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ORIGINAL SCIENTIFIC ARTICLE

EFFECTIVENESS OF USING ACTIVE GAMES FOR STRENGTH DEVELOPMENT IN 10-YEAR-OLD BOYS AT THE INITIAL TRAINING STAGE IN KYOKUSHIN KARATE

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Abstract

The objective of the study was to examine the level of strength fitness indicators of 10-year-old boys who do Kyokushin Karate, and experimentally test the effectiveness of the impact of play techniques on the dynamics of strength development.

Materials and methods. The study involved 40 10-year-old boys. The children and their parents were informed about all the features of the study and gave their consent to participate in the experiment. To achieve the objective set, the following research methods were used: analysis of scientific and methodological literature, pedagogical testing, and methods of mathematical statistics for processing research results.

Results. There were the biggest changes in the results of the tests "Standing long jump" by 15.9% ($p < 0.001$), "Sit-ups in 30 s" by 16.0% ($p < 0.001$), "Pull-ups" by 18.3% ($p < 0.001$), and "Bent arm hang" by 15.6% ($p < 0.001$). The experimental group boys' result of the "Standing long jump" changed from low to above average. The lowest increase in results was observed in the "Right hand grip test" by 7.2% ($p < 0.001$), "Left hand grip test" by 6.9% ($p < 0.001$), and "Push-ups" by 11.8% ($p < 0.001$).

Conclusions. The initial level of the boys' strength fitness is sufficient and conforms to age norms. Most of them had an average – 30.36%, an above average – 19.64%, and a high – 23.21% level of strength abilities development. The data obtained give reason to recommend that teachers and coaches use active games aimed at developing strength. As a result of using play load (5 games, 3 repetitions with rest intervals of 40 s), there was a statistically significant increase in strength indicators ($p < 0.001$).

Keywords: boys, strength abilities, active games, play load, Kyokushin Karate.

Introduction

Martial arts have a special educational potential in developing positive models of behavior and moral values that can help reduce aggression in society (Augustovicova, Argajova, Rupcik, & Thomson, 2020; Cynarski, 2019; Cynarski & Niewczas, 2019). Kotarska, Nowak, Szark-Eckardt and Nowak (2019), Greco, Fischetti, Cataldi, and Latino (2019) found a positive correlation between martial arts, especially if they are practiced at a competition level, and healthy behaviors and a higher level of quality of life self-assessment.

Researchers have long proven the great potential of using a play-based approach in physical education (Khudolii & Marchenko, 2007; Marchenko, 2008, 2010; Nikitenkova & Marchenko 2017) and sport training (Korotkov, 1971; Alabin, Strashinskiy, Solovtsov, & Gavrilov, 1992; Slastina, Kravchuk, & Bybel, 2019). Active games and play-based exercises are increasingly used as some of the effective tools in the training process for comprehensive improvement of motor abilities in various sports.

Since active games are a mixed (cyclic and acyclic) activity, it is mainly dynamic, speed and strength in nature. Such actions as moving on the tatami, performing various kicks, defensive actions against an opponent's attack require a significant development of such a physical quality as strength.

The content of practical material during training depends on the tasks to be solved. When the task is to develop strength, it is useful to include in classes additional and preliminary games associated with short-term speed and strength efforts and various forms of overcoming an opponent's muscular resistance in a direct combat. The main content components of such games include various kinds of pulling, pressing, holding, pushing, elements of wrestling, etc. Motor operations with weights appro-

priate for players, bending, squatting, arm bending and extending, rotating, turning, running, or jumping are very effective for solving this task (Meshcheryakov & Tashnichenko, 2010).

A sufficient level of strength fitness is the foundation for mastering a technique, and the means of its development occupy a central place in programs of teaching motor actions (Di Palma & Cusano, 2020; Marchenko & Kovalenko, 2020). Strength training is also seen as a basis for developing other motor abilities (Khudolii, Ivashchenko, Iermakov, Veremeenko, & Lopatiev, 2020; Khudolii, Kapkan, Harkusha, Marchenko, & Veremeenko, 2020; Khudolii, Ivashchenko, Iermakov, Nosko & Marchenko, 2019). Strength abilities development is most effective with an overall development of all muscle groups, so games should be diverse (Marchenko & Ishchenko, 2016; Nikitenkova & Marchenko, 2017; Do Kim & Pieter, 2020). According to Marchenko and Ishchenko (2016), significant increases in strength indicators of primary-school-age boys can be observed with a rational organization of strength training. Nikitenkova and Marchenko (2017) recommend the use of small weights and play-based exercises using one's body weight. Games should be performed at a fast and moderate pace. The number of games may vary from 4 to 8 depending on age, gender, level of physical development and physical fitness of pupils.

Unfortunately, today there is not enough literature to cover the issues described above regarding the use of active games and play-based exercises at the initial training stage in Kyokushin Karate. Most studies address issues related to high performance sport. Therefore, the issue of search and effective use of play techniques for strength development in 10-year-old boys who do Kyokushin Karate is relevant.

The objective of the study was to examine the level of strength fitness indicators of 10-year-old boys who do Kyokushin Karate, and experimentally test the effectiveness of the impact of play techniques on the dynamics of strength development.

Materials and methods

Study participants

The study involved 40 10-year-old boys who do Kyokushin Karate. The boys were randomly divided into two groups, an experimental group (n = 20) and a control group (n = 20). The children and their parents were informed about all the features of the study and gave their consent to participate in the experiment.

Study organization

To achieve the objective set, the following research methods were used: analysis of scientific and methodological literature, pedagogical testing, and methods of mathematical statistics for processing research results.

The testing program included well-known tests: Standing long jump, Right and left hand grip test, Push-ups, Sit-ups in 30 s, Pull-ups, Bent arm hang (Khudolii, 2019; Ivashchenko, 2020).

In the experimental group, during classes, the play material and loads proposed by Marchenko (2003, 2008) were used. Games for strength abilities development were conducted primarily at the beginning of the main part of the class. At the end of the main part, collective games with a predominant focus on developing strength endurance (Table 1) were used. Play load during the class included 5 games, number of repetitions – 3, rest intervals – 40 s.

Table 1. Organizational and methodological distribution of play means for strength abilities development in boys

No	Game	Participation in games		Predominant movements in the game				Physiological load					Place of the game during classes		
		Without division into teams	With division into teams	Running	Jumping	Throwing	Integrated actions	Low	Average	High	High	Maximal	Preparatory	Main	Closing
1	Carrying balls		+		+		+					+		+	
2	Move the bench		+				+				+			+	
3	Urgent cargo		+	+		+	+			+			+	+	
4	Who is stronger		+				+			+			+	+	
5	Wheelbarrow relay		+				+			+			+	+	
6	Relay with flags						+			+					
7	Wrestling in squares	+					+			+			+	+	
8	Forbidden circle	+					+			+			+	+	
9	Roll the ball		+				+			+			+	+	
10	Ball racing in rows	+			+		+			+			+	+	
11	Ball passing with feet	+		+			+			+			+	+	
12	Three's a crowd with resistance	+					+		+					+	+
13	Ball in the basket		+				+		+				+	+	
14	Flock of ducks	+					+		+				+	+	
15	Fight of roosters	+					+		+				+	+	
16	Break the circle	+					+		+				+	+	+

The subjects of the control group continued to attend traditional karate classes.

Statistical analysis

Data were collected and organized with EXCEL. Statistical analysis was performed using the IBM SPSS Statistics 26 statistical software package. The following parameters were calculated: arithmetic mean, standard deviation, arithmetic means were compared using the Student's t-test for dependent samples, Student's t-test for independent samples. The hypothesis about the normality of data distribution was determined using the Kolmogorov-Smirnov test.

Results

The ascertaining stage of the study (Table 2) revealed no statistically significant difference in any of the studied indicators of strength development between the experimental and control groups ($p > 0.05$). This meets the experiment requirements and indicates that the selected study sample fully meets the requirements of representativeness. It reproduces the characteristics of the general population and ensures the objectivity of conclusions of the performed pedagogical experiment.

The analysis of the obtained results at the beginning of the pedagogical experiment showed that the 10-year-old boys' strength abilities were sufficiently developed. Most of them had an average – 30.36%, an above average – 19.64%, and a high – 23.21% level of strength abilities development. 11.43% of the boys performed the set of tests at a low level, 15.36% – at a below average level. The best results were observed in the tests "Push-ups" (60%), "Pull-ups" (50%), and "Bent arm hang" (25%). The boys showed average and above average results in the tests "Right hand grip test" (42.5%, 27.5%), "Left hand grip test" (47.5%, 20%), and "Sit-ups in 30 s" (60%, 35%). Most children performed the test "Standing long jump", which characterizes speed and strength abilities, at low and below average levels (37.5%, 30%).

Thus, in general, the level of the boys' strength fitness conforms to age norms, and a considerable lag was found only in speed and strength fitness indicators.

The Kolmogorov-Smirnov test determined that the measurements for all characteristics in all the tests were nor-

Table 2. Statistical description of strength fitness indicators of the groups at the beginning of the experiment

Indicators under study	EG (n = 20)			CG (n = 20)			p
	Mean	Standard deviation	Standard error of mean	Mean	Standard deviation	Standard error of mean	
Standing long jump, cm	141.4	14.36	3.21	141.7	13.88	3.1	.947
Right hand grip test, kg	17.45	1.98	.44	17.4	1.98	.44	.937
Left hand grip test, kg	16.05	2.52	.56	15.95	2.23	.50	.895
Push-ups, times	26.35	7.60	1.7	26.55	7.67	1.71	.934
Sit-ups in 30 s, times	16.85	4.19	.94	16.65	4.18	.93	.881
Pull-ups, times	6.3	2.75	.61	6.25	2.63	.59	.954
Bent arm hang, s	18.68	10.11	2.26	18.73	10.12	2.26	.988

Table 3. Description of the impact of active games on strength development in 10-year-old boys

Indicators under study	Groups	Paired differences					t	Value (two-sided)	%
		Mean	Standard deviation	Standard error of mean	95% confidence interval for difference				
					Lower	Upper			
Standing long jump, cm	EG	22.5	6.848	1.531	25.705	19.295	14.69	.000	15.9
	CG	13.4	3.455	.773	15.017	11.783	17.34	.000	9.5
Right hand grip test, kg	EG	1.25	1.02	.228	1.727	.773	5.48	.000	7.2
	CG	.45	.887	.198	.865	.035	2.27	.035	2.6
Left hand grip test, kg	EG	1.1	.912	.204	1.527	.673	5.39	.000	6.9
	CG	.5	.761	.170	.856	.144	2.94	.008	3.1
Push-ups, times	EG	3.1	1.971	.441	4.022	2.178	7.03	.000	11.8
	CG	2.3	1.559	.349	3.03	1.57	6.59	.000	8.7
Sit-ups in 30 s, times	EG	2.7	.923	.206	3.132	2.268	13.07	.000	16.0
	CG	1.7	.865	.193	2.105	1.295	8.79	.000	10.2
Pull-ups, times	EG	1.15	.813	.182	-1.53	-.77	6.33	.000	18.3
	CG	.90	.641	.143	-1.20	-.60	6.28	.000	14.4
Bent arm hang, s	EG	2.92	1.619	.362	-3.678	-2.16	8.06	.000	15.6
	CG	1.83	.945	.2113	-2.275	-1.39	8.67	.000	9.8

mally distributed. So in this case, the use of the Student's t-test to compare paired samples is correct.

The results of a formative experiment investigating the effectiveness of using active games for strength abilities development in 10-year-old boys who do Kyokushin Karate are shown in Table 3.

A comprehensive control of the 10-year-old boys' strength fitness revealed statistically significant changes in all indicators in both groups ($p < 0.05$). There is a tendency for greater improvement of the results towards the experimental group.

There were the biggest changes in the results of the tests "Standing long jump" by 15.9% ($p < 0.001$), "Sit-ups in 30 s" by 16.0% ($p < 0.001$), "Pull-ups" by 18.3% ($p<0.001$), and "Bent arm hang" by 15.6% ($p < 0.001$). The experimental group boys' result of the "Standing long jump" changed from low to above average. The lowest increase in results was observed in the "Right hand grip test" by 7.2% ($p < 0.001$), "Left hand grip test" by 6.9% ($p < 0.001$), and "Push-ups" by 11.8% ($p < 0.001$).

Discussion

The study assumed that the use of specially selected active games could facilitate strength abilities development in 10-year-old boys who do Kyokushin Karate at the initial training stage. In the experimental group, the comparison of indicators showed a greater relative increase in all indicators than in the control group. The dynamics of results in all the exercises was statistically significant ($p < 0.001$).

The results obtained expand and supplement the data of Khudolii (2009), Ivashchenko and Yermakova (2015), Marchenko and Kovalenko (2020), Marchenko and Taranenko (2020) on the need for a sufficient level of children's strength fitness to improve the learning process and its importance for developing other motor abilities (Khudolii & Ivashchenko, 2014; Ivashchenko & Cieślicka, 2017; Khudolii, Ivashchenko, Iermakov, Nosko & Marchenko, 2019).

The study confirmed and verified the information on the effectiveness of using the load proposed by Marchenko (2008, 2010), Ivashchenko, Cieślicka, Khudolii and Iermakov (2014), Khudolii, Ivashchenko, Iermakov, Nosko and Marchenko (2019). It was found that for strength abilities development in 10-year-old boys it is optimal to perform 5 games, from 1 to 3 repetitions with rest intervals of 40 s.

Conclusions

Thus, active games are an important part of the training process in Kyokushin Karate. They contribute to an effective overall development of various muscle groups. The competitive nature of the game encourages all its participants to a greater manifestation of their abilities.

The initial level of the boys' strength fitness is sufficient and conforms to age norms. Most of them had an average – 30.36%, an above average – 19.64%, and a high – 23.21% level of strength abilities development.

The data obtained give reason to recommend that teachers and coaches use active games aimed at developing strength. As a result of using play load (5 games, 3 repetitions with rest intervals of 40 s), there was a statistically significant increase in strength indicators ($p < 0.001$).

Conflict of interest

The authors declare no conflict of interest.

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ЕФЕКТИВНІСТЬ ВИКОРИСТАННЯ РУХЛИВИХ ІГОР ДЛЯ РОЗВИТКУ СИЛИ У ХЛОПЦІВ 10 РОКІВ НА ЕТАПІ ПОЧАТКОВОЇ ПІДГОТОВКИ В КІОКУШИНКАЙ КАРАТЕ

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

Реферат. Стаття: 6 с., 3 табл., 28 джерела.

Мета дослідження – вивчити рівень показників силової підготовленості хлопців 10 років, які займаються кіокушинкай карате, та експериментально перевірити ефективність впливу ігрових засобів на динаміку розвитку сили.

Матеріали і методи. У дослідженні взяли участь 40 хлопців 10 років. Діти та їхні батьки були інформовані про всі особливості дослідження і дали згоду на участь в експерименті. Для вирішення поставлених завдань були

застосовані такі методи дослідження: аналіз науково-методичної літератури, педагогічне тестування та методи математичної статистики обробки результатів дослідження.

Результати. Найбільші зміни відбулися за показниками тестів «Стрибок у довжину з місця» на 15,9% ($p < 0,001$), «З положення лежачи на спині піднімання в сід за 30 с» на 16,0% ($p < 0,001$), «Згинання і розгинання рук у висі» на 18,3% ($p < 0,001$) та «Вис на зігнутих руках» на 15,6% ($p < 0,001$). У хлопців експериментальної групи результат «Стрибка у довжину з місця» змінився з низького рівня до вище середнього. Найнижчий приріст результатів спостерігався у тестах «Кистьова динамометрія правої руки» на 7,2% ($p < 0,001$), «Кистьова динамометрія лівої руки» на 6,9% ($p < 0,001$) та «Згинання і розгинання рук в упорі лежачи» на 11,8% ($p < 0,001$).

Висновки. Початковий рівень силової підготовленості хлопців достатній та відповідає віковим нормам. Більшість із них мали середній – 30,36%, вище середнього – 19,64% та високий – 23,21% рівні розвитку силових здібностей. Отримані дані дають підставу рекомендувати вчителям і тренерам використовувати рухливі ігри спрямовані на розвиток сили. У результаті застосування ігрового навантаження (5 ігор, 3 повторення з інтервалами відпочинку 40 с) відбулося статистично достовірне зростання силових показників ($p < 0,001$).

Ключові слова: хлопці, силові здібності, рухливі ігри, ігрове навантаження, кіокушинкай карате.

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