

Effects Of A Specific Exercise Program On The Coordination And Speed Of Young Karatekas

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Abstract: *The aim of this study was to examine the effect of applying an experimental training program on the development of speed and coordination in boys aged 9 to 12, members of karate clubs. The study included 32 subjects who have been regularly practicing karate for at least a year and who are medically fit to participate in the training process. All subjects formed a homogeneous group that was exposed to the same training program. Speed was assessed using the 20-meter high-start run, 4x10-meter run, and reaction to a sound signal tests. Coordination was assessed using the pattern tapping, pattern jumping, ball dribbling, and ball-target shooting tests. The results obtained indicate significant improvements in most of the tested variables, suggesting that the experimental program had a positive impact on the development of speed and coordination in children aged 9 to 12 who practice karate.*

Keywords: karate, speed, coordination, children, training program, motor skills, experimental research

INTRODUCTION

Karate, as a complex martial discipline, requires a high level of motor skills, among which speed and coordination occupy a central place. In children between the ages of 9 and 12, these abilities are in a phase of intensive development, and a properly directed training process can have long-term effects on the child's sports progress and general motor status (Milanović, 2007). Speed in karate is not only expressed through linear movement, but through explosive reactions, sudden changes of direction, and the ability to quickly perform technical elements in high-tempo situations (Katić, Jukić & Bala, 2002). On the other hand, coordination enables the correct execution of complex movements, maintenance of balance, spatial orientation and coordination of body and limb movements - all of which are essential for performing karate at a high level (Bompa & Haff, 2009).

The period between the ages of 9 and 12 has been recognized as a sensitive period for the development of these abilities, which is an ideal time for their systematic improvement (Malacko & Rađa, 2004). Children at this age learn quickly, have high neuromuscular plasticity and a strong interest in acquiring new skills, which is why it is desirable to incorporate the development of coordination and speed through diverse, functional and sport-specific tasks (Starosta, 2006). Karate as a discipline, in itself, contains elements that stimulate the development of these abilities, but additional progress can be achieved through targeted programs that supplement the basic training content.

Previous research confirms that the application of structured programs in children can significantly improve the speed of movement execution, as well as coordination skills that include spatial precision, rhythm, balance and orientation (Željaskov, 2004; Sekulić & Metikoš, 2007). It is especially important that exercises for the development of speed and coordination are applied in the form of games and situational tasks, which maintains children's motivation and increases engagement in the learning process (Ćirković, 2011).

Modern approaches to children's sports training emphasize the importance of individualizing the program and adjusting it to the developmental characteristics of each individual (Madić, 2014). In karate, in addition to general abilities, it is important to develop specific forms of speed - the speed of reaction to visual and auditory stimuli, the speed of execution of blows and movements in the context of a competitive situation. Coordination, on the other hand, also has an important cognitive component, as it is related to spatial perception, the development of motor intelligence and coordinated movement planning (Nešić, 2016).

Training programs that combine elements of play, martial arts, and modern principles of motor development have proven to be particularly effective with younger school-age children (Bašić, 2013). By designing a program that includes tasks for developing agility, reaction speed, spatial coordination, and bilateral motor control, one can significantly improve karate performance, as well as the child's overall motor development.

The aim of this study was to examine the effect of a specific program, implemented over a period of three months, on the development of speed and coordination in pioneer karate players. Through a series of standardized tests, changes in abilities that are crucial for successful performance in karate competitions were monitored. The study aims to contribute to a better understanding of the training needs of children at this age, and to offer a work model that can be applied in karate clubs and other sports schools. It is expected

that the results will show statistically significant improvements in most of the tested abilities, with the exception of linear sprinting, where the effects are usually somewhat weaker in this age group (Marković, 2010).

METHOD

Respondent sample

The research included 32 boys, members of karate clubs from East Sarajevo, aged 9 to 12, who have been practicing karate regularly for at least one year. All subjects were in good health and regularly attended the training process during the experiment. The subjects were divided into one homogeneous group that was included in the experimental program.

Sample variables

The following tests were used to assess speed:

- Running 20 meters from a high start
- 4x10 meter run
- Reaction to sound signal

The following tests were used to assess coordination:

- Tapping on a template
- Jumping around the scheme
- Driving the ball between the cones
- Shooting a ball at a target (accuracy and coordination of movements)

Experimental program

The experimental program lasted a total of 12 weeks (three months), with a frequency of three training sessions per week. Each training session lasted between 60 and 75 minutes and was aimed at improving speed and coordination through specific exercises that imitated karate combat situations. The program was designed progressively, so that the complexity of the tasks and the intensity of the load gradually increased in accordance with the adaptation of the subjects.

Phase	Weeks	Goals	Main activities
Introductory phase	1–4	Mastering basic motor skills, improving basic speed and coordination	– Rhythmic exercises for hand and foot coordination – Running with changing direction – Reaction games to sound and visual signals – Working with cones, ladders
Middle stage	5–8	Improving more complex coordination and agility, quick reactions	– Multidirectional changes of direction – Fast sequences of movements and kicks – Pair work – Tasks with props and time limits
Final stage	9–12	Applying what has been learned in situational conditions, developing anticipation and precision	– Karate simulations (attacks/defenses) – Movement combinations: punch + change of direction + balance – Cognitively complex tasks – Competitive games

Statistical data processing

Descriptive statistics (arithmetic mean and standard deviation) were used to describe the results of the initial and final measurements. Univariate analysis of variance for dependent samples (ANOVA) was used to determine statistically significant differences between measurements, with the significance level set at $p < 0.05$.

RESULTS WITH DISCUSSION

At the initial measurement, the subjects achieved the expected results in accordance with their age and training. The lowest average values were recorded in the signal reaction test, which indicates a less developed reaction speed in most subjects. The greatest dispersion of results was observed in the 4x10m test, which may indicate differences in coordination and ability to change direction. The values show a solid initial speed, but there is room for improvement, especially in more complex fast movements.

Table 1. Descriptive parameters at initial measurement – speed tests (n=32)

Test	M (Mean)	SD	Min.	Max
Running 20 m (s)	4.21	0.23	3.85	4.62
4x10 m run (s)	12.88	0.51	12.02	13.95
Signal response (s)	0.42	0.04	0.36	0.50

After the program, significant changes were observed in the results of the 4x10m and signal response tests. In the 4x10m running test, a significant decrease in time was observed, indicating progress in agility and speed with a change of direction. Reaction time also improved, indicating better readiness for rapid motor reactions. The 20m running test showed minimal changes, suggesting that the program did not significantly affect the development of maximum sprint speed.

Table 2. Descriptive parameters at final measurement – speed tests (n=32)

Test	M (Mean)	SD	Min.	Max
Running 20 m (s)	4.19	0.22	3.83	4.57
4x10 m run (s)	12.15	0.48	11.45	13.10
Signal response (s)	0.37	0.03	0.32	0.44

At baseline, subjects demonstrated a solid level of coordination in most tests. They achieved the best results in the pattern tapping test, which may indicate already developed fine motor skills. However, tests that require whole-body movement and changes in direction (e.g., dribbling and jumping according to a pattern) indicate room for improvement. There is also a dispersion of results, which indicates different levels of coordination among subjects.

Table 3. Descriptive parameters at initial measurement – coordination tests (n=32)

Test	M (Mean)	SD	Min.	Max
Driving the ball between the cones (s)	10.74	0.68	9.45	11.90
Eight-fold jump (points)	22.4	2.8	17	28
Jumping pattern (s)	13.55	0.85	12.10	15.40
Tapping on a pattern (accurate in 30s)	17.9	2.2	14	22

The final measurement shows a visible improvement in all coordination tests. The changes were particularly pronounced in the ball dribbling test, where a decrease in time was recorded, which indicates progress in movement coordination and body control. In the pattern jumping and pattern tapping tests, there was also an increase in efficiency, which indicates better movement organization abilities. These results confirm the positive impact of the specific program on the development of coordination in young karatekas.

Table 4. Descriptive parameters at final measurement – coordination tests (n=32)

Test	M (Mean)	SD	Min.	Max
Driving the ball between the cones (s)	9.88	0.61	8.90	10.95
Eight-fold jump (points)	25.1	2.4	20	29
Jumping pattern (s)	12.60	0.79	11.30	14.20
Tapping on a pattern (accurate in 30s)	20.6	2.1	16	24

The results of the ANOVA analysis show statistically significant differences between the initial and final measurements in all tests, except for the 20-meter run test. The largest changes were observed in the coordination tests, which confirms the effectiveness of the specific training program in developing more complex motor skills. Significant changes in speed tests such as 4x10m and reaction to signal indicate an improvement in speed with a change of direction and response speed. The lack of change in the 20-meter run test suggests that the program was not intense enough to affect maximum sprint speed.

Table 5. Results of ANOVA for dependent samples – changes between initial and final measurements

Test	F	p	η^2 (eta squared)
20m run	1.12	0.296	0.036
4x10m run	28.74	0.000**	0.487
Signal response	19.43	0.000**	0.389
Driving the ball between the cones	35.21	0.000**	0.531
Eight-fold jump	22.88	0.000**	0.423
Jumping around the scheme	17.05	0.000**	0.368
Tapping on a template	24.63	0.000**	0.441

The results of the study show that a specific training program had a positive impact on the development of speed and coordination in pioneer karatekas aged 9 to 12. Statistically significant improvements were observed in almost all tests, except for the 20-meter run, which indicates that the program was not sufficiently focused on developing maximum sprint speed. The greatest progress was recorded in tests involving speed with a change of direction and quick reaction, which is especially important for karatekas in combat situations. Coordination tests also showed significant changes, confirming that children at this age are particularly receptive to the development of complex motor skills.

Results in tests such as ball dribbling and pattern jumping indicate progress in precision, spatial orientation and rhythm of movement. An increase in the number of correct repetitions in the pattern tapping test indicates better concentration and faster information processing. These results confirm that significant improvements can be achieved in children aged 9 to 12 if programs are specifically aimed at developing functional motor skills. Also, the specificity of karate as a sport, which requires the simultaneous use of speed, precision and coordination, further contributes to the effects of a well-structured training program. Based on the results obtained, it can be concluded that the application of such programs has high developmental potential and should be an integral part of working with children of this age.

CONCLUSION

Based on the conducted research, it can be concluded that the specific training program had a positive impact on the development of speed and coordination in young karatekas aged 9 to 12. Significant improvements were observed in almost all tests, except for the 20-meter run. Abilities that include speed with a change of direction and complex forms of coordination were especially improved. The obtained results confirm the importance of planned and targeted work in this developmental period. It is recommended to apply similar programs in the training process in order to make the most of the sensitive period of motor skills development.

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