	,000	,001		,001	,000	,000	,000	,000	,000
	N	75	75	75	75	75	75	75	75	75
Stork Standing Balance	Pearson Correlation	,703 **	,369 **	,373 **	1	,612 **	,531 **	,497 **	,448 **	,576 **
	Sig. (2-tailed)	,000	,001	,001		,000	,000	,000	,000	,000
	N	75	75	75	75	75	75	75	75	75
Throw Catch the BallTennis	Pearson Correlation	,836 **	,534 **	,487 **	,612 **	1	,711 **	,672 **	,528 **	,654 **
	Sig. (2-tailed)	,000	,000	,000	,000		,000	,000	,000	,000
	N	75	75	75	75	75	75	75	75	75
Two Hands Medicine BallPut	Pearson Correlation	,838 **	,602 **	,543 **	,531 **	,711 **	1	,623 **	,528 **	,580 **
	Sig. (2-tailed)	,000	,000	,000	,000	,000		,000	,000	,000
	N	75	75	75	75	75	75	75	75	75
Standing Broad Jump	Pearson Correlation	,773 **	,527 **	$1,499 **	,497 **	,672 **	,623 **	1	,466 **	,467 **
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000		,000	,000
	N	75	75	75	75	75	75	75	75	75
Sit Up 2 Minute	Pearson Correlation	,722 **	$1,509 **	,485 **	,448 **	,528 **	,528 **	,466 **	1	,601 **
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	,000		,000
	N	75	75	75	75	75	75	75	75	75
MultistageFitness	Pearson Correlation	,808 **	,568 **	,536 **	,576 **	,654 **	,580 **	,467 **	,601 **	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	,000	,000	
	N	75	75	75	75	75	75	75	75	75

Based on the statistical test results, the correlation coefficient of each component of the physical test instrument for junior karate athletes in the men's kumite category against the criteria is very significant, p-value ≤ 0.05. Clearer results can be seen in table 3.

Table 4.
Results Test Calculation Statistics To 8 Item Test Daughter

Y		Y	V Sit And Reach	Hexagonal Obstacle	Stork StandingBalance	Throw Catch the Ball Tennis	Two Hands Medicine BallPut	tanding Jump	Sit Up 2Minute	Multistage Fitness
Y	Pearson Correlation	1	,754 **	$1,799 **	,850 **	,729 **	,797 **	,729 **	,756 **	,872 **
	Sig. (2-tailed)		,000	,000	,000	,000	,000	,000	,000	,000

	N	42	42	42	42	42	42	42	42	42
V Sit AndReach	Pearson Correlation	,754 **	1	,579 **	,570 **	,542 **	,429 **	,451 **	,522 **	,661 **
	Sig. (2-tailed)	,000		,000	,000	,000	,005	,003	,000	,000
	N	42	42	42	42	42	42	42	42	42
HexagonalObstacle	Pearson Correlation	$1,799 **	,579 **	1	,784 **	,505 **	,583 **	,449 **	,537 **	,573 **
	Sig. (2-tailed)	,000	,000		,000	,001	,000	,003	,000	,000
	N	42	42	42	42	42	42	42	42	42
Stork Standing Balance	Pearson Correlation	,850 **	,570 **	,784 **	1	,505 **	,684 **	,567 **	,512 **	,676 **
	Sig. (2-tailed)	,000	,000	,000		,001	,000	,000	,001	,000
	N	42	42	42	42	42	42	42	42	42
Throw Catch the BallTennis	Pearson Correlation	,729 **	,542 **	,505 **	,505 **	1	,703 **	,439 **	,442 **	,607 **
	Sig. (2-tailed)	,000	,000	,001	,001		,000	,004	,003	,000
	N	42	42	42	42	42	42	42	42	42
Two Hands Medicine Ball Put	Pearson Correlation	,797 **	,429 **	,583 **	,684 **	,703 **	1	$1,595 **	,521 **	,571 **
	Sig. (2-tailed)	,000	,005	,000	,000	,000		,000	,000	,000
	N	42	42	42	42	42	42	42	42	42
Standing Broad Jump	Pearson Correlation	,729 **	,451 **	,449 **	,567 **	,439 **	$1,595 **	1	,583 **	,665 **
	Sig. (2-tailed)	,000	,003	,003	,000	,004	,000		,000	,000
	N	42	42	42	42	42	42	42	42	42
Sit Up 2Minute	Pearson Correlation	,756 **	,522 **	,537 **	,512 **	,442 **	,521 **	,583 **	1	,694 **
	Sig. (2-tailed)	,000	,000	,000	,001	,003	,000	,000		,000
	N	42	42	42	42	42	42	42	42	42
MultistageFitness	Pearson Correlation	,872 **	,661 **	,573 **	,676 **	,607 **	,571 **	,665 **	,694 **	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	,000	,000	
	N	42	42	42	42	42	42	42	42	42

Based on the statistical test results, the correlation coefficient of each component of the physical test instrument for junior karate athletes in the men's kumite category against the criteria is very significant, p-value ≤ 0.05. Clearer results can be seen in table 4.

Mark

The following is the score calculation table, after the eight physical test items have been carried out in a battery test or should not be intermittent, then each item's score category will be calculated by adding up the five test results. T1+T2+T3+T4+T5 +T6+T7+T8 = Result.

Table 5.
Male category values

Mark	V Sit And Reach	Agility Hexagonal/ Obstacle (Seconds)	Balance Stork Standing Balance Test	Coordination/ Throw and Catch a Tennis Ball	Arm Power/ Two Hands Medicine Ball Put (Cm)	Limb Power/ Standing Broad Jump (Meters)	Abdominal Endurance/ Sit Ups 2 Minutes	Cardio Respiratory Endurance/ Multistage Fitness Test
1	<3	< 13.44	< 20.48	<4	< 243	< 1.75	< 26	<32.4
2	4 - 5	13.45 - 14.66	20.49 - 41.94	5 – 8	244 – 286	1.76 - 2.10	27 – 35	32.5 - 35.5
3	6 - 7	14.67 - 15.87	41.95 - 63.41	9 – 12	287 – 329	2.11 - 2.45	36 – 44	35.6 - 38.7
4	8 - 10	15.88 - 17.09	63.42 - 84.87	13 – 16	330 – 371	2.46 - 2.80	45 – 52	38.8 - 41.8
5	>11	>18.09	>85.87	>17	>372	> 2.81	> 53	> 42.8

Table 6.
Female category values

Mark	V Sit And Reach	Agility Hexagonal/ Obstacle (Seconds)	Balance Stork Standing Balance Test	Coordination/ Throw and Catch a Tennis Ball	Arm Power/ Two Hands Medicine Ball Put (Cm)	Limb Power/ Standing Broad Jump (Meters)	Abdominal Endurance/ Sit Ups 2 Minutes	Cardio Respiratory Endurance/ Multistage Fitness Test
1	< 3	< 15.66	< 0	<1	<196	< 1.32	<25	< 30.70
2	4 – 7	15.67 - 16.99	0.01 - 25.52	2 - 7	197 – 250	1.33 - 1.67	26 - 31	30.71 - 33.96
3	8 – 12	17.00 - 18.33	25.53- 52.20	8 - 13	251 – 303	1.68 - 2.02	32 - 36	33.97 - 37.22
4	13 – 17	18.34 - 19.66	52.21 -78.87	14 - 19	304 – 357	2.03 - 2.36	37 - 42	37.23 - 40.48
5	>18	>20.66	>78.88	>20	>358	>3.36	>43	>41.48

Norm

The following is the calculation of norms after calculating the total scores obtained by participants and classifying test ability levels physique karate junior category say aged 16-17 years.

Table 7.
Norms of physical karate junior category son

Numbers	Physical fitness	Classification
1	X 16	E (Very Not enough)
2	16 < X 24	D (Not enough)
3	24 < X 29	C (Fair)
4	29 < X 34	B (Good)
5	34 <	A (Good Very)

Based on the test norms that have been developed, athletes carry out physical tests karate junior category male and gets a total score of less than 16, then he is declared to have Very Poor physical ability (E), the athlete gets a total score of more than 16 to 24, is declared to have Poor physical ability (D), the athlete gets a total score of more than 24 up to 29 are declared to have less than moderate physical ability (C). athletes getting a total score of more than 29 to 34 are considered to have good fitness (B), and athletes getting a total score of more than 34 are considered to have Very Good fitness (A). Results can be seen in table 7.

Table 8.
Norms of physical karate junior category daughter.

Numbers	Physical fitness	Classification
1	X 13	E (Very Not enough)
2	13 < X 17	D (Not enough)
3	17 < X 24	C (Fair)
4	24 < X 27	B (Good)
5	27 <	A (Good Very)

Based on the test norms that have been developed, athletes carry out physical tests karate junior category female and gets a total score of less than equal to 13, then she is declared to have Very Poor physical ability (E), the athlete gets a total score of more than 13 to 17, is declared to have Poor physical ability (D), the athlete gets a total score of more than 17 up to 24 are declared to have less than moderate physical ability (C). athletes getting a total score of more than 24 to 27 are considered to have good fitness (B), and athletes getting a total score of more than 27 are considered to have Very Good fitness (A). Results can be seen in table 8.

Discussion

The purpose of this research is to develop tests and compile a normative instrument for junior karate physical tests aged 16-17 years that can be used as a measuring tool to test the physical condition of karateka. The results of the expert review and focus group discussion (FGD) resulted in several important points: 1) the usefulness and benefits of the test, 2) the ease of test implementation, 3) the economic value of the test, 4) the validated test instrument, and 5) the product in the form of a karate physical test instrument model and its guidebook. The results also showed the existence of eight karate physical test models suitable for male and female junior athletes in the kata category, namely V Sit and Reach, Hexagonal Obstacle, Stork Standing Balance, Tennis Ball Throw, Two Hands Medicine Ball Put, Standing Broad Jump, Sit Up 2 Minutes, and Multistage Fitness Test. Previous research on karate athletes, especially the kumite sparring category in the age range of 14-17 years, developed the reaction time test by Androi, the Hexagone Obstacle Test, Obstacle Jumping, Fast Attack to measure and improve physical abilities (Setiadi et al., 2018).

Physical condition is an absolute requirement for achieving sporting achievements, because every athlete must have an excellent physique to be able to excel. The elements of physical condition required in each sport are different, therefore an athlete's physical condition needs to be improved through training carried out systematically, steadily and continuously (Hadi & Yudhistira, 2023). Physical conditions generally consist of cardiorespiratory endurance, muscle strength, endurance, flexibility, and body composition which are important parts of physical growth (Zhu et al., 2017). Physical condition in the sport of karate is a condition where Karate athletes have excellent and good physical condition and are ready to face competing opponents (Hadi & Yudhistira, 2023). Physical factors in each category in Karate have several different needs. Physical conditions are a unit that cannot be separated from each other (Hardinata et al., 2023), but in practice there are several dominant physical conditions that have a greater contribution and influence on a particular sport.

Several studies prove that physical activity has a positive impact on physical fitness (Pahkala et al., 2013; Suryadi, 2022; Suryadi et al., 2021), health (Moreno-Quispe et al., 2021), physical fitness (Dede Pebriandi Sihotang & Novita, 2021), children's knee structure (Antony et al., 2016), adiposity, bone health, psychological health, and cardiorespiratory fitness. (Loprinzi et al., 2012), improve children's vascular hemodynamics (Köchli et al., 2021), reduce body fat levels (Dias et al., 2018; Magalhães et al., 2019; Ortega et al., 2013; Türk et al., 2017), prevention of overweight (Obert et al., 2017; Wewege et al., 2017), obesity (Afrasyabi et al., 2019; De Lorenzo et al., 2018; Musálek et al., 2021; Soh et al., 2020), type 2 diabetes mellitus (Rush & Simmons, 2014), muscle endurance (Alficandra et al., 2019), and the possibility of increasing sports participation in high school (Battista et al., 2021).

This was further confirmed by Helmi Chaabe'ne, et al. (2012) that in kata competitions at national and international levels, karateka assessments are based on technique, rhythm, power, movement variations and also kime which is the most important assessment in the execution of kata. The tests developed may be more relevant for kata categories and not fully applicable to kumite categories or other karate disciplines. This limits the generalizability of the study results to the entire karate community. In addition, the environmental conditions under which the test was conducted (e.g., training venue, weather, athlete's physical condition) may affect the test results. This variability may lead to inconsistencies in test results that may not reflect the true physical abilities of the athletes. Limitations in access to standardized and uniform test equipment at all research sites may affect the validity and reliability of the tests developed. Variations in equipment quality can lead to differences in test results.

Conclusion

Based on the research steps that have been carried out, the data collected, and the analysis carried out, it can be concluded that there are eight physical test models suitable for junior male and female karateka in the kata category, namely: (V Sit and Reach, Hexagonal Obstacle, Stork Standing Balance, Tennis Ball Throw, Two Hands Medicine Ball Put, Standing Broad Jump, 2 Minute Sit Ups, and Multistage Fitness Test). This physical condition test model is effectively used for junior karateka in the kata category. This effectiveness can be seen from the difference between the pretest score before treatment and the posttest after treatment, where the posttest mean score is higher than the pretest mean score. Overall, the results of this research and development concluded that there are two sets of physical tests for junior karateka in the kata category that are valid, with each having a category norm. Therefore, the results of

this battery of physical tests have important implications for the selection and development of karate performance systems. These efforts will be more efficient if carried out with a scientific approach, one of which is through the use of physical tests and measurements in the selection of junior male and female karateka in the kata category, because statistically it has a better impact than without using tests or only based on observation.

This research has produced eight valid and reliable physical test models for the kata category in junior karateka, which provide standardized evaluation tools for coaches and athletes. With specific and measurable test instruments, coaches can design more effective training programs that focus on relevant physical aspects, thereby improving the overall quality of training. This study focused on physical aspects, so to improve the selection of prospective karate athletes, it is recommended that further research be conducted on psychological, technical, and tactical aspects.

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Conflict of internet

All authors declare there is no conflict of interest

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