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IMPROVING THE PHYSICAL PREPARATION OF ARTISTIC GYMNASTS BASED ON SENSITIVE PERIODS

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Abstract
This article examines the scientific and methodological foundations of developing the physical fitness of rhythmic gymnasts based on sensitive periods. The study examined the indicators of coordination, flexibility, strength, speed, and special endurance in gymnasts aged 7–14. During the pedagogical experiment, the effectiveness of the training methodology developed taking into account sensitive periods was statistically analyzed. The results showed a significant improvement in physical qualities in the experimental group.

Keywords: Rhythmic gymnastics, sensitive periods, physical fitness, coordination, flexibility, statistical analysis, young athletes, training methodology.

Introduction

СОВЕРШЕНСТВОВАНИЕ ФИЗИЧЕСКОЙ ПОДГОТОВКИ ХУДОЖЕСТВЕННЫХ ГИМНАСТОК НА ОСНОВЕ ЧУВСТВИТЕЛЬНЫХ ПЕРИОДОВ

Аннотация
В статье рассматриваются научно-методические основы развития физической подготовленности художественной гимнастки на основе сенситивных периодов. В исследовании изучались показатели координации, гибкости, силы, скорости и специальной выносливости у девочек-гимнасток в возрасте 7–14 лет. Статистически проанализирована эффективность методики тренировки, разработанной с учетом сенситивных периодов в ходе педагогического эксперимента. Результаты показали значительное улучшение физических качеств в экспериментальной группе.

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Ключевые слова: художественная гимнастика, критические периоды, физическая подготовка, координация, гибкость, статистический анализ, юные спортсмены, методика тренировки.

INTRODUCTION

Rhythmic gymnastics is a complex coordination sport that requires a high level of physical and functional fitness from athletes. In this sport, the accuracy of technical elements, their rhythm, amplitude, balance, and aesthetic expression are of paramount importance. Therefore, planning training sessions taking into account the laws of the development of the body of young athletes is one of the important areas of modern sports pedagogy. The concept of sensitive periods is of particular scientific importance in the theory of sports physiology and training of young athletes. Sensitive periods refer to stages of the body's high sensitivity to the development of certain physical qualities. It is during these periods that targeted training will yield maximum results. Numerous studies have scientifically proven that coordination skills and flexibility develop effectively at an early age, while strength and endurance develop more effectively in later stages. However, the study of the statistical effectiveness of training methods that take into account sensitive periods in rhythmic gymnastics remains one of the urgent problems. The purpose of this study is to study the physical fitness of rhythmic gymnasts based on sensitive periods and to statistically determine the effectiveness of the training methodology.

METHODS

Study participants the study involved 48 rhythmic gymnasts aged 7–14 years. Athletes were divided into the following groups according to age characteristics: № Age group Number of athletes 1 7-8 years old 12 2 9-10 years old 12 3 11-12 years old 12 4 13-14 years old 12 During the study, athletes were divided into control and experimental groups. Research methods. The following scientific and methodological methods were used: • analysis of scientific literature; • pedagogical observation; • pedagogical experiment; • control tests; • mathematical and statistical analysis. Control tests The following tests were used to assess physical fitness: 1. Forward bend test – flexibility; 2. Balance on one leg – coordination; 3. 30-meter sprint – speed; 4. Abdominal press – strength quality; 5. 6-minute run – endurance. The pedagogical experiment lasted 6 months. In the experimental group, a training methodology suitable for sensitive

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periods was used. Statistical analysis The results were processed based on the following statistical indicators: • arithmetic mean ($\bar{X}$); • standard deviation (σ); • percentage increase (%); • Student's t-test; • correlation analysis (r); • level of significance ($p<0.05$; $p<0.01$).

RESULTS

TABLE-1 Coordination and flexibility indicators in gymnasts aged 7–10 years

Indicator	Group	$\bar{X}\pm\sigma$ at the beginning of the experiment	At the end of the experiment $\bar{X}\pm\sigma$	Growth (%)	p
Forward bending(cm)	Control	10,4±1,2	12,1±1,1	16,3	>0,05
	Experience	10,6±1,3	15,8±1,0	49,0	<0,01
Balance(sec)	Control	14,2±1,5	16,3±1,4	14,8	>0,05
	Experience	14,4±1,4	21,5±1,2	49,3	<0,01

Table analysis

In the experimental group, it was observed that flexibility increased by 49.0%, while coordination abilities increased by 49.3%. In the control group, however, growth was significantly lower. Statistically, the differences were found to be significant ($p<0.01$).

Diagram1

Dynamics of the development of coordination abilities

Control group [redacted] 14,8%

Experimental group [redacted] 49,3%

Diagram analysis According to the results of the diagram, sensitive training led to a significant development of coordination abilities. This is explained by the high plasticity of the central nervous system.

Diagram 2

Flexibility quality development indicators

Control group [redacted] 16.3%

Experimental group [redacted] 49,0%

Chart analysis

The high development of flexibility is associated with the high elasticity of the muscular and ligamentous apparatus during the age of 7–10 years.

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TABLE 2 Strength and endurance indicators in gymnasts aged 11–14 years

Indicator	Group	X̄±σ at the beginning of the experiment	At the end of the experiment X̄±σ	Growth (%)	p
Abdominal press (times)	Control	21,4±2,1	24,1±2,0	12,6	>0,05
	Experience	21,6±2,2	30,8±1,9	42,5	<0,01
6-minute run (m)	Control	1012±45	1084±42	7,1	>0,05
	Experience	1018±43	1216±40	19,4	<0,01

Table analysis Strength and endurance qualities have significantly developed in athletes aged 11–14. In the experimental group, abdominal muscle strength increased by 42.5%.

Diagram 3

Development of strength quality

Control group [redacted] 12,6%

Experimental group [redacted] 42,5%

Diagram analysis

The high development of strength qualities is explained by the biological maturation of the organism and the active development of the muscular system.

Diagram 4

Changes in endurance indicators

Control group [redacted] 7,1%

Experimental group [redacted] 19,4%

Chart analysis

Special endurance indicators developed much higher in the experimental group. This is due to the correct planning of age-appropriate loads.

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CORRELATION ANALYSIS

TABLE 3 Relationship between coordination and technical skills

Indicators	r
Balance and rotation technique	0,81
Flexibility and amplitude of the element	0,78
Rhythmic coordination and work with the subject	0,84

Analysis

Correlation analysis showed a high correlation between the quality of performing technical elements and coordination training (r=0.78–0.84).

Coordination and flexibility indicators in gymnasts aged 7–10 years

Indicator	Group	X̄±σ at the beginning of the experiment	At the end of the experiment X̄±σ	Growth (%)	p
Forward tilt (cm)	Control	10,4±1,2	12,1±1,1	16,3	>0,05
	Experience	10,6±1,3	15,8±1,0	49,0	<0,01
Balance (sec)	Control	14,2±1,5	16,3±1,4	14,8	>0,05
	Experience	14,4±1,4	21,5±1,2	49,3	<0,01

Table analysis

In the experimental group, flexibility increased by 49.0%, and coordination skills by 49.3%. In the control group, the increase was significantly lower. Statistically, the differences were found to be significant (p<0.01). Diagram 1 Dynamics of the development of coordination abilities

Diagramma tahlili

Diagramma natijalariga ko‘ra, sensitiv mashg‘ulotlar koordinatsion qobiliyatlarning sezilarli rivojlanishiga olib kelgan. Bu markaziy nerv tizimining yuqori plastiklik xususiyati bilan izohlanadi.

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Diagram 2

Flexibility quality development indicators

Control group [redacted] 16,3%

Experimental group [redacted] 49,0%

Diagram analysis

The high development of flexibility is associated with the high elasticity of the muscular and ligamentous apparatus during the period of 7–10 years.

TABLE 2 Strength and endurance indicators in gymnasts aged 11–14

Indicator	Group	$\bar{X}\pm\sigma$ at the beginning of the experiment	At the end of the experiment $\bar{X}\pm\sigma$	Growth (%)	p
Belly press (times)	Control	21,4±2,1	24,1±2,0	12,6	>0,05
	Experience	21,6±2,2	30,8±1,9	42,5	<0,01
6-minute run (m)	Control	1012±45	1084±42	7,1	>0,05
	Experience	1018±43	1216±40	19,4	<0,01

Table analysis

Strength and endurance qualities have significantly developed in athletes aged 11–14 years old. The strength of the abdominal muscles in the experimental group increased by 42.5%.

Diagram 3

Development of power quality

Control group [redacted] 12,6%

Experimental group [redacted] 42,5%

Diagram analysis

The high development of strength qualities is explained by the biological maturation of the organism and the active development of the muscular system.

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Diagram 4

Changes in endurance indicators

Control group [redacted] 7.1%

Experimental group [redacted] 19.4%

Chart analysis Special durability indicators have developed much higher in the experimental group. This is due to the correct planning of age-appropriate downloads.

CORRELATION ANALYSIS

TABLE 3 The relationship between coordination and technical skill

Indicators	r
Balance and rotation techniques	0,81
Flexibility and amplitude of the element	0,78
Rhythmic coordination and work with the subject	0,84

Analysis

Correlational analysis showed a high correlation between the quality of performing technical elements and coordination training (r=0.78–0.84).

DISCUSSION

The results of the study confirmed the practical effectiveness of the theory of sensitive periods in rhythmic gymnastics. The high development of coordination abilities and flexibility, especially at the age of 7–10, is explained by the level of plasticity of the central nervous system. In the experimental group, the regular use of exercises that develop the vestibular apparatus, rhythmic movements, and amplitude exercises made it possible to master technical elements faster. The development of strength and endurance qualities in athletes aged 11–14 is associated with the biological maturation of the body, and it has been found that the effectiveness of special physical training tools is high during this period. The results obtained are consistent with the studies of Platonov, Matveev, Bompa and Tarasova. Their scientific views also indicate that taking into account sensitive periods in young athletes is one of the main principles of sports training.

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CONCLUSION

1. Training based on sensitive periods ensures effective development of physical qualities.
2. The age range of 7–10 years is considered the optimal period for developing coordination and flexibility.
3. The age range of 11–14 years is the most favorable for developing strength and endurance qualities.
4. The statistical results showed a significant advantage in the experimental group ($p<0.01$).
5. It was found that coordination training is strongly correlated with technical skills ($r=0.78–0.84$).
6. A training methodology that takes into account sensitive periods is important in improving athletic performance and preventing injuries.

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