

## WAYS TO ENHANCE THE ENDURANCE OF ADOLESCENT ATHLETES IN SWIMMING TRAINING

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**Abstract:** This article analyzes effective methods for developing and enhancing endurance in adolescent swimmers. Endurance plays a key role in athletes' technical and tactical preparation, contributing significantly to successful performance in competitions. The study explores the optimal organization of load and rest ratios in swimming training, the balance between aerobic and anaerobic exercises, as well as the influence of motivation and psychological readiness on endurance.

**Keywords:** swimming, endurance, adolescents, physical training, aerobic

## ПУТИ ПОВЫШЕНИЯ ВЫНОСЛИВОСТИ СПОРТСМЕНОВ-ПОДРОСТКОВ НА ТРЕНИРОВКАХ ПО ПЛАВАНИЮ

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**Аннотация:** В статье анализируются эффективные методы развития и повышения выносливости у пловцов-подростков. Выносливость играет ключевую роль в технико-тактической подготовке спортсменов, внося значительный вклад в успешные выступления на соревнованиях. В исследовании рассматриваются оптимальная организация соотношения нагрузки и отдыха в тренировках по плаванию, баланс аэробных и анаэробных нагрузок, а также влияние мотивации и психологической готовности на выносливость.

**Ключевые слова:** плавание, выносливость, подростки, физическая подготовка, аэробика

## SUZUVCHI MASHG'ULOTLARDA O'SMIR SPORTCHILARNING CHIDAMLILIGINI OSHIRISH YO'LLARI

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**Annotatsiya:** Ushbu maqola o'smir suzuvchilarda chidamlilikni rivojlantirish va kuchaytirishning samarali usullarini tahlil qiladi. Chidamlilik sportchilarning texnik va taktik tayyorgarligida muhim rol o'ynaydi va musobaqalarda muvaffaqiyatli ishtirok etishiga sezilarli hissa qo'shadi. Tadqiqot suzish mashqlarida yuk va dam olish nisbatlarini optimal tashkil etish, aerob va anaerob mashqlar o'rtasidagi muvozanat, shuningdek, motivatsiya va psixologik tayyorgarlikning chidamlilikka ta'sirini o'rganadi.

**Kalit so'zlar:** suzish, chidamlilik, o'smirlar, jismoniy tarbiya, aerobika

## INTRODUCTION

In the system of physical education and sports training, endurance holds a central role in both the general and special preparation processes of athletes. Especially in sports such as swimming, which require high energy expenditure, the sufficient level of endurance is recognized as a crucial factor determining the success of an athlete's performance.

Adolescence is a stage characterized by significant physiological growth, the development of motor skills, and the active formation of sporting abilities. At this stage, the purposeful development of endurance plays an important role in safeguarding athletes' health and ensuring their achievement of high performance results.

The development of endurance in swimmers depends on many factors, including the volume and intensity of exercises, the balanced ratio between load and recovery, as well as the athlete's individual physiological condition and psychological preparedness. Today, one of the urgent tasks is to design a comprehensive, scientifically based training system adapted to young athletes, built upon the achievements of sports medicine and sports pedagogy.

Since the independence of the Republic of Uzbekistan, the sports sector, particularly swimming and the training of young athletes, has been gradually developing through scientific and methodological research. Local scholars have carried out studies aimed at improving children's and adolescents' sports training, with a special focus on increasing physical qualities such as endurance, and their findings are being introduced into practice.

Scientific research conducted by Uzbek scholars on the development of endurance in young athletes, especially swimmers, has established a solid theoretical and practical foundation in this field.

For example, M. Khamidov, in his studies, analyzed the relationship between adolescent athletes' physiological adaptation to training and the formation of endurance potential, emphasizing its close link with age-specific changes. His scientific views serve as an important practical guideline for coaches in planning training loads based on individual physiological capacities.

The scientific works of these scholars have provided a theoretical and practical basis for improving scientifically grounded methodologies to develop endurance in swimmers, fostering an individualized approach to training, and integrating these methods into practical training systems.

At the same time, research conducted at specialized Olympic reserve sports schools operating throughout the Republic, as well as at the scientific research centers under the Uzbekistan State University of Physical Education and Sport, contributes to enriching young swimmers' preparation with scientific approaches and fostering their development through modern methods.

### **RESEARCH AIM**

The main aim of this study is to effectively develop endurance in adolescent swimmers. To achieve this aim, the research set the following objectives: the design of exercise complexes specifically targeted at improving endurance during swimming training, and the development of training programs that take into account the optimal balance between load and recovery.

In order to address these objectives, a range of research methods was employed. These included the theoretical analysis and synthesis of scientific and methodological literature, as well as the theoretical examination of documents related to the educational process. A pedagogical experiment was conducted alongside pedagogical observations to monitor the effectiveness of the training process. Additionally, questionnaire and survey methods were applied to collect subjective data from participants. Physical and morphofunctional indicators were measured using specialized equipment such as TANITA Bioimpedance and a Spirograph. Pedagogical competencies were also identified, while cognitive ability structures were assessed through pedagogical testing. Finally, the collected data were analyzed using mathematical and statistical methods to ensure reliability and validity of the findings.

## RESEARCH METHODOLOGY

This scientific research was conducted on the basis of a pedagogical-experimental approach aimed at effectively developing endurance in adolescent swimmers. The study relied on the following methodological foundations, principles, and stages:

A systems approach to sports training.

Consideration of age-specific physiological and psychological characteristics of adolescents.

The principle of individualization and differentiation in training.

Integration of modern sports science technologies and diagnostic tools.

**Analysis and Results.** During the study, 40 adolescent swimmers aged 12–15 were divided into two groups: the Experimental Group (EG) and the Control Group (CG). In the Experimental Group, a special training system aimed at developing endurance was implemented, while the Control Group continued with standard training sessions. The experiment lasted for 12 weeks.

**Table 1. Indicators of 400 m swimming performance and heart rate in the experimental and control groups ( $\bar{X} \pm S$ )**

| Indicators                    | Experimental Group<br>(n=20) |                 | Control Group<br>(n=20) |                  |
|-------------------------------|------------------------------|-----------------|-------------------------|------------------|
|                               | Initial                      | Final           | Initial                 | Final            |
| 400 m swimming time (sec)     | 384.2 $\pm$ 11.4             | 351.2 $\pm$ 9.7 | 386.7 $\pm$ 10.9        | 379.8 $\pm$ 10.4 |
| HR after exercise (beats/min) | 164 $\pm$ 8                  | 152 $\pm$ 6     | 166 $\pm$ 7             | 164 $\pm$ 7      |
| Recovery time (sec)           | 102 $\pm$ 9                  | 78 $\pm$ 7      | 104 $\pm$ 10            | 100 $\pm$ 8      |

Now, in the Results section, you could highlight the statistical meaning of these changes. For example:

The experimental group showed a significant improvement in 400 m swimming time (–33 sec,  $p < 0.01$ ), whereas the control group's improvement was minimal (–6.9 sec, not significant).

Post-exercise heart rate in the experimental group decreased by 12 bpm ( $p < 0.05$ ), indicating better cardiovascular adaptation, while in the control group the change was negligible (–2 bpm).

Recovery time improved considerably in the experimental group (–24 sec,  $p < 0.01$ ), but only slightly in the control group (–4 sec).

This demonstrates that the endurance-oriented training program was effective in enhancing both performance and physiological recovery in adolescent swimmers.

The findings of the study revealed notable improvements in the endurance capacity of adolescent swimmers in the experimental group. Performance in the 400 m swimming test showed a significant enhancement, with an average improvement of 8.6%, whereas the control group demonstrated no meaningful change over the course of the program. Heart rate analysis further indicated that athletes in the experimental group developed greater cardiovascular resilience to training loads, as reflected in a reduction of post-exercise heart rate values.

In addition, recovery time after physical exertion was markedly shorter in the experimental group, confirming functional improvements in their endurance capacity. Throughout the training

process, heart rate and recovery speed were systematically monitored after each session, while endurance levels were reassessed every two weeks using 400–800 m swimming tests. Furthermore, short drill-based exercises focusing on breath control, concentration, and technical execution were regularly incorporated into the program, contributing to the overall effectiveness of the training methodology.

### CONCLUSIONS

Developing and improving endurance in adolescent swimmers is one of the priority directions in their athletic preparation. This physical quality plays a decisive role in competitive performance, technical precision, and long-term athletic development. The core methodological principles include balanced distribution of training loads, optimal organization of recovery periods, and the integration of aerobic and anaerobic exercises.

The findings of the experimental study showed that the training system implemented in the experimental group significantly enhanced cardiovascular and respiratory endurance. Positive changes were observed through faster post-exercise recovery, lower heart rate, and improved swimming speed. The methodological complex demonstrated high effectiveness in increasing both general and specific endurance capacities in young athletes.

Furthermore, psychological readiness, internal motivation, and individualized approaches strengthened the athletes' attitude toward endurance, contributing to the development of competitive spirit and discipline.

Overall, the results confirm that a comprehensive training system aimed at developing endurance in young swimmers can sustainably improve performance outcomes and serve as an effective methodological foundation for practicing coaches.

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