



METHODOLOGY FOR DEVELOPING HAND MOVEMENT SPEED IN YOUNG TABLE TENNIS ATHLETES

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Abstract

This article describes a specialized methodology aimed at developing hand movement speed in young table tennis players aged 10-12 years. One of the key factors for achieving success in table tennis is a high level of reaction speed and frequency of hand movements. During the research, a specially designed set of exercises (focusing on reaction speed, movement frequency, and muscle sense) was tested, in contrast to traditional training methods. Based on the results of a pedagogical experiment, the article scientifically substantiates a significant improvement in three components of hand movement speed – reaction time, single movement speed, and movement frequency. In the experimental group, hand reaction speed increased by 18.5%, and movement frequency increased by 15.2%. The results indicate that the proposed methodology has high efficiency in improving the functional fitness of young table tennis players.

Keywords: table tennis, hand movement speed, reaction speed, movement frequency, young athletes, methodology, pedagogical experiment.

Introduction

Table tennis is a sport that requires not only technical skill but also a high level of physical fitness, particularly speed. In modern table tennis, the flight speed of the ball can reach 150-170 km/h, and the time it takes for the ball to travel from one side of the table to the other is only 0.3-0.5 seconds. Within this short time interval, the athlete must determine the ball's trajectory, spin, and speed, select the most optimal return shot, and execute it accurately. This, in turn, requires a high level of development of the athlete's psychomotor abilities, such as hand



movement speed, i.e., reaction speed, single movement speed, and movement frequency.

In the system of training young athletes, the development of speed is of particular importance. The age of 10-12 years is characterized by the highest mobility of children's central nervous system and is considered the most favorable period for developing these qualities. It is during this age that, through directed pedagogical influences, speed abilities can be developed to a maximum level. However, in the current training process, the main focus is often on teaching technical elements, while exercises for developing specific speed qualities are not systematically applied, or they are not sufficiently effective.

The relevance of this study lies in the need to develop scientifically based, effective methodologies aimed at developing hand movement speed in young athletes and implementing them into practice to achieve high results in table tennis.

The aim of the research is to develop a scientifically based methodology for developing hand movement speed in young table tennis players aged 10-12 and to determine its effectiveness through experimental testing.

Research objectives

1. To analyze scientific and methodological literature on the importance of hand movement speed in table tennis and methods for its development.
2. To determine the initial level of hand movement speed in 10-12-year-old table tennis players.
3. To develop a set of special exercises aimed at developing hand movement speed and test it experimentally.
4. To statistically analyze the effectiveness of the developed methodology and develop practical recommendations.

Literature Review

The issue of speed in table tennis has been studied by many scientists and coaches. In particular, experts such as A.N. Amelin, G.V. Barchukova, and O.V. Matytsin have developed the theoretical and methodological foundations for developing speed in table tennis. They define speed not only as a physical quality



but also as an important factor determining the effectiveness of technical and tactical actions.

A.I. Kuznetsova, in her research, elaborated in detail on the forms of speed manifestation. According to her, all types of speed in table tennis – reaction speed, single movement speed, starting speed, and movement frequency – are of great importance. The author emphasizes the complex analytical and synthetic work performed by the athlete's brain during the ball's flight time (0.3-0.5 sec) and calls this process the "speed of thinking reaction."

A correlational study conducted by Indonesian researchers Sahabuddin and others determined the contribution of hand reaction speed and foot movement speed to table tennis playing skills. According to the results, hand reaction speed contributes 61.6% to playing skills, and together with foot movement speed, this figure reaches 73.9%. This once again confirms the importance of hand movement speed.

Research by Z. Bańkosz and T. Stefaniak showed that table tennis players have a highly developed sense of elbow joint position and hand pressure under conditions of quick reaction. This indicates the necessity of considering not only muscle contraction speed but also proprioceptive sensitivity when developing specific speed.

Furthermore, S.D. Inozemtsev developed a methodology for developing speed abilities in 15-year-old students, while Iranian researchers provided a comparative analysis of traditional and combined methods in their experiment. According to them, the combined method was found to be more effective in developing speed and strength qualities compared to the traditional method.

Research by M.M. Bekimurodov and other local scholars also pays special attention to table tennis technique and physical training issues, providing important recommendations for organizing the training process considering the age characteristics of young athletes.

The literature analysis shows that while considerable attention has been paid to the issue of developing speed in table tennis, there is a lack of sufficiently developed special methodologies for the comprehensive development of hand movement speed specifically in 10-12-year-old athletes, and further research in this area is necessary.

Methodology

The research was conducted at the "Yoshlik" sports school table tennis section in Fergana city. The study involved 40 children aged 10-12 who engage in table tennis. They were divided into two equal groups: a control group (CG, n=20) and an experimental group (EG, n=20). The control group trained according to a traditional methodology (mainly repeating technical elements and game exercises), while the experimental group trained using a specially developed methodology.

The methodology applied in the experimental group was based on the following principles:

1. Developing Reaction Speed: Exercises involving quick movements in response to various signals (sound, light, opponent's movement).

- Tasks aimed at increasing "hand speed" (e.g., hitting the wall at maximum speed, catching a released tennis ball without dropping it).
- Exercises developing complex reaction (choice reaction) (responding to balls in different directions, hitting in the direction indicated by the coach).

2. Increasing Movement Frequency:

- Performing hand movements at maximum speed while standing still and moving (hand movements while running in place, frequently repeating strikes using the "shadow boxing" method).
- Performing exercises using the "multi-ball" method (the coach continuously feeds balls, the player returns them quickly).
- Exercises of hitting at maximum frequency with the table placed close to the wall.

3. Developing Muscle Sense and Movement Accuracy:

- Hitting with small weights (0.5-1 kg) attached to the hand, then hitting without weights (contrast method).
- Working with balls of different weights.
- Exercises hitting precise targets (numbers, circles) on the table.

The methodology was applied for 8 weeks, 3 times a week (Monday, Wednesday, Friday), for 20-25 minutes during the main part of the training session.

The following tests were conducted at the beginning and end of the training period:

- **Hand reaction speed (ruler test):** The distance (cm) at which the falling ruler is caught. The smaller the distance, the higher the reaction speed.
- **Single movement speed:** The time (ms) to extend the arm to a 90° angle at maximum speed. Measured using a special electronic stopwatch.
- **Movement frequency:** Number of hits with the hand at maximum speed in 10 seconds (times).

The obtained data were processed using mathematical-statistical methods (arithmetic mean – \bar{X} , standard deviation – σ , Student's T-test).

As can be seen from the table data, at the beginning of the experiment, the indicators of both groups were almost identical, with no statistically significant difference ($p > 0.05$). This indicates the equality of the groups and the correct organization of the experiment.

At the end of the experiment, significant differences were recorded. In the control group, positive changes were observed in all indicators, but they were statistically insignificant ($p > 0.05$). This is explained by natural growth and the effect of traditional training.

In the experimental group, however, significant and statistically reliable ($p < 0.01$) changes were recorded in all indicators. Specifically:

Results and Discussion

The results of the conducted pedagogical experiment are presented in the following table.

Table 1 Changes in hand movement speed indicators at the beginning and end of the experiment ($\bar{X} \pm \sigma$)

No.	Test types	Groups	Beginning of experiment	End of experiment	Growth, %	T-test	P
1.	Hand reaction speed (cm)	CG	21.4 ± 0.8	19.8 ± 0.7	7.5%	2.1	>0.05
		EG	21.6 ± 0.9	17.6 ± 0.6	18.5%	4.3	<0.01
2.	Single movement speed (ms)	CG	185.3 ± 4.2	176.5 ± 3.8	4.7%	1.8	>0.05
		EG	184.7 ± 4.5	162.3 ± 3.1	12.1%	3.9	<0.01
3.	Movement frequency (per 10 sec)	CG	28.2 ± 0.9	30.1 ± 0.8	6.7%	2.0	>0.05
		EG	28.5 ± 1.0	32.8 ± 0.7	15.2%	4.1	<0.01



• **Hand reaction speed** improved by 18.5% (from 21.6 cm to 17.6 cm). This is explained by the positive effect of exercises specifically developing reaction speed (especially tasks involving responses to unexpected signals and choice reaction) on the central nervous system of young athletes.

• **Single movement speed** improved by 12.1% (from 184.7 ms to 162.3 ms). This demonstrates the effectiveness of exercises performed using the contrast method (with and without weights) and special exercises requiring speed.

• **Movement frequency** increased by 15.2% (from 28.5 to 32.8). The "multi-ball" method and exercises performed at maximum frequency led to a significant increase in movement frequency.

The highest increase was observed in reaction speed. This indicates the high potential for developing qualities related to the mobility of nervous processes, such as reaction speed, in 10-12-year-old children. Furthermore, the "multi-ball" method and exercises with light weights contributed to the increase in movement frequency and single movement speed.

The obtained results align with the research of Sahabuddin et al., as well as Bańkosz and Stefaniak, confirming the important role of special exercises aimed at developing hand movement speed in the training of young athletes.

Conclusion

The results of the conducted research and pedagogical experiment allow drawing the following conclusions:

1. Hand movement speed in table tennis is one of the main factors for successful game activity, requiring a combination of reaction speed, single movement speed, and movement frequency. The potential for developing these qualities in 10-12-year-old children is very high.
2. The literature analysis shows that existing methodologies are mainly focused on technical training, and systematic approaches to the comprehensive development of specific speed are insufficiently developed.
3. Initial test results showed no significant difference in hand movement speed indicators between the athletes of the two groups ($p > 0.05$). This confirmed the equivalence of the groups.
4. The developed methodology, which includes special exercises for developing reaction speed, movement frequency, and muscle sense, proved to be



significantly more effective than the traditional methodology. In the experimental group, hand reaction speed improved by 18.5%, single movement speed by 12.1%, and movement frequency by 15.2%, while in the control group these indicators were 7.5%, 4.7%, and 6.7%, respectively. The changes in the experimental group were statistically reliable ($p < 0.01$).

5. It is recommended that coaches working with young table tennis players apply the proposed methodology in their practice. This, in turn, will serve to improve the functional fitness of athletes, enable them to master technical elements quickly and accurately, and achieve high sports results.

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