The effectiveness of developing special endurance in young handball players

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Abstract
This study is dedicated to examining the effectiveness of the process of developing special endurance in young handball players. Key factors and methods for enhancing endurance were analyzed, taking into account the physical loads and movement intensity specific to game activity. Interval, repetitive, and game-based exercises were employed during the training process, and their impact on athletic results was scientifically substantiated. Throughout the study, heart rate, recovery levels, and indicators from special tests were comparatively analyzed, leading to the development of an effective training methodology designed to improve the functional capabilities of young athletes.
Keywords: special endurance, interval training, game activity, physical conditioning, functional capabilities, recovery process, sports training methodology, motor activity, athletic performance.

Introduction

Handball, as a modern sport, demands a high level of physical conditioning, speed, strength, and particularly, special endurance. During a match, athletes perform repetitive, high-intensity movements in short intervals, which places a significant strain on their functional capabilities. For this reason, the effective development of special endurance in young handball players is a crucial factor in improving athletic performance.

Special endurance is an athlete's ability to perform game-specific actions with high efficiency for a prolonged period. Unlike general endurance, it is specifically adapted to the unique demands of handball. Insufficient development of this quality leads to rapid fatigue during gameplay and an increase in technical and tactical errors. From this perspective, developing a scientifically-grounded training methodology focused on improving special endurance is a pressing issue.

This research serves to a certain extent to fulfill the tasks set forth in the Decrees of the President of the Republic of Uzbekistan: No. PQ-421, dated December 4, 2024, "On Measures to Develop Team Sports and Improve the System for Selecting Talented Youth," and No. PQ-221, dated July 8, 2025, "On the Comprehensive Preparation of Uzbekistan's Athletes for the XXXIV Summer Olympic and XVIII Paralympic Games in Los Angeles (USA) in 2028," as well as other regulatory and legal documents pertaining to this field.

This study examines the effectiveness of developing special endurance in young handball players and analyzes the impact of game-specific physical loads and training methods. In particular, it comparatively evaluates athletes' functional indicators, heart rate, recovery process, and special test results through interval, repetitive, and game-based training methods. Based on the obtained results, an effective training methodology will be developed for young athletes, which will contribute to achieving high results in the sport of handball.

Aim of the research. To determine the effectiveness of the process of developing special endurance in young handball players and to develop scientifically-based training methods aimed at improving it.

Research objectives:

to identify the primary training methods used to develop special endurance in young handball players;

step-by-step study of the load-to-rest ratio in the process of developing special endurance;

analyzing the dynamics of changes in heart rate, recovery rate, and work capacity during training;

assessing the impact of training aimed at developing special endurance on sports results and game performance.

Results and discussion

Twenty young handball players participated in the study. The athletes performed interval, repetitive, and game-style exercises. During the training process, heart rate, recovery rate, and work capacity were assessed through tests, and the results were comparatively analyzed.

Table 1. .A set of special exercises for young handball players

Block	Exercise Name	Exercise Objective	Description	Performance Standard (pulse/time)
Aerobic Capacity Development Block	Continuous multi-directional running	Building the aerobic base	Running across the court, changing direction (diagonal, lateral, backward)	145-155 bpm 15 minutes
	4 vs 2 in a square	Active movement during the game	In a small area, 4 players control the ball while 2 players try to take it away. If the ball is lost, roles are switched immediately.	145-160 bpm 8-10 minutes
	Fartlek (variable speed run)	Muscular aerobic endurance	2 minutes of light jogging across the court + 1 minute at medium speed + 30 seconds of acceleration	Average pulse 155 bpm 15-20 minutes
	Active defensive movements	Increasing special work capacity	Continuous movement along the 6-meter line in a defensive stance for 3 minutes.	150-160 bpm 4 sets, 2 minutes rest
Anaerobic Capacity Development Block	Shuttle sprint (15 m x 4)	Speed endurance	4 repetitions of running back and forth over a 15-meter distance at maximum speed.	170-175 bpm, 6-8 sets
	Explosive counterattack	Increasing glycolytic anaerobic capacity	A maximum sprint of 20-30 meters from the defensive area toward the opponent's goal, receiving the ball, and executing a jump shot.	175-185 bpm 6-8 sets. 30 sec work/30 sec rest

The influence of various training methods on heart rate, movement intensity, and recovery processes is studied based on biomechanical and functional criteria, which allows for the scientific substantiation of the athletes' training process and the improvement of the training methodology.

The use of a set of exercises divided into energy zones (aerobic and anaerobic) demonstrated higher effectiveness in increasing the special endurance of young handball players compared to traditional training. When organizing training sessions based on the table below, the "supercompensation" principle must be followed. After high-intensity exercises in the anaerobic block, it is recommended to give the body at least 48 hours to recover or to provide a light aerobic load (a recovery workout) the following day.

The developed set of exercises allows for a gradual increase in the physiological capabilities of young handball players. The strength of the aerobic base created the foundation for easier assimilation of anaerobic loads. This proves that systematic interval loads are the most optimal way to increase specific endurance.

Handball is a sport of variable intensity in which an athlete covers an average distance of 5-6 km during a game, but the main part of this distance consists of short sprints, jumps, and contact plays.

The aerobic block is the athlete's "general endurance base," which serves to maintain work capacity throughout the 60 minutes of the game and to lower the pulse more quickly during breaks (for example, when the ball is out of play).

The anaerobic block, on the other hand, is "special endurance," which ensures that muscles function effectively despite the accumulation of acid (lactate) during game-deciding, 6-10 second explosive situations (like a counterattack or active defense in the 9-meter zone).

In the aerobic zone, at a heart rate of 145-160 bpm, the heart's stroke volume increases, which improves blood circulation. In the anaerobic zone (175 bpm and above), the body's lactate tolerance increases. This indicator is very important for skilled handball players, as victory in the last 5-10 minutes of the game depends on their training in this zone.

The set of specialized exercises detailed in the table above had a positive impact on the physical and technical indicators of young handball players. The results of the shuttle run (25 m x 8) test improved noticeably. This indicates that the "Shuttle sprint" exercises developed for the anaerobic block increased the athletes' maneuvering speed and anaerobic capabilities. An increase was observed in all types of shooting tests (supported, jumping, and falling). In particular, the shooting accuracy from a

Table 2. Results of special physical and technical training tests for young handball players

Test	At the beginning of the study		At the end of the study		Wilcoxon value	P	Statistical significance
	$\bar{X}$	Dispersion	$\bar{X}$	Dispersion			
Shuttle run (25 m x 8)	7.99	0.71	6.10	0.65	3	0.028	Significant
Running test (5 x 50 m), with 45 sec rest	43.43	1.26	40.22	1.29	2.5	0.034	Significant
Shooting at a 50x50 cm square target from a support position	2	0.50	3.0	0.75	4	0.042	Significant
Jump shot at a 50x50 cm square target	2	0.25	3.0	0.50	2	0.038	Significant
Fall shot at a 50x50 cm square target	2	0.50	2.5	1.01	2	0.046	Significant
Overhead pass over a 4 m distance for 30 sec.	14	1.75	17	2.50	2.5	0.031	Significant
Overhead throw at a wall target from a distance for 30 sec.	16	2.50	18	0.75	3	0.025	Significant

supported position increased from 2 to 3, with the statistical significance level of 0.061 approaching the highest result. This demonstrates that the ability to maintain accuracy even while fatigued has been developed.

A quantitative increase (from 14 to 17 and from 16 to 18) was also recorded in the tests of passing the ball overhead in a circle and to a target on the wall for 30 seconds. This reflects the positive effect of the technical-tactical exercises in the aerobic and anaerobic blocks on the athletes' endurance and coordination.

According to the Wilcoxon statistical criterion, there are positive shifts in all indicators. Although the p-value (Sig.) is high in some tests (which may be due to the small size of the sample group or the short duration of the study), the overall dynamics prove the effectiveness of the developed exercise program.

As shown in this table, during interval training, the athletes' average heart rate is 175±15 bpm, movement intensity is 5.2±0.8 m/s, and recovery time is 3.5±0.6 minutes. The primary active muscle groups in these workouts are the thigh, calf, and abdominal muscles; the high intensity and short recovery period are crucial for increasing the athlete's specific endurance and developing motor coordination.

Table 3. Physiological and Biomechanical Indicators of Training Methods

Type of Training	Heart Rate (beats/min)	Movement Intensity (m/s)	Recovery Time (min)	Primary Active Muscle Groups
Interval Training	175 ± 15	5.2 ± 0.8	3.5 ± 0.6	Thigh, calf, and abdominal muscles
Repetitive Training	185 ± 12	6.5 ± 1.2	4.5 ± 0.8	Thigh, abdominal, and back muscles
Game-Style Training	180 ± 18	4.8 ± 1.5	5.0 ± 1.0	Full-body muscles

Repetitive training sessions register an average heart rate of 185±12 bpm, a movement intensity of 6.5±1.2 m/s, and a recovery time of 4.5±0.8 minutes. The thigh, abdominal, and back muscles show high activity, which helps maintain the synchronicity of movement phases

and muscle activity at an optimal level, as well as enhance endurance and recovery ability.

In game-style training, the heart rate is 180±18 bpm, movement intensity is 4.8±1.5 m/s, and recovery time is 5.0±1.0 minutes. All muscles of the body are engaged, and this type of training simulates real game conditions, improves coordination, speed, and the synchronicity of muscle activity, while maximizing the development of the athlete's specific endurance.

The results obtained can be effectively applied in the individual and group training of young handball players, creating an opportunity for coaches to develop methodical and scientifically-grounded training programs. This approach also serves to improve results in national and international competitions by increasing the athletes' special endurance and enhancing their competitiveness.

Conclusion

Special endurance development training is directly linked to an athlete's cardiovascular function, muscle activity, and movement coordination. High-intensity interval, repetitive, and game-based training methods are effective in increasing an athlete's movement speed, recovery ability, and overall work capacity.

In training, an individual approach and programs that account for muscle activity and body balance yield maximum results. 3D motion analysis, heart rate monitoring, and other functional tracking tools make it possible to identify an athlete's weaknesses, optimize them, and refine the training methodology.

During the training process, coaches must apply programs based on the individual endurance indicators and recovery characteristics of the athletes.

High-intensity training with short recovery periods effectively develops an athlete's specialized endurance while simultaneously enhancing motor coordination and speed. It is recommended to optimize training and address an athlete's individual weaknesses by using functional and biomechanical monitoring tools.

The results obtained will serve to theoretically and practically substantiate the training process for young handball players, as well as to develop methodological guides for coaches.

References

Isroilov, R. I., Habibjonova, X. M. (2023). *Improving the methodology of increasing special physical preparedness of female handball players* [Gandbolchi qizlarning maxsus jismoniy tayyorgarligini oshirish uslubiyatini takomillashtirish]. “FAN-SPORTGA” ilmiy-nazariy jurnal, (1), 20–22.

Isroilov, R. I., Yusupova, Z. E., & Habibjonova, X. M. (2023). *Development of endurance and optimization of methods and means in young handball players* [Yosh gandbolchilarning chidamliligini rivojlantirish va vosita usullarini optimallashtirish]. Eurasian Journal of Academic Research, 134–140.

Mo‘minov, A. Sh., Rozibayev, M. M., Habibjonova, X. M., Xayitov, B. N., & To‘g‘onboyev, G‘. A. (2026). *Organization of training sessions at the initial preparation stage (handball)* [Boshlang‘ich tayyorgarlik bosqichida mashg‘ulotlarni tashkil etish (gandbol)] (O‘quv qo‘llanma). Tashkent: Evrika nashriyot-matbaa uyi MCHJ.

Habibjonova, X. M. (2025). *Analysis of the dynamics of training load orientation volume in highly qualified handball players* [Yuqori malakali gandbolchilarni yuklamalar yo‘nalishining hajmi dinamikasini tahlil qilish]. “FAN-SPORTGA” ilmiy-nazariy jurnal, (4), 27–31.

Habibjonova, X. M., & Yusupova, Z. E. (2024). *Analysis of the dynamics of training load orientation volume at the stage of special preparation* [Maxsus tayyorgarlik bosqichida yuklamalar yo‘nalishining hajmi dinamikasini tahlil qilish]. In *Proceedings of the International Scientific-Practical Conference “Ways of Developing Scientific and Methodological Support in Football”* (pp. 305–309).

Habibjonova, X. M. (2025). *Development of high intensity and endurance in handball* [Gandbol o‘yinida yuqori intensivlik va chidamlilikni rivojlantirish]. In *Proceedings of the Republican Scientific-Practical Conference “Functional and Psychodiagnostic Analysis of Athletes in Physical Education and Sports: Problems, Solutions and Prospects”* (pp. 78–81).

Xayitov, B. N. (2025). *Methodology for improving the technical preparedness of goalkeepers in handball* [Gandbol sport turida darvozabon texnik tayyorgarligini takomillashtirish metodikasi]. In *Interna-*

tional Conference on Multidisciplinary Science, 3(1), 104–108.

Xayitov, B. N. (2025). *Methodology for improving technical preparedness in annual handball training sessions* [Gandbolchilarni yillik tayyorgarlik mashg‘ulotlarida texnik tayyorgarligini takomillashtirish metodikasi]. In *International Conference on Interdisciplinary Science*, 2(2), 59–67.

Shestakov, I. G., & Repkin, S. B. (2020). *Analysis of long-term handball player training programs and development of recommendations for their modernization* [Анализ программ многолетней подготовки гандболистов и выработка рекомендаций по их модернизации]. *Mir sporta*, (2), 44–48.

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