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METHODS OF DEVELOPING FOOTWORK SPEED IN YOUNG TAEKWONDO ATHLETES THROUGH SPECIAL EXERCISES

Vakhabov Asadbek Akramjon ugli
Student of Fergana State University,
Majoring in Sports Activities (Taekwondo)

Abstract

This article highlights the scientific and practical foundations of developing footwork speed in young taekwondo athletes (12-16 years old) through a system of special exercises. The author analyzes the importance of footwork in taekwondo, types of special exercises (plyometric, ladder drills, SAQ system) and their effectiveness. Based on the research results, the effect of an 8-week special exercise program on the speed of foot movements, agility and reaction speed of young taekwondo athletes was determined, and practical recommendations were developed.

Keywords: taekwondo, young athletes, footwork speed, plyometric exercises, ladder drills, SAQ system, agility.

Introduction

Taekwondo is considered one of the martial arts with the most complex technical elements among modern sports. To achieve success in this sport, athletes are required to possess a high level of physical fitness, speed, agility, and the ability to maintain balance [1]. In particular, footwork speed in taekwondo determines not only the effectiveness of offensive and defensive movements but also the ability to evade opponent's strikes, quickly change position, and organize counterattacks [2].

In the Republic of Uzbekistan, the development of physical education and sports, especially improving the system of training talented young athletes in Olympic

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sports, is one of the priority directions of state policy. President Sh.M. Mirziyoyev's decree dated February 13, 2019, "On the Concept of Further Development of Physical Education and Mass Sports" serves as an important foundation for reforms in this area [3].

In the process of training young taekwondo athletes, developing footwork speed is of particular importance. The age period of 12-16 years is considered the "golden age" in children's physical development, and it is precisely during this age interval that speed and agility qualities are most effectively developed [4]. Therefore, developing a system of special exercises for taekwondo athletes in this age group and scientifically substantiating their effectiveness is considered a relevant scientific-pedagogical problem.

The purpose of this article is to scientifically substantiate methods of developing footwork speed in young taekwondo athletes through special exercises (plyometric, ladder drills, SAQ system) and to develop practical recommendations.

Literature Review

An analysis of research conducted on the physical preparation of young taekwondo athletes, particularly on developing footwork speed, shows that there is a rich theoretical-methodological heritage in this field.

Among Uzbek scholars, in research conducted by B.Sh. Rakhmatov and P.K. Ubenov (2024), the effectiveness of developing vestibulosomatic abilities of 15-16-year-old taekwondo athletes using special exercises performed on the right and left legs was studied. The authors emphasize that balance stability and movement accuracy are important components of footwork speed, requiring a system of special exercises for their development [1].

Examining international experience, in research conducted by Indonesian scholars R.N. Gunawan and N. Hidayah (2025), the effect of ladder drills on agility in 9-12-year-old taekwondo athletes was studied. As a result of 16 training sessions conducted over 5 weeks, the athletes' agility indicators improved by 2.5%, and this change was determined to be statistically significant ($p<0.05$) [3].

In comprehensive research conducted by Turkish researchers, the effect of different plyometric training methods (on sand and tatami) on biomotor and technical indicators in 14-16-year-old taekwondo athletes was analyzed. After an

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8-week training program, significant positive changes were recorded in speed, agility, jumping, and technical indicators, especially in the group that performed plyometric exercises on sand [4].

In randomized controlled research conducted by Pakistani researchers, the additional effect of ladder drills and jump training on the agility, core stability, and balance of taekwondo players was studied. As a result of a 6-week program (18 training sessions), significant improvements were found in all indicators in the experimental group [9].

Analysis and Results

Based on the purpose and objectives of the research, the following methodological approaches were applied:

The research was conducted at the "Bunyodkor" sports complex and "Chig'atoy" taekwondo sports club in Tashkent during the 2024-2025 academic year. A total of 84 taekwondo athletes aged 12-16 (boys – 52, girls – 32) participated in the research. All participants had at least 2 years of taekwondo experience.

Research stages:

1. **Identification stage (1-2 weeks)** – initial footwork speed indicators of taekwondo athletes were determined and they were divided into 3 equal groups (2 experimental and 1 control group).
2. **Formative stage (8 weeks)** – special exercise programs were introduced in the experimental groups:
   - Experimental group 1 (n=28) – plyometric exercises + ladder drills
   - Experimental group 2 (n=28) – SAQ system + combined exercises
   - Control group (n=28) – traditional taekwondo training
3. **Control stage (1 week)** – final tests were conducted in all groups and results were compared.

Research methods

- Pedagogical observation
- Tests (10 m run, "T-test" agility test, multi-directional footwork test, Multiple Frequency Speed of Kick Test – MFSKT) [8]
- Physiological measurements (heart rate, reaction speed)
- Video analysis (Kinovea software)

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- Mathematical-statistical analysis (Student's t-test, ANOVA)

Table 1 Dynamics of footwork speed indicators of taekwondo athletes in experimental and control groups (mean values, n=84)

№	Test types	Groups	Initial (M±σ)	Final (M±σ)	Growth %	P
1	10 m run (sec)	Experimental group 1 (n=28)	2.24±0.12	2.01±0.09	10.3	<0.01
		Experimental group 2 (n=28)	2.26±0.13	1.98±0.08	12.4	<0.001
		Control group (n=28)	2.25±0.11	2.16±0.10	4.0	>0.05
2	"T-test" agility (sec)	Experimental group 1	11.84±0.62	10.52±0.48	11.1	<0.01
		Experimental group 2	11.92±0.58	10.38±0.45	12.9	<0.001
		Control group	11.88±0.60	11.42±0.52	3.9	>0.05
3	Multi-directional footwork test (points)	Experimental group 1	6.8±0.9	8.4±0.7	23.5	<0.001
		Experimental group 2	6.7±1.0	8.7±0.6	29.9	<0.001
		Control group	6.9±0.8	7.4±0.7	7.2	>0.05
4	MFSKT (number of kicks/10 sec)	Experimental group 1	12.4±1.2	14.6±1.1	17.7	<0.01
		Experimental group 2	12.3±1.3	15.1±1.0	22.8	<0.001
		Control group	12.5±1.1	13.2±1.0	5.6	>0.05
5	Reaction speed (ms)	Experimental group 1	284±24	248±20	12.7	<0.01
		Experimental group 2	286±26	242±18	15.4	<0.001
		Control group	283±22	271±21	4.2	>0.05

As can be seen from the table data, after the 8-week special exercise program, a significant increase in indicators was recorded in both experimental groups across all test types. Especially in experimental group 2 (SAQ + combined exercises), the growth rates were higher, achieving improvements of 29.9% in the multi-directional footwork test, 22.8% in MFSKT, and 15.4% in reaction speed. These changes have a high level of statistical significance ($p<0.001$). In the control group, however, the increase in indicators was in the range of 4-7%, which is not statistically significant ($p>0.05$).

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2. Comparative effectiveness of special exercise types

The research results showed that combined exercises based on the SAQ system (speed, agility, quickness) (experimental group 2) have a number of advantages compared to plyometric and ladder drills:

- 6.4% higher effectiveness in developing multi-directional foot movements
- 5.1% higher effectiveness in increasing kick speed
- 2.7% higher effectiveness in improving reaction speed

These results align with the research of J.S. Chan (2020), confirming the high effectiveness of combination training [10].

3. Analysis by age and gender characteristics

Analysis of participating athletes by age groups showed that the effectiveness of special exercises in 14-15-year-old taekwondo athletes is on average 8-10% higher compared to 12-13-year-olds. This confirms that this age period is a "sensitive period" for developing speed qualities [4].

In the analysis by gender, no statistically significant difference was found between boys and girls in the effectiveness of special exercises ($p>0.05$).

4. Dynamics of functional indicators

Positive changes were also recorded in the functional indicators of the cardiovascular system in the experimental groups. According to the Rufier index, the level of adaptation of cardiac activity to physical load improved by an average of 16.8% in experimental group 1 and 19.3% in experimental group 2, while this indicator was 6.1% in the control groups.

Discussion

The obtained results align with data from international research. As noted by Gunawan and Hidayah (2025), ladder drills are an effective tool for developing agility [3]. The conclusions of Turkish researchers on plyometric training also confirm our results [4]. Furthermore, it was practically confirmed that the MFSKT test developed by Apollaro et al. (2024) has high reliability in assessing the kicking speed of taekwondo athletes [8].

Conclusions and Recommendations

Based on the conducted research results, the following conclusions can be formulated:

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1. In taekwondo, footwork speed is an important factor for successful competitive activity, including components such as agility, reaction speed, multi-directional movement, and kicking speed.
2. In developing footwork speed in young taekwondo athletes (12-16 years old), a system of special exercises (plyometric, ladder drills, SAQ) has higher effectiveness compared to traditional taekwondo training. An 8-week special exercise program allows improving speed indicators by 10-30%.
3. Combined exercises based on the SAQ system (speed, agility, quickness) provide 5-6% higher effectiveness in developing footwork speed compared to plyometric and ladder drills. This method is most optimal especially for developing multi-directional movements and kicking speed.
4. The age of 14-15 is the most "sensitive period" for developing footwork speed, with the effectiveness of special exercises applied at this age being 8-10% higher compared to 12-13-year-olds. Gender characteristics do not significantly affect the effectiveness of special exercises.
5. The following practical recommendations were developed for developing footwork speed in young taekwondo athletes:
   - Organize training sessions that include special exercises at least 3 times a week;
   - Combine plyometric, ladder, and SAQ exercises in training;
   - Use game-based methods for 12-13-year-olds, and repetitive and interval methods for 14-16-year-olds;
   - Increase the complexity of exercises every 4-5 weeks;
   - Conduct regular monitoring through the MFSKT test.
6. Continuing research in this direction, developing and implementing innovative pedagogical technologies designed for taekwondo athletes of different age groups and skill levels is a promising direction of scientific-pedagogical research.

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