Improving speed endurance of qualified karate athletes at the stage of athletic performance enhancement

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Abstract

Purpose: is to develop and experimentally validate the effectiveness of a methodology for improving speed endurance in qualified karate athletes.

Methods: To achieve the research objectives, the athletes were divided into two equal groups (experimental and control), each consisting of 15 karate practitioners. The control group continued training according to the traditional program, while the experimental group implemented a specially developed set of exercises aimed at improving speed qualities. The effectiveness of the proposed methodology was determined through serial testing and analysis of the dynamics of changes in key indicators of athletes' speed preparedness throughout the pedagogical experiment.

Results: At the final stage of the experiment, the average statistical indicators in the test "Stance changes with a strike (change → gyaku-tsuki) in 30 seconds" for karate athletes in the experimental group (EG) were 24.3±2.49 at $p<0.05$, which corresponds to an increase of 11.46% compared to the initial data. In the control group (CG), this result reached 23.9±2.72 at $p>0.05$, with an increase of 4.36%.

Conlcusion: The results of testing the proposed methodology confirmed its high effectiveness in developing speed endurance in karate athletes and showed a statistically significant advantage compared to the traditional training system used in the control group. The increase in indicators for athletes in the experimental group at the final stage of the experiment was: in the "Olympic jump for 30 seconds" test - 10.0%; in the "Push-ups in 30 seconds" test - 7.74%; in the "Stance switching with a strike (switch → gyaku-tsuki) in 30 seconds" test - 4.36%; in the "Ura mawashi geri kicks in 30 seconds" test - 13.24%.

Keywords: speed endurance, physical fitness, physical qualities, physical development, timing, kumite modeling.

Introduction

Modern sport is an integral part of world culture, serving as a universal tool for improving public health, unlocking personal potential, self-realization, and countering negative social phenomena. Its role in the system of global values has significantly increased, and the international sports movement, of which Uzbekistan's sport is a part, has become one of the largest and most influential social phenomena uniting millions of people worldwide.

In recent years, the Republic of Uzbekistan has been implementing targeted and systematic measures aimed at developing physical culture and mass sports, promoting a healthy lifestyle among the population, and enhancing the competitiveness of national athletes in the international arena. As part of state policy, modern sports complexes are being constructed, infrastructure is being improved, and support for young talents and sports reserves is being strengthened.

The achievements of leading Uzbek athletes, who have repeatedly demonstrated the high level of national sports at world championships, Olympic and Asian Games, inspire pride in their compatriots and deserve recognition from the global sports community. The regular victories of these athletes contribute to the country's international prestige and serve as a source of motivation for young people, encouraging them to actively engage in sports.

At the stage of sports improvement at ages 15-16, the development of speed endurance becomes particularly important, as this age period is optimal for building the body's resistance to multiple high-intensity speed actions. During this period, energy systems actively improve, the ability to maintain a high frequency of movements for extended periods increases, and recovery mechanisms after intense loads enhance. The combination of morphofunctional changes allows for the effective incorporation of special exercises into the training process, aimed at increasing fatigue resistance while maintaining high speed in executing technical actions. Developing speed endurance at this age creates a solid foundation for effective competitive performance and improves the stability of karate athletes' technical and tactical actions in combat conditions.

Speed endurance is a specific physical quality that manifests in an athlete's ability to maintain high-speed motor activity under conditions of fatigue. For karate athletes at the stage of sports mastery, it is a key component of competitive effectiveness, especially in ku-

mite, where the match requires a continuous sequence of rapid bursts, stops, attacks, and defenses. In this context, the athlete must demonstrate maximum technical precision with a high amplitude of physical exertion and recovery within a short period of time.

According to V.N. Platonov, speed endurance is formed based on the combination of speed-strength qualities and the body's functional stability, which is particularly important for martial arts. Yu.V. Verkhoshansky emphasized that this component of preparedness plays a crucial role in ensuring the stability of technical actions during fatigue. Research by foreign specialists (Newton, 2006; Cometti, 2001) also confirms the importance of incorporating plyometric and interval exercises to develop the ability to maintain high movement speed during repeated loads.

The complex of morphofunctional transformations occurring in athletes aged 15-16 creates favorable conditions for the use of special exercises aimed at developing fatigue resistance while maintaining high speed in performing offensive and defensive actions. The development of speed endurance during this period serves as a foundation for achieving high sports results and contributes to increasing the stability of karate athletes' technical and tactical arsenal in competitive activities.

In karate, specific endurance is expressed in the athlete's ability to: maintain a high frequency of striking actions throughout the entire round (2-3 minutes); quickly recover between series of attacks; effectively switch between "attack - defense" phases without decreasing the tempo; maintain accuracy, rhythm, and coordination when performing striking and defensive techniques under conditions of increasing fatigue.

The scientific novelty of the research lies in the effectiveness of our developed experimental methodology for improving the speed endurance of qualified karate athletes aged 15-16 years.

Scientific and practical significance. The research results contribute to deepening scientific understanding of the mechanisms and patterns of improving speed endurance in qualified karate athletes aged 15-16 years. The obtained data reveal the dynamics of changes in speed endurance indicators and the effectiveness of the proposed specialized training methodology. The practical significance lies in the possibility of applying this methodology in the training process to purposefully improve the speed endurance level of karate athletes at the stage of sports improvement.

A set of exercises based on the principle of specialized orientation of training effects was developed. Its key objective was the development of speed endurance, which in karate is defined as the athlete's ability to repeatedly perform technically accurate and high-speed actions under the time constraints of a match.

Unlike exercises primarily aimed at developing "pure" speed (reaction or starting speed), this complex mainly focused on the serial execution of striking combinations and match simulation (kumite), which ensured a direct connection with the requirements of competitive activity.

The developed program includes two main blocks.

Striking combinations (No. 1-4) represent a series of technical actions - hand and foot strikes in various combinations, performed for 30 seconds with a fixed number of repetitions (3). Gradual increase in complexity is achieved by changing stances and alternating strikes in different directions, which aligns with the principle of variability in training methods. Regulated rest intervals (30-60 seconds) allow for partial recovery while maintaining high training intensity.

Kumite modeling (No. 5-7) includes exercises that simulate competitive match conditions: performing the maximum number of attacks per round, working according to the "attack - counterattack" scheme, and interacting with a partner while limiting the technical arsenal. This implements the method of competitive exercises with an emphasis on functional modeling of combat situations.

The principles of load regulation include:

Time parameter - 30 seconds for performing strikes and 2 minutes for kumite tasks (corresponding to a competition round); rest intervals of 30-60 seconds, contributing to the development of fatigue resistance and the ability to repeatedly demonstrate high intensity; volume - 3 repetitions of each series, which corresponds to the principle of the repeated method with an emphasis on maximum execution speed.

Impact combinations contribute to developing the ability to repeatedly perform high-frequency movements while maintaining technical accuracy, while kumite modeling forms the athlete's comprehensive readiness, combining speed qualities, tactical thinking, and the

ability to act effectively under fatigue conditions.

Thus, the program ensures the targeted development of special speed endurance, which directly affects the success of competitive activity. Its implementation allows the karateka to perform serial striking actions under conditions of pronounced fatigue, builds resistance to competitive stress, and integrates technical, tactical, and physical training, which meets the modern requirements for training high-level athletes.

Results and discussion

To verify the effectiveness of the proposed methodology, a pedagogical experiment was conducted, and the reliability of the obtained data was ensured by applying mathematical statistics methods. The level of general and special physical preparedness of karate athletes was assessed using a set of tests reflecting various components of their physical condition and functional readiness. A comparative analysis of the indicators of the athletes in the control and experimental groups before and after the experiment is presented in Table 1.

Table Dynamics of changes in GPP and SPP indicators in CG and EG (n=30)

No	Studied indicators	Control group (n=15)							Experimental group (n=15)						
		At the beginning of the study		At the end of the study		t_{cr}	P	Increase (%)	At the beginning of the study		At the end of the study		t_{cr}	P	Increase (%)
		$\bar{x} \pm \sigma$	υ	$\bar{x} \pm \sigma$	υ				$\bar{x} \pm \sigma$	υ	$\bar{x} \pm \sigma$	υ			
1	"Olympic Jump" in 30 sec (count)	23.6±3.20	13.6	24.8±2.93	11.8	1.07	P > 0.05	5.1	22.9±2.42	10.6	25.2±2.34	9.3	2.69	P < 0.05	10.0
2	Push-ups in 30 sec (count)	15.5±2.45	15.7	16.7±2.44	14.6	1.27	P > 0.05	7.7	15.3±2.09	13.67	17.7±2.66	15.1	2.75	P < 0.05	15.7
3	Stance changes with strike (change → gyaku tsuki) in 30 sec (count)	22.9±2.29	10.04	23.9±2.72	11.4	1.09	P > 0.05	4.36	21.8±2.7	12.41	24.3±2.49	10.3	2.6	P < 0.05	11.5
4	"Ura mawashi geri" kicks in 30 sec (count)	21.9±2.36	10.8	22.9±2.77	12.1	1.06	P > 0.05	4.57	21.9±2.63	12	24.8±2.88	11.6	2.84	P < 0.01	13.2

The increase in karate athletes' preparedness indicators reached significant values by the end of the experiment. Thus, in the CG, the indicators of the "Olympic Jump in 30 sec" test were 24.8±2.93 at p>0.05, with an increase of 5.1%, while in the EG, the indicators were 25.2±2.34 at p<0.05, with an increase of 10.0%.

In the "Push-ups in 30 seconds" test, the indicators of the athletes in the experimental group (EG) at the final stage of the experiment were 17.7±2.66 at p<0.05, which corresponds to a 15.7% increase compared to the initial level. In the control group (CG), this result reached 16.7±2.44 at p>0.05, an increase of 7.7%.

A similar trend is observed in the average group results of the "Ura-mawashi-geri kicks for 30 seconds" test. In the control group (CG), the indicators were 22.9±2.77 at p>0.05, which corresponds to a 4.57% increase compared to the initial data. In the experimental group (EG), this result reached 24.8±2.88 kicks at p<0.05, reflecting a 13.24% increase.

Conclusion

At the initial stage of the pedagogical experiment, the control and experimental groups were characterized by statistically comparable initial results across all analyzed indicators. However, upon completion of the study, the high effectiveness of the developed methodology for improving speed endurance in qualified karate athletes aged 15-16 was recorded.

A comparative analysis of the dynamics of physical quality development showed an improvement in results for both groups; however, the increase was more pronounced in the athletes of the experimental group, which indicates a positive direction of changes and confirms the advantage of the experimental approach.

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