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Original Article

Improving basketball technique at the initial training stage for boys

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Abstract:
In modern sports, scientists, coaches, and specialists continually seek new training methods across various disciplines while improving existing ones. Basketball is no exception. ***Purpose:*** To develop and assess the effectiveness of a methodology for teaching basketball technique to boys aged 8–10 at the initial training stage, with a focus on improving shooting accuracy. ***Materials and methods.*** The pedagogical experiment was performed during the 2023–2024 academic year using the sports facilities of a children's and youth sports school in Altay, Russia. A random selection method was used to recruit 24 boys aged 8–10 years who were enrolled in an initial basketball training group. The participants were divided into a control group (CG, n = 12) and an intervention group (IG, n = 12). Both groups followed the training program outlined by the federal standard. In the IG, the second half of the training was performed using a methodology we developed, which incorporated sets of various general physical and specialized exercises. The proposed methodology included exercises from gymnastics, aerobics, step aerobics, outdoor games, and sports activities, all designed to develop basic physical qualities and improve the accuracy of throwing a ball into a hoop. At both the beginning and end of the experiment, motor skills, throwing accuracy, and hand muscle strength were tested. **Results:** After completing the pedagogical experiment, it was determined that the results of motor skill testing, hand dynamometry, and strength index measurements showed significant improvements. The accuracy of one-armed shoulder throws by the participants from the IG significantly exceeded the values of these indicators in the young athletes from the CG, who followed the conventional methodology. **Conclusions:** The data obtained from testing the improved methodology for training basketball players at the initial stage of their annual macrocycle can be applied in the training plans of coaches working with 8–10-year-old basketball players in youth sports schools, as well as by physical education teachers in general education institutions.
Key Words: **basketball players, motor skills, physical training, physical education, motor activity, health**

Introduction

Basketball is a popular sport in many countries around the world (Hagiwara et al., 2020; Kobelkova et al., 2024) and is a speed–power game that places high demands on athletes (López-Sierra et al., 2025).

Research indicates that athletes in team sports, including basketball, have a considerable advantage in decision-making speed compared to professionals in other sports (Kudryavtsev et al., 2024; Vorozheykin et al., 2020;). Additionally, studies show that basketball training for children aged 7–10 years positively impacts their cognitive abilities (Policastro et al., 2018; Li et al., 2025).

During competitions, basketball players experience substantial physical exertion, covering distances of 5,000–7,000 m, performing 130–140 jumps, and executing up to 150 accelerations, with an average physiological intensity surpassing the lactate threshold and reaching 85% of the maximum heart rate (Stojanović et al., 2018). It has been established that the energy expenditure during the game is of a mixed aerobic and anaerobic nature (Gobatto et al., 2020). The primary indicator of aerobic capacity is maximum oxygen consumption, which increases as athletes' qualifications improve (Mancha-Triguero et al., 2020). Attention must be given to the substantial stress placed on the players' nervous systems, as well as the mental and physical effort required to achieve victory (Xue et al., 2024). Improving body balance is important for basketball players (Domeika et al.,

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2020; Kolokoltsev et al., 2021), and proprioceptive training can be an effective strategy for coaches to enhance athletes' physical performance and reduce the risk of injuries (Yılmaz et al., 2024). Core training, particularly on unstable surfaces, along with a combination of static and dynamic core exercises, has been shown to improve both athletic and professional performance in basketball players (Luo et al., 2023).

An analysis of the literature reveals that the effectiveness of athletes' sports development is directly influenced by the optimal integration of movement technique training and physical conditioning methods (Trushkova, & Trushkov, 2024; Sosa et al., 2025). Researchers and coaches across various sports disciplines emphasize that an athlete's level of general and specialized physical fitness considerably impacts their technique and overall performance (Rendón-Galvez et al., 2024). The training of physical qualities should occur in parallel with the refinement of sports techniques. In basketball, this includes improving the accuracy of throwing the ball into the hoop. At the same time, a basketball jump shot is regarded as a highly complex motor skill involving coordinated actions (França et al., 2021; Kryzhevsky et al., 2022). To achieve significant sports success and ensure continuous improvement, it is important to increase the functional base. This can be accomplished through the use of general developmental physical exercises and specialized training. Additionally, improving the relationship between motor qualities and skills, as well as optimizing the vegetative and functional characteristics of the athlete's body, plays an important role (Hernandez et al., 2024). Physical exercises play a key role in the development of a child's body, with the results of regular participation reflecting the level of physical development and functional fitness of those engaged in sports. During childhood and adolescence, the foundation for key motor qualities and skills is established (Li et al., 2025).

A high level of physical fitness improves the ability to perceive and respond effectively to changes in effort dynamics, as well as spatial and temporal variations during the execution of different types of motor activity (Larissa Fernanda Porto Maciel et al., 2024).

Motor skills are improved and developed through the acquisition of physical qualities that are essential for achieving high performance in a specific sports discipline (Brini et al., 2023; Mischenko et al., 2021;). The development of physiological qualities that influence motor actions plays a significant role in the effectiveness of technique training for athletes (Li et al., 2024; Osipov et al., 2024). According to Larsen et al. (2020), positive improvements in the cardiovascular system were observed in children aged 8–10 years after 10 months of intensive training, which included basketball and football activities. Therefore, control and pedagogical tests have become crucial benchmarks in the preparation of young athletes (Musiienko et al., 2025). In modern sports, consistent success and rapid improvements in performance are increasingly evident. Thus, coaches are exploring new training methods for basketball while also improving existing approaches (Gonzalo-Skok et al., 2025; Abade et al., 2025). However, the issue of improving the training process for children aged 8–10 years during the initial phase of learning basketball in children's sports schools is not fully addressed in the scientific literature. This complicates their sports development. We believe that incorporating innovative methods into training sessions for young basketball players in the early stages of their sports careers will considerably enhance their overall physical and technical training, ultimately improving the key skill in basketball—the accuracy of throwing the ball into the hoop.

Research aim: To improve and evaluate the effectiveness of a methodology for teaching basketball techniques to boys aged 8–10 years at the initial training stage, with a focus on improving the accuracy of throwing the ball into the hoop.

Materials and methods

The pedagogical experiment was performed over 52 weeks during the 2023–2024 academic year, using the sports facilities of the Children's and Youth School of the Olympic Reserve in Barnaul, Altai, Russia. A randomized design was used to select 24 boys aged 8–10 years (9.3 ± 1.2 years) who were in the initial stage of basketball training. They were divided into two groups: the control group (CG, n = 12) and the intervention group (IG, n = 12). The athletes in both groups showed no significant differences in their physical training levels, as confirmed by the results of preliminary testing. Parents or guardians provided written consent for their children to participate in the pedagogical experiment. The project adheres to the principles outlined in the 2008 Helsinki Declaration regarding the participation of individuals in medical and biological research. Researchers from various universities in Russia and Kyrgyzstan contributed to the study.

During the one-year educational experiment, 154 training sessions were performed for athletes in both groups, with each session lasting 2 h. The training sessions for basketball players in both groups followed a standardized structure, consisting of three main parts: the preparatory (warm-up), main, and final segments. Both the CG and IG followed a sports training program based on the protocol outlined in the Federal Standard for Sports Training in Basketball (Order of the Ministry of Sports of the Russian Federation, November 16, 2022, No. 1006). For athletes in the IG, the second half of each training session followed a basketball technique methodology developed by the authors of this study. The methodology focused on exercises designed to improve speed and coordination, which are key motor qualities for basketball players. To achieve this, the experimental program incorporated the physical exercise complexes developed by the authors to improve both general and special

physical fitness. IG athletes engaged in active and sports games, as well as physical exercises and individual elements of gymnastics, acrobatics, aerobics, and step aerobics. These activities were included once a week in their training regimen. At the start of the school year, general physical training accounted for 60%–70% of the total training time. However, in the second half of the macrocycle, the weekly training schedule allocated more time to technical, tactical, and integrated training.

Specialized sets of speed–strength exercises, adapted to the individual characteristics of the players, were developed for the athletes in the IG. Specially selected methods and exercises were used to improve the accuracy of shooting the ball at the hoop. For "point" tasks, IG basketball players threw the ball at varying distances: 2 m (short), 4 m (medium), and 6 m (long) from the hoop. In the "contrast" training method, athletes alternated throws from two different distances to the basketball backboard. The "close tasks" method involved alternating between short and long throws, with the distance gradually reduced by 100 cm after each attempt.

Physical fitness tests for young basketball players were performed both at the beginning and at the end of the experiment. The following test battery was used: 30-m sprint (s), 5 × 10 m shuttle run (s), standing long jump (cm), standing high jump (cm), and throwing a 1-kg ball (m). Dynamometry was used to assess hand strength for both hands (kg). The strength index was calculated using the standard formula. The accuracy of one-handed throws from the shoulder into the hoop was evaluated at distances of 2, 4, and 6 m. The calculation was made for 10 throws from the left and right sides of the shield at an angle of 45° to it.

Parametric statistical methods were used to calculate the arithmetic mean, its error, and the standard deviation. The reliability of the differences between the indicators was determined using the t-Student coefficient. A p-value of <0.05 was considered statistically significant for the differences in values.

Results

The use of motor tests at the beginning and end of the pedagogical experiment allowed for the assessment of changes in the physical fitness thresholds of young basketball players (Table 1).

Table 1. Results of testing the physical fitness of young basketball players in both experimental groups, M±m

No.	Tests	CG, n= 12		IG, n= 12	
		Beginning of observation	End of observation	Beginning of observation	End of observation
1.	30-m run, s	5.82±0.26	5.42±0.29	5.83±0.20	5.13±0.18*
2.	Shuttle run 5 × 10 m, s	16.80±0.47	16.46±0.44	16.70±0.43	15.20±0.26*
3.	Standing long jump with two legs, cm	163.5±3.46	175.2±4.87*	163.7±3.56	180.5±5.45*
4.	Standing high jump with two legs, cm	33.43±2.34	42.28±2.68*	33.4±2.26	46.45±2.96*
5.	Throwing a 1 kg ball, m	4.66±0.18	4.96±0.23	4.62±0.19	5.45±0.35*

*Note. * - reliable value of indicators in athletes at the end of the experiment, p <0.05*

At the beginning of the experiment, no significant differences were observed in the motor test indicators between the novice athletes in the CG and IG ($p > 0.05$), allowing the study to proceed. By the end of the experimental period, a positive trend was observed in the motor test indicators for all basketball players. However, athletes in the IG demonstrated a statistically significant improvement in all motor test indicators ($p < 0.05$), whereas the CG showed significant improvements in only two of the test exercises. Meanwhile, in the IG, the increase in all test indicators after the introduction of the methodology was significantly greater than in the CG (Figure 1).

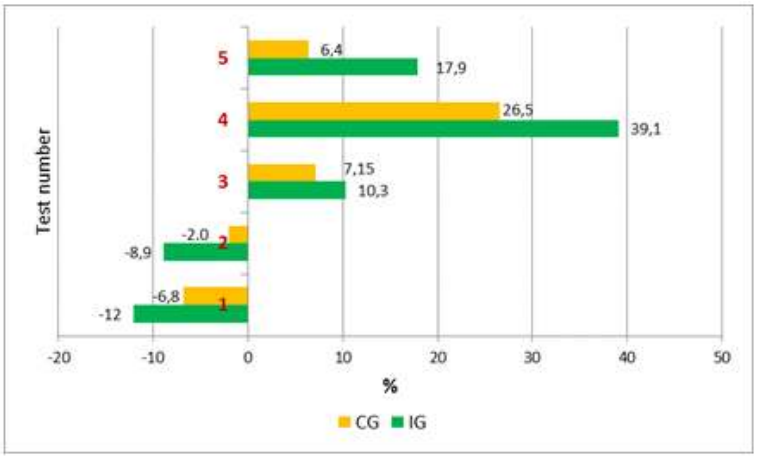

Fig. 1. Change in the values of motor test indicators after the implementation of the proposed method

In all motor tests, the increase in the values of the indicators for the boys in the IG was greater than that observed for athletes in the CG. The most significant improvements in the IG were noted in tests No. 4 (high jump from a standing position) and No. 5 (throwing a 1 kg ball), compared to the results of basketball players in the CG. The results presented in Figure 1 demonstrate the higher effectiveness of the proposed training method for young basketball players when compared to traditional training approaches.

During the pedagogical experiment, the accuracy of one-handed shoulder throws into the hoop was assessed, as shown in Table 2.

Table 2. Results of boundary testing for the skill "accuracy of throwing the ball into the hoop" in athletes from both groups, M ± m

No.	Control exercises	CG, n= 12		IG, n= 12	
		Beginning of observation	End of observation	Beginning of observation	End of observation
1.	Distance 2 m, number of hits	3.62±1.12	7.27±2.14*	3.43±1.32	9.56±3.56*
2.	Distance 4 m, number of hits	2.96±0.78	6.56±2.05*	2.82±0.83	8.87±3.22*
3.	Distance 6 m, number of hits	1.14±0.54	3.25±1.79	1.16±0.34	6.82±2.76*

*Note. * - reliability of the difference in the values of the indicators in athletes at the end of the experiment, p <0.05*

Before the experiment, no significant differences were observed in the "accuracy of throwing the ball into the hoop" skill between CG and IG athletes ($p > 0.05$), indicating a similar level of technical training. After the experiment, an increase in the number of successful shots was observed in both experimental groups. However, the "accuracy of throwing the ball into the hoop" skill was significantly more developed in the IG athletes compared to those in the CG ($p < 0.05$).

This improvement followed the implementation of the proposed training methodology for athletes in the IG, with greater increases observed in all control test indicators compared to the CG (Figure 2).

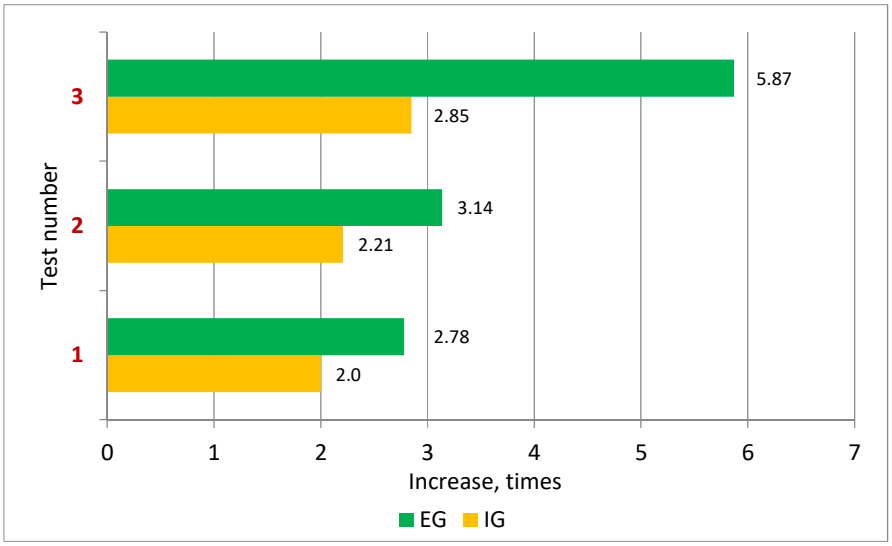

Fig. 2. Change in the accuracy of hoop throws in athletes from both experimental groups at the end of the pedagogical experiment, number of successful attempts

The best results in the "accuracy of throwing the ball into the hoop" skill were observed for throws at a distance of 6 m in both experimental groups.

Additionally, the accuracy of athletes in the IG was twice as high as that of the CG athletes. During the pedagogical experiment, changes were observed in the dynamometry indicators for both hands and the strength index for all athletes, as shown in Table 3.

Table 3. Boundary changes in hand dynamometry values and strength index in control and intervention group athletes, M ± m

No.	Tests	CG, n= 12		IG, n= 12	
		Start of observation	End of observation	Start of observation	End of observation
1.	Dynamometry of the left hand, kg	20.5±1.1	22.2±1.5	20.4±1.0	23.7±1.6*
2.	Dynamometry of the right hand, kg	21.1 ±1.2	22.8±1.6	21.2 ±1.2	24.3±1.7*
3.	Strength index of the left hand, %	70.6 ±3.2	74.3±3.5	70.3±3.3	79.6±4.1*
4.	Strength index of the right hand, %	72.7±3.7	76.4±3.9	73.1±3.8	82.4±4.7*

*Note: * indicates reliability of the difference in the values of the indicators in athletes at the end of the experiment, $p < 0.05$.*

At the beginning of the pedagogical experiment, no significant differences were observed in the dynamometry indicators and strength index between the CG and IG athletes ($p > 0.05$). However, after the implementation of the technique, an increase in the strength indicators for both hands was noted in athletes from both experimental groups. A significant improvement in hand muscle strength and the strength index was observed in the IG basketball players ($p < 0.05$), indicating the effectiveness of the proposed method in enhancing strength training in basketball players at the initial stage of the annual macrocycle.

Dicussion

Improving the basketball training process continues to be a relevant topic among specialists in the field of sports activities. This is indicated by numerous modern studies by authors who are engaged in this problem (Gonzalo-Skok et al., 2025; Abade et al., 2025). Therefore, this study is timely and necessary for specialists and coaches in this sport. Particularly important is the development of effective methods for training young basketball players at the initial stage of their involvement in sports activities, which allows creating a promising reserve of athletes in this sport.

It is known that modern basketball is characterized by a significant increase in the load in sports matches (Stojanović et al., 2018). This creates high demands on the physical fitness of players, which is especially evident in the final stages of the sports game. Therefore, in the training of young basketball players, it is necessary to pay attention to the development of effective exercises for general and special physical training. An important role is given to the development of techniques and exercises aimed at developing the skills of accurate throwing the ball into the hoop. To solve such problems in the training of young basketball players aged 8-10 years, the methodology was improved and tested. The experimental methodology was based on a set of various exercises aimed at developing physical abilities and motor skills. These included: general developmental exercises, specially selected complexes, as well as elements and training tasks from other sports, such as acrobatics, including jumping exercises. We agree with the opinion of other researchers that the effectiveness of the sports improvement process depends on the combination of mastering the technique of movements and the methodology of physical training of athletes (Sosa et al., 2025). We believe that to achieve significant results in sports, it is necessary to continuously expand the functional base (Hernandez et al., 2024). According to our recommendation, young athletes in the experimental group performed specialized sets of exercises in various modes - point, contrast and close tasks. The use of such a technique significantly increased the accuracy of one-handed overhand throws in subjects from the intervention group.

During the pedagogical experiment conducted using the improved training process methodology, a higher growth dynamics of the values of the motor quality indicators of young basketball players in the implementation group was established compared to the result in the control group. We believe that these changes occurred as a result of the use of physical exercises and sports games of speed, strength and coordination orientation. Exercises from gymnastics, acrobatics and aerobics, which were used in the educational and training process, also played a role. The positive dynamics in jumping tests can be explained by the fact that jumping-oriented sports disciplines were used in the educational and training sessions of young basketball players in the intervention group. These were volleyball, handball and, of course, basketball, which contribute to an increase in the speed-strength qualities of the lower limbs of athletes. A significant increase in the values of the strength index and dynamometry of the hands of athletes in the intervention group occurred as a result of the use of strength complexes from aerobics and acrobatics. This contributed to the targeted development of this motor quality in young athletes.

The key skill in basketball is the accuracy of throwing the ball into the hoop (Franca et al., 2021). At the beginning of the pedagogical experiment, the results of testing young basketball players in both groups showed that the subjects had approximately the same accuracy in hitting the ball into the hoop with one hand at different distances. As a result of improving the skill of hitting the ball into the hoop during the pedagogical experiment, an improvement in the accuracy of hitting the ball into the hoop was revealed in athletes in both observation groups. However, in the implementation group, the increase in the accuracy of hitting the ball into the hoop was greater than in the comparison group. This confirms the effectiveness of the proposed methodology and exercises that are aimed at developing the accuracy of throwing meat into the hoop.

Conclusions

To improve the effectiveness of teaching basketball techniques to boys aged 8–10 at the initial stage of sports training, an experimental methodology was developed and tested. The proposed methodology was based on specially designed complexes of various physical exercises, incorporating elements from gymnastics, aerobics, acrobatics, and sports games. These exercises were aimed at developing speed–strength, coordination qualities, and the skill of accurately shooting the ball into the hoop.

At the end of the pedagogical experiment, it was observed that the results of testing motor qualities, hand dynamometry, strength index, and the accuracy of one-handed shoulder throws in the participants from the IG significantly exceeded the same indicators in the young basketball players from the CG, who followed the conventional training method. This demonstrates the high effectiveness of the training sessions using the proposed method. The results obtained from testing the improved methodology for training basketball players aged 8–10 years at the initial stage of their annual macrocycle are of practical importance. These findings can be applied by coaches at children's sports schools when developing training plans and by physical education teachers in general education institutions.

Conflicts of interest. The authors declare no conflict of interest.

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