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Research of Reliability and Informativeness of Indicators of Muscular Fitness of Karate Boys Aged 8 Years

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Abstract

The aim of the research is to develop a program for testing the strength fitness of boys aged 8 years at the level of orange belt (10, 9 kyu) with the use of informative tests that are available for application in conditions of general education school.

Materials and methods. The study involved 20 boys aged 8 years. Informed consent for children's participation in the experiment was obtained from their parents. The following research methods were applied to solve the set tasks: analysis of scientific and methodical literature, pedagogical testing of strength abilities, and methods of mathematical statistics for processing research results.

Results. The analysis of correlation dependence between test tasks that characterize the display of different types of force generally shows a large and numerous interrelation of the average and high level of significance between all tests ($\rho xy = 0.508 - 0.879$ at $p<0.05$; $p<0.01$. Processing of retest data showed the stability of the battery of tests and sufficient retest reliability for most test scores (rtt ranged from 0.818 to 0.984, $p<0.001$).

Conclusions. The selected battery of tests is accessible, informative, and reliable. It will allow us to solve the following pedagogical tasks more effectively: to control the efficiency and effectiveness of physical training as an element of the pedagogical process of formation of motor skills and development of physical qualities, to maintain and strengthen health, to maintain a productive level of general working capacity, and to increase body resistance to action of unfavorable factors of the present.

Keywords: kyokushinkai karate, strength abilities, reliability of tests, informativeness of tests, boys.

Introduction

Muscle strength is one of the main components of physical training in martial arts. Well-developed upper and lower limb muscle strength is the key to effectively performing high physical and technical-tactical requirements in Kyokushinkai karate (Marchenko & Satdyiev, 2021; Hontarenko, Marchenko & Korol, 2022). It can also have a preventive effect on athletes involved in combat sports to prevent injuries (Pocecco, Ruedl, Stankovic et al., 2013; Follmer, Dellagrana, de Lima et al., 2017; Lystad, Augustovičova, Harris et al., 2020).

Marchenko & Handymov (2021), Kim, Won, & Shin (2021), and Hontarenko, Marchenko, & Korol (2022) note that regular strength training can contribute to an increase in physical activity, improve physical fitness and individual health only when it is part of a general physical education or sports program

Marchenko & Satdyiev (2021), Marchenko & Handymov (2021), for the development of strength in 10-year-old boys and girls engaged in Kyokushinkai karate, proposed the use of special outdoor games and game exercises as an effective means in the educational and training process for the complex improvement of strength abilities. According to Ropret & Jevtić (2019), Perreault & Gonzalez (2021), and Siswantoyo, Sudarko, Arga et al. (2023), the concept of martial arts training programs for children should be conducted in a playful way, cause pleasant sensations, and avoid specialization stages. Ropret & Jevtić (2019), Styriak, Billman, & Augustovicova (2020), and Ce & Ag (2023) believe that training children at the professional level negatively affects their growth, physical, and mental development, and increases the risk of injury.

In martial arts, achieving this goal is closely related to understanding the system of planning and management of the sports and training process (Chernozub, Danylchenko, Imas et al., 2019; Marchenko, Khudolii, Ivashchenko et al., 2023). In martial arts, coaches need to pay special attention to the components of profiling (conducting a fight with different dosages of contact, formal complexes with or without weapons, solo compositions to music) and testing individual progress in a particular type of martial arts.

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Evaluation of training effects at certain stages requires regular observation and coaching control, which are important in the process of training a young athlete. With the help of test results, physical education teachers and coaches have the opportunity to adjust training and competitive loads, which will allow them to correctly direct the training process (Pochettia, Ponczosznika, Filártigaa et al., 2018; He, Pan, & Du, 2019; Marchenko & Verdysh, 2021).

There is a need for comprehensive control of special strength indicators of schoolchildren's engaged in karate. Checking a complex of tests for informativeness and reliability will allow us to obtain the information necessary for a more exact assessment of the state of children's power fitness.

The aim of the research is to develop a program for testing the strength fitness of 8-year-old boys at the level of orange belt (10, 9 kyu) with the use of informative tests that are available for application in the conditions of general education schools.

Materials and methods

Participants in the study

The study involved 20 boys aged 8 years. The children and their parents were informed about the features of the study and agreed to participate in the experiment.

Design of the research

The following research methods were applied to solve the set tasks: analysis of scientific and methodical literature, pedagogical testing of power abilities, and methods of mathematical statistics for processing research results.

The procedure for testing strength abilities

The level of power fitness was determined using a battery of simple tests that do not require complicated additional equipment and are widely used in physical training. The selected tests cover all the main muscle groups, correspond to the purpose and tasks of the research. At the beginning of the experiment, the pupils were familiarized with the tests and the testing procedure. Health risk screening was conducted. Informed consent was obtained from the parents. Protocol forms were prepared, which included basic information about strength training. An appropriate warm-up was developed. When planning the study of strength training, parameters such as age, gender were taken into account, and testing conditions were created in accordance with the methodology. Standard EUROFIT protocols were used (Eurofit, 1993; Sergienko, 2010; Đurić S, Sember V, Starc G, Sorić M, Kovač M, Jurak, 2021).

Testing was conducted during a week during classes in the Kyokushinkai Karate Section. Children were given one to three attempts to complete the tests. The best result was taken for analysis.

Control exercises were conducted in the school gym. Before the examination, a set of exercises (10-15 min) was performed, which included running, jumping, general developmental exercises, and outdoor games. It was aimed at preparing children for the test tasks.

To check the selected set of tests for reliability and informativeness, a month later, a retest procedure was conducted under the same conditions (Hopkins, 2002; Anastasi & Urbina, 2007; Sergienko, 2010).

The complex chosen for experimental observations included the following tests:

Test 1 – push-ups;
Test 2 – hanging push-ups;
Test 3 – bent arm hang;
Test 4 – standing long jump;
Test 5 – sit-ups in 30s from the supine position;
Test 6 – handgrips of the right hand;
Test 7 – handgrips of the left hand;
Test 8 – throwing a stuffed ball (1 kg) from behind the head with both hands from a sitting position;
Test 9 – vertical jump.

Statistical analysis

IBM SPSS STATISTICS 26 was used in the study. The following parameters were calculated: arithmetic mean (X), standard squared deviation characterizing the variability of the mean (σ), standard error of the mean (m), median (Md), mode (Mo), skewness (AS), standard deviation of skewness, kurtosis (Ek), standard error of kurtosis, minimum, maximum. The hypothesis of normality of the data distribution was determined using the Kolmogorov-Smirnov (Dn) and the Shapiro-Wilk (W) tests.

We analyzed the correlation between test tasks that characterize the manifestation of the different types of strength using Spearman's rank correlation coefficient ρ. To determine the reliability of the test results, we calculated the reliability coefficient (rn) for correlating the paired samples.

Results

The results presented in Table 1 demonstrate the average level of the strength fitness of boys aged 8 years. The obtained values of the test results were compared with the norms of physical fitness assessment of primary school pupils of Ukraine (Sergienko, 2010) and certification norms in Kyokushinkai karate for fulfillment of qualification requirements of orange belt levels 10 and 9 kyu (Goncharenko, 2007; Goncharenko, 2021). According to the majority of the obtained values, children have high, above average, and average levels of development of strength abilities. In this sample, there were no indicators below the average.

Boys aged 8 years engaged in Kyokushinkai karate showed high results in dynamic strength and strength endurance. This may be due to the fact that the training program in Kyokushinkai karate at the orange belt level (10th and 9th kyu) involves active physical training with an emphasis on the development of trunk and upper limb muscle strength. Active strength gains in boys of this age may also be associated with age-related changes and occur to some extent independently of physical activity. At the same time, in the test aimed at detecting the strength of the abdominal muscles, the children showed an average result that corresponds to a good grade. It was found that the strength of the muscles of the lower extremities in boys is somewhat less developed. Tests in jumping exercises were performed using a satisfactory grade. In connection with the discrepancy of work of the lower and upper parts of

Table 1. Results of the calculation of descriptive statistics

Statistics		Push-ups, times	Hanging push-ups, times	Bent arm hang, s	Standing long jump, cm	Sit-ups in 30s from the supine position, times	Handgrips of the right hand, kg	Handgrips of the left hand, kg	Throwing a stuffed ball (1 kg) from behind the head with both hands from a sitting position, cm	Vertical jump, cm
N	Validated	20	20	20	20	20	20	20	20	20
	Skipped	0	0	0	0	0	0	0	0	0
Mean		22.5	2.95	14.495	129.5	14.45	11.8	11.2	302.8	25.7
Standard error of the mean		1.004	0.266	1.27	2.28	0.515	0.421	0.451	10.19	0.657
Median		21.5	3.0	14.3	132.5	14.0	12.0	12.0	317.5	26.0
Mode		18a	2	12.40a	134	13	12	13	322	25a
Standard deviation		4.49	1.191	5.674	10.195	2.305	1.881	2.016	45.603	2.94
Skewness		0.936	0.105	-0.387	-0.933	0.472	-0.154	-0.689	-0.271	-0.183
Standard deviation of skewness		0.512	0.512	0.512	0.512	0.512	0.512	0.512	0.512	0.512
Kurtosis		0.550	-0.839	-0.254	0.679	0.503	-10.17	-0.579	-10.243	-0.458
Standard error of the kurtosis		0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992	0.992
Minimum		17	1	2.5	105	10	9	7	229	20
Maximum		34	5	23.60	145	20	15	14	365	31

a. There are several modal values. The lowest value is shown

a body, it is desirable to include more exercises for muscles of the legs, as in karate they play an important role in training and performance of a kicking technique of the legs and different types of movements of karate athlete on the tatami.

The hypothesis of normality of the data distribution was determined using the Kolmogorov-Smirnov test. In almost all tests, the hypothesis of normality of data distribution is accepted. Due to the fact that the hypothesis of normality of distribution was not confirmed in the test "Handgrips of the left hand" ($p < 0.05$), we used the nonparametric Shapiro-Wilk test (Table 2). The value obtained from the Shapiro-Wilk test ($p > 0.05$) allows us to continue further calculations.

According to Hopkins (2002), the value of the correlation coefficient was considered trivial ($r < 0.1$), small ($0.1 \le r < 0.3$), moderate ($0.3 \le r < 0.5$), large ($0.5) \le r < 0.7$), numerous ($0.7 \le r < 0.9$), almost perfect ($r \ge 0.9$), and perfect ($r = 1$). The significance level was set at $p < 0.05$ (Table 3).

Table 2. Normality of data distribution according to the Kolmogorov-Smirnov and the Shapiro-Wilk tests (N=20)

Indicators under study	the Shapiro-Wilk test			
	Statistics	p	Statistics	p
Push-ups, times	0.161	0.184	0.914	0.075
Hanging push-ups, times	0.187	0.064	0.923	0.112
Bent arm hang, s	0.106	0.200*	0.968	0.716
Standing long jump, cm	0.147	0.200*	0.936	0.202
Sit-ups in 30s from the supine position, times	0.177	0.099	0.953	0.412
Handgrips of the right hand, kg	0.192	0.051	0.915	0.081
Handgrips of the left hand, kg	0.204	0.028	0.905	0.051
Throwing a stuffed ball (1 kg) from behind the head with both hands from a sitting position, cm	0.172	0.122	0.928	0.141
Vertical jump, cm	0.106	0.200*	0.982	0.959

Table 3. Interpretation of the closeness of the correlation coefficient (according to Hopkins, 2002)

Correlation coefficient	Characterization of the closeness of the correlation
0.0-0.1	very small, insignificant, practically zero
0.1-0.3	small, low, and insignificant
0.3-0.5	moderate, medium
0.5-0.7	large, high, main
0.7-0.9	very large, very high, huge
0.9-1	near, practically or almost: perfect, infinite

Since the sample size was n<30 and the variables in Handgrips of the left hand,test were not normally distributed (the Kolmogorov-Smirnov test), we decided to choose Spearman's rank correlation coefficient ρ to calculate the correlation between the test tasks.

The analysis of correlation dependence between test tasks (Table 4), characterizing the manifestation of different types of force, generally shows a large and numerous interrelation of medium and high level of significance almost between all tests (ρxy = 0,508 - 0,879 at p<0,05; p<0,01).

The results of the test "Sit-ups in 30s", which characterizes the manifestation of dynamic strength, do not show a huge correlation with all selected tests.

Statistically significant direct correlations were observed. All identified correlations had significant closeness according to Hopkins scale (2002).

The results of the test "Push-ups" have a very high correlation of high statistical significance with the tests "Hanging push-ups", ρxy = 0.795 at p<0.001, "Bent arm hang",

Table 4. Correlation dependence between the test tasks

		Correlationsb								
		Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**	**Test 6**	**Test 7**	**Test 8**	**Test 9**
Test 1	Correlation coefficient	1								
	Signif. (two-sided)									
Test 2	Correlation coefficient	0.795**	1							
	Signif. (two-sided)	0.000								
Test 3	Correlation coefficient	0.795**	0.692**	1						
	Signif. (two-sided)	0.000	0.001							
Test 4	Correlation coefficient	0.715**	0.676**	0.524*	1					
	Signif. (two-sided)	0.000	0.001	0.018						
Test 5	Correlation coefficient	0.525*	0.531*	0.605**	0.376	1				
	Signif. (two-sided)	0.017	0.016	0.005	0.103					
Test 6	Correlation coefficient	0.840**	0.656**	0.710**	0.651**	0.508*	1			
	Signif. (two-sided)	0.000	0.002	0.000	0.002	0.022				
Test 7	Correlation coefficient	0.652**	0.572**	0.633**	0.460*	0.630**	0.746**	1		
	Signif. (two-sided)	0.002	0.008	0.003	0.041	0.003	0.000			
Test 8	Correlation coefficient	0.833**	0.773**	0.592**	0.746**	0.528*	0.842**	0.675**	1	
	Signif. (two-sided)	0.000	0.000	0.006	0.000	0.017	0.000	0.001		
Test 9	Correlation coefficient	0.754**	0.879**	0.649**	0.712**	0.442	0.715**	0.657**	0.798**	1
	Signif. (two-sided)	0.000	0.000	0.002	0.000	0.051	0.000	0.002	0.000	

**. The correlation is significant at 0.01 level (two-sided).

*. The correlation is significant at 0.05 level (two-sided).

b. Reference value N=20

ρxy = 0.795 at p<0.001, "Standing long jump", ρxy = 0.715 at p<0.001, "Handgrips of the right hand", ρxy = 0.840 at p<0.001, "Throwing a stuffed ball", ρxy = 0.833 at p<0.001 and "Vertical jump", ρxy = 0.754 at p<0.001.

The test "Hanging push-ups" demonstrates a reliable very high degree of correlation of high degree of significance with the results of tests "Throwing a stuffed ball", ρxy = 0,773 at p<0,001 and "Vertical jump", ρxy = 0,879 at p<0,001.

The mathematical processing of the data also revealed a very high correlation at a high level of significance of p<0.001 between the results of the two tests: "Bent arm hang" and "Handgrips of the right hand", ρxy = 0.710.

In addition, a very large correlation of high degree of significance was observed between indicators of the test "Standing long jump" with tests "Throwing of a stuffed ball", ρxy = 0,746 at p<0,001 and "Vertical jump", ρxy = 0,712 at p<0,001.

The results of correlation analysis demonstrate a very large positive interrelation of high degree of significance between indicators of the test "Handgrips of the right hand" with indicators of tests "Handgrips of the left hand", ρxy = 0,746 at p<0,001, "Throwing of a stuffed ball", ρxy = 0,842 at p<0,001, "Vertical jump", ρxy = 0,715 at p<0,001.

A very large positive correlation between indicators of the test "Throwing a stuffed ball" with "Vertical jump" with a value ρxy = 0,798 at p<0,001 was revealed.

As a result of correlation analysis peculiarities of interrelation between indicators of the test "Push-ups" with results of tests: "Sit-ups in 30s from the supine position" and "Handgrips of the left hand". There is a large positive correlation between them. In "Sit-ups in 30s from the supine position" ρxy = 0,525 at a low degree of significance p<0,017 and in "Handgrips of the left hand" ρxy = 0,652 at an average force of statistical significance p<0,002.

A large positive correlation with varying degrees of significance was also observed in the tests presented below. Thus, the test "Hanging push-ups" correlates with a high degree of significance p<0.001 with the tests "Bent arm hang", ρxy = 0.692 and "Standing long jump", ρxy = 0.676. At the level of average significance p<0.01, the results of this test correlate with the indicators of the tests "Handgrips of the right hand", ρxy = 0.656 and "Handgrips of the left hand", ρxy = 0.572. At a low statistical significance level of p<0.05, a correlation was observed with the results of the test "Sit-ups in 30s", ρxy = 0.531.

In the test "Bent arm hang" indicators have a big positive correlation with "Standing long jump", ρxy = 0,524, "Sit-ups in 30s", ρxy = 0, 605, "Handgrips of the left hand", ρxy = 0.633, "Throwing a stuffed ball", ρxy = 0.592 and "Vertical jump", ρxy = 0.649 at the level of average degree of significance (p<0.01).

The results of the test "Standing long jump" show a high correlation with the data obtained in the test "Handgrips of the right hand", ρxy = 0,651 at the average level of significance (p<0,002).

The correlation coefficients between test tasks "Sit-ups in 30s" and "Handgrips of the right hand", "Handgrips of the left hand", "Throwing of a stuffed ball" are in the range from 0,508 to 0.630, which characterizes a rather high level of correlation dependence at the average level of significance (p<0,05).

A high correlation dependence was obtained in comparison of the test "Handgrips of the left hand" with the test "Throwing of a stuffed ball", ρxy = 0,675 at a high level of significance (p<0,001) and at an average level of significance with the test "Vertical jump" ρxy = 0,657 (p<0,002).

There was a level of correlation of average strength between a test "Standing long jump" with "Sit-ups in 30s", ρxy = 0,376 and "Handgrips of the left hand", ρxy = 0,460; a test "Sit-ups in 30s" with "Vertical jump", ρxy = 0,442. The

connection between variables is statistically insignificant (>0.05) at detection of a correlation of "Standing long jump" with "Sit-ups in 30s", and "Sit-ups in 30s" with "Vertical jump". In this case, the correlation is recognized as statistically unreliable and not subject to meaningful interpretation.

A low degree of significance (p<0.041) was found between "Standing long jump" with "Handgrips of the left hand".

The data of correlation analysis give the possibility to carry out more perfect control over a condition of power fitness of boys aged 8 years engaged in Kyokushinkai karate.

To determine the level of reliability of the selected tests, we conducted additional testing within a month. In our opinion, this is a sufficient period for primary school children. The data processing showed the stability of the test battery and sufficient retest reliability for most test indicators (rtt ranges from 0.818 to 0.984). According to the reliability scale (Sergienko, 2010), poor reliability was found in the test "Sit-ups in 30s" (rtt = 0.761). However, from a practical point of view, there is evidence that values around 0.7 are considered good (Table 5).

Table 5. Correlations between paired samples

	Content	N	Reliability coefficient r_{tt}
Pair 1	Test 1 & retest 1	20	0.984
Pair 2	Test 2 & retest 2	20	0.818
Pair 3	Test 3 & retest 3	20	0.967
Pair 4	Test 4 & retest 4	20	0.919
Pair 5	Test 5 & retest 5	20	0.761
Pair 6	Test 6 & retest 6	20	0.931
Pair 7	Test 7 & retest 7	20	0.936
Pair 8	Test 8 & retest 8	20	0.995
Pair 9	Test 9 & retest 9	20	0.877

N = 20, p < 0,001

The analysis of the obtained correlations of paired samples indicates excellent reliability of "Push-ups" (rtt = 0.984), "Bent arm hang" (rtt = 0.967), "Throwing a stuffed ball" (rtt = 0.995).

During the repeated testing procedure, good reliability was obtained in the tests "Standing long jump" (rtt = 0.919), "Handgrips of the right hand" (rtt = 0.931), "Handgrips of the left hand" (rtt = 0.936).

The tests "Vertical jump" and "Hanging push-ups" showed acceptable reliability over time with rtt = 0.877 and rtt = 0.818, respectively.

Discussion

In the research, it was assumed that the offered complex of tests comprehensively characterizes the level of development of force in boys aged 8 years who train in a sports section of Kyokushinkai karate. The results of the correlation analysis between test tasks demonstrate their high reliability.

The obtained correlation coefficients between the results of two measurements (test-retest) indicate high reliability and stability of the test results. In the selected contingent of schoolchildren, there were parallel changes in different manifestations of power abilities.

The analysis of scientific papers has revealed that muscle strength is one of the main components of physical training for the successful fulfillment of high physical, technical, and tactical requirements in martial arts. Scientists have reported the emergence of "physical activity deficiency syndrome" with the negative consequences for the health of children and adolescents in many countries.

Experts note the need to revise the criteria for assessing motor abilities and make adjustments in accordance with current conditions (coronavirus, war in Ukraine, distance learning, migration). They point to the lack of monitoring studies and systematic approaches to assess the physical fitness of schoolchildren involved in sports clubs. This hinders the development of updated assessment criteria that would contribute to the individualization of the educational process.

The need to develop strength in martial arts students has been confirmed (Ma & Qu, 2017; Marchenko & Satdyiev, 2021; Hontarenko, Marchenko & Korol, 2022). Sufficient development of different muscle groups contributes to the successful performance of technical actions in Kyokushinkai karate (Hontarenko, Marchenko & Korol, 2022; Marchenko, Ivashchenko, Jagiello et al., 2022; Marchenko, Khudolii, Ivashchenko et al., 2023). The authors include preparatory exercises for the development of strength abilities in their training programs (Marchenko & Taranenko, 2020; Litvin & Marchenko, 2021; Marchenko, Khudolii, Ivashchenko et al. 2023, etc.).

Our results agree with Radenković & Stanković (2012), Liqin Yin, Changfa Tang & Xia Tao (2018), and Shaw, Schwartzel, Millard et al. (2020), who found that the correlation coefficients between the long jump and other upper limb strength tests were low. However, the long jump was also challenged by Radenković & Stanković (2012), Liqin Yin, Changfa Tang, & Xia Tao (2018), as the test results were sensitive to factors such as skill training.

Knowledge about the importance of control at the initial stage of schoolchildren's sports training and the consideration of such important characteristics as reliability and informativeness has been expanded (Liqin Yin, Changfa Tang & Xia Tao, 2018; Pochettia, Ponczosznika, Filártigaa, et al., 2018; Marchenko & Verdysh, 2021). The results obtained in this way will further contribute to the effective selection and use of various tests, the development of effective control programs, and the consideration of its results in the further planning of sports activities (Chernozub, Danylchenko, Imas et al., 2019; Kim, Won & Shin, 2021; Marchenko, Khudolii, Ivashchenko et al., 2023). The study also contributes timely detection of shortcomings during training at different stages of sports improvement.

Conclusions

The average indicators obtained after the first test correspond to the norms of development of children's strength abilities in this age category as defined by scientists in scientific literature. Children have high, above average, and average levels of development of power abilities. In the given sample, there were no indicators that had a level below an average.

Statistically significant direct correlations were observed. All the revealed connections had a noticeable closeness. The

data of correlation analysis allow to perform more perfect control over a condition of power fitness, covering control of different muscle groups in Kyokushinkai karate, promote the improvement of a training process and increase quality of planning of means of development of different types of force.

The informativeness of all chosen tests indicates the high efficiency of the use of this technique for the measurement of both general and special strength fitness of karate boys aged 8 years.

According to the results of the retest, there is a high reliability of the offered chosen test battery for checking the power possibilities of boys. Tests characterize different sides of the manifestation of power abilities and are directed on an estimation of the muscular force of the whole body.

The chosen battery of tests will allow us to solve the following pedagogical tasks more effectively: to control the efficiency and effectiveness of physical training as a pedagogical process of formation of motor skills and development of physical qualities, to maintain and strengthen health, to maintain a productive level of general working capacity, and to increase body resistance to the action of unfavorable factors of the present.

The next research area could be the development of norms of strength fitness for primary school pupils attending the sports section of Kyokushinkai karate for health improvement.

Conflict of interest

The authors declare no conflict of interest.

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Дослідження надійності та інформативності показників м'язової підготовленості хлопців каратистів 8 років

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 5 табл., 31 джерело.

Мета дослідження – розробити програму тестування силової підготовленості хлопців 8 років на рівні помаранчевого поясу (10, 9 кю) з використанням інформативних тестів, які доступні для застосування в умовах загальноосвітньої школи.

Матеріали і методи. У дослідженні взяли участь 20 хлопців 8 років. Від батьків було отримано поінформовану згоду на участь дітей в експерименті. Для вирішення поставлених завдань були застосовані такі методи дослідження: аналіз науково-методичної літератури, педагогічне тестування силових здібностей та методи математичної статистики обробки результатів дослідження.

Результати. Аналіз кореляційної залежності між тестовими завданнями, які характеризують прояв різних видів сили, в цілому показує великий та дуже великий взаємозв'язок середнього та високого рівня значимості між усіма тестами (ρxy = 0,508 – 0,879 при p<0,05; p<0,01. Обробка даних повторного тестування показала стабільність батареї тестів і достатню ретестову надійність за більшістю показників тестів (rtt знаходиться в межах від 0,818 до 0,984, p<0,001).

Висновки. Обрана батарея тестів є доступною, інформативною та надійною. Яка дозволить більш ефективно вирішувати наступні педагогічні задачі: контролювати ефективність та результативність фізичної підготовки, як елементу педагогічного процесу формування рухових навичок та розвитку фізичних якостей, підтримувати та зміцнювати здоров'я, зберігати продуктивний рівень загальної працездатності, підвищувати стійкість організму до дії несприятливих факторів сьогодення.

Ключові слова: кіокушинкай карате, силові здібності, надійність тестів, інформативність тестів, хлопці

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