

The Impact of Mini-Basketball Training Sessions on the 6-7-Year-Old Boys' Physical Fitness and Physical Development

Olena Mitova¹, Grygoriy Griban^{2,*}, Dmytro Oleniev³, Artem Yakovenko¹, Viola Onyshchenko⁴, Oleksandr Mozolev⁵, Bogdan Semeniv⁶, Andrii Lytvynenko⁷, Oksana Khurtenko⁸, Svitlana Zamrozevuch-Shadrina⁹, Larysa Kozibroda¹⁰, Maryna Hres¹¹

¹Department of Sport Games, Prydniprovsk State Academy of Physical Culture and Sport, Dnipro, Ukraine

²Department of Physical Education and Sport Improvement, Zhytomyr Ivan Franko State University, Zhytomyr, Ukraine

³Department of Theory, Methodology and Organization of Physical Training and Sports, The National Defense University of Ukraine named after Ivan Cherniakhovskiy, Kyiv, Ukraine

⁴Municipal Institution, Dnipropetrovsk Professional College of Sports, Dnepropetrovsk Regional Council, Dnipro, Ukraine

⁵Department of Tourism, Theory and Methods of Physical Culture and Valeology, Khmelnytskyi Humanitarian-Pedagogical Academy, Khmelnytskyi, Ukraine

⁶Department of Physical Education, Sports and Health, Stepan Gzhytskyi National University of Veterinary Medicine and Biotechnologies Lviv, Lviv, Ukraine

⁷Department of Physical Education, Kharkiv National University of Radio Electronics, Kharkiv, Ukraine

⁸Department of Theory and Methods of Physical Education, Vinnytsia Mykhailo Kotsiubynskiy State Pedagogical University, Vinnytsia, Ukraine

⁹Department of Professional Methods and Technologies of Primary Education, Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine

¹⁰Department of Physical Education, Lviv Polytechnic National University, Lviv, Ukraine

¹¹Department of Physical Education, Zhytomyr Polytechnic State University, Zhytomyr, Ukraine

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Abstract The aim of the research is to investigate the level of physical fitness and physical development of 6-7-year-old boys before and after the implementation of the authors' program of mini-basketball training sessions at the stage of initial training. The research involved 32 6-7-year-old boys, who were divided into experimental (EG) and control (CG) groups of 16 each. Physical fitness of boys was assessed by the following tests: 3x10 m shuttle run with running around stuffed balls, 4x9 m shuttle run, running to numbered stuffed balls, assessment of the sense

of time, standing long jump, standing high jump, 10 m run, angle body from a sitting position, Romberg test. Physical development of boys was assessed by indicators of height, body weight, wrist dynamometry, vital capacity of the lungs, heart rate and blood pressure. As a result, the Robinson, Rufier, Kettle, vital and strength indices were calculated. At the end of the experiment the EG boys revealed significantly better indicators of coordination skills, static balance, sense of time, speed and strength qualities in comparison with the CG boys. There was also a

positive effect of the authors' program on the physical development of boys: the Robinson and Rufier indices improved significantly in the EG. It was established that authors' program of mini-basketball training sessions, which is built according to the age peculiarities of 6-7-year-old boys, creates the most favourable conditions for the development of physical qualities in boys, their harmonious physical development, improvement of body function and revealing cognitive abilities.

Keywords Mini-Basketball, Physical Fitness, Physical Development, 6-7-Year-Old Boys, Stage of Initial Training

1. Introduction

The leading experts in sports science have substantiated in their research for many years various components of the theory and methods of team sports, including basketball [1-5]. Despite scientists' sufficient attention to the problems of basketball [6-9], a number of issues remain unresolved regarding the structure and content of the educational and training process at the stage of initial training. This is primarily due to different opinions of scientists about the age limits, i. e. the age of children, from which they should start playing this team competitive sport. The issue of starting mini-basketball training sessions remains especially acute.

Given the different viewpoints of experts on the early start of team sports games, the world practical experience of leading countries [10-13] shows that children begin to successfully master the basics of basketball from 6-7 years of age, and regularly train in sport classes and perform in competitions from the age of eight. The main difference in these countries is the organizational and methodological conditions of the educational and training process of beginners. The world practice shows [10, 14, 15] that the leading type of basketball, created specifically for children from 6 years of age, is the game of mini-basketball, which was founded in 1948. Much attention has been paid by foreign scholars to the development of mini-basketball at the international level. Moreover, many experts from around the world [11, 16, 17] have developed and disseminated practical recommendations in the open scientific space that contain examples of exercises for mini-basketball. However, the structure and content of the educational and training process, as well as the dosage of physical activity during mini-basketball training sessions to improve the level of physical fitness and physical development of 6-7-year-old children is insufficiently studied, which determines the relevance of our research.

2. Literature Review

World practice shows the creation and development of

special games for 6-7-year-old children in many countries, such as: mini-basketball, mini-tennis, mini-volleyball and emphasizes their popularity, as well as the positive impact on the physical and mental condition of children and their harmonious physical development [18, 19].

The analysis of literature sources on the general theory of sports [20, 21, 22] made it possible to reveal the objective and main tasks of the initial training stage in team sport games, to characterize the main methods and tools of training, to determine general and special physical and mental qualities to be developed in young athletes, however, no structure and content of the educational and training process during the first year of training in mini-basketball were found in the analysed literature.

The studies of many scientists proved that ball exercises have a positive effect on physical development and working capacity of the child, promote his / her visual estimation, concentration, agility, rhythm, coordination of movements and orientation in space. Exercises with balls of different weight, volume and texture develop not only large but also small muscles of both hands; increase the mobility of the joints of fingers and hands. Ball games also develop the child's physical qualities: speed, jumping ability and strength [23, 24, 25]. The development of physical qualities i. e. strength, speed, endurance, flexibility and agility correlates with the general growth and development of the organism, morphological and functional maturation of the central nervous system, musculoskeletal and autonomic systems. The processes of intramuscular coordination are improved in connection with the differentiation of motor nerve endings in the muscles up to the age of 6-7 years, which increases the strength manifestations [26, 27]. Children are notable for their expressed flexibility in the period of the first childhood. This quality is gradually reversible without training in ontogenesis. It is necessary to take into account the following aspects when conducting the training process with 6-7-year-old children: untimely ossification of certain parts of the skeleton; disproportionality in accordance with the individual elements of the cardiovascular and respiratory systems; frequent mismatch of the body's reactions to the significance, magnitude and strength of the stimulus; weakness of inhibitory and predominance of excitatory processes [13, 28, 29].

There is a noticeable morphological and functional reorganization of the organism at the age of six in most children, compared with their predecessors. The child noticeably grows by this age, his / her body weight increases, movements become more coordinated. 6-7-year-old children's musculature is still poorly developed, especially the muscles of the back and abdomen, the growth rate of the lower and upper extremities increases, the overall configuration of the torso, especially the chest, changes. Oxygen consumption considerably increases by six-year-old and older children during movements and further indicators of their aerobic possibilities increase to 10-12 years that depends largely on

mobility of the child. Children are very sensitive to the influence of deforming factors, especially the vertebral spine during this period [14, 16]. Excessive rotation or bending of the head is not desirable in the games of 6-7-year-old children, as this can lead to severe damage to the cervical vertebrae. Games that require forceful tension of the spine (types of tug-of-war) are not recommended for them. Such games are possible with children from the age of nine. The musculoskeletal system in children of this age is adapted mainly to dynamic loading. Static loading, even small (support of the torso when sitting in classroom or standing) is difficult for children to tolerate, especially at the age of 6-7 years. Games should be short in time and accompanied by frequent breaks. In addition, the scientists have proven that insufficient physical activity negatively affects the intellectual and mental development of the child [10, 11]. The force of nervous processes in this age period is still underdeveloped. In this case, the excitation processes prevail over the inhibition processes. Children at this age are restless, irritable and inattentive. They have difficulty performing monotonous tasks. Their movements are often spontaneous, chaotic and irrational. They spend a lot of energy on a task, because they involve different muscle groups at the same time. Excessive physical activity leads to increased excitability of the child's nervous system. Fatigue in children is much faster than that in adults. This is due to the fact that there is no accumulation of lactic acid in the blood of 6-7-year-old children (as in the elderly) with a heavy load. Due to this, the energy resources of primary school children spent during work are restored quite quickly [22, 30, 31].

The reason for the rapid fatigue of the child is due to the peculiarities of the cardiovascular system. The child's speed of blood circulation is higher than in adults. This is due to the fact that the vessels in children are wider. The volume of blood relative to body weight is greater, the range of blood flow is shorter i. e. all this leads to a slight irregular heartbeat, especially during prolonged exercise. The cardiovascular system is poorly developed: the normal heart rate is 90-100 beats / min, and after exercise often reaches 200 beats / min. At the end of the first year of study, sports, in particular games, reduce this difference in heart rate to a normal level. This indicates that 6-7-year-old children adapt relatively quickly to playing games. The resulting physical activity strengthens the cardiovascular and nervous systems, has a positive effect on the respiratory and musculoskeletal systems, and improves metabolism in the body [23, 26]. The game has a positive effect on the mental development of children [10, 32, 33]. Taking actions with objects, the child begins to operate in a supposed, conditional space. Gradually, play activities are reduced, and the child begins to act internally and mentally. The child turns to thinking in images and ideas [12, 34, 35].

Currently, the issue of rational selection of tools of physical education and sports in primary school age is of particular importance, as it was found that there are

significant functional reserves in the body of children in this age period. However, these age opportunities are not used enough, as a result of which the level of physical fitness is low. It is also necessary to take into account the amount of load and alternate intensive exercises with less active exercises that would be useful during the training session and act as a rest. It is very important at the initial stage of training not to harm the child's health and control their physical condition during the training session, changing the amount of load (increasing and decreasing, which will correspond to the specifics of the sport when there are "active" and "passive" phases of the game). Therefore, it is important to approach the planning of the structure and content of the educational and training process with great responsibility.

According to modern ideas about the health effects of exercise within a single training session, the maximum dosage of each load is the body's response with a maximum heart rate of 160-170 beats min^{-1} , and the minimum parameters of the training session is 30-35 minutes. Pulse values of physical exercises for individual components of physical potential should be as follows: exercises for the speed component – 150-160 beats min^{-1} , the coordination component – 140 beats min^{-1} , the strength component – 130-140 beats min^{-1} , the speed-strength component, the speed and speed-strength endurance – 170-190 beats min^{-1} , total endurance – 130-140 beats min^{-1} [36].

The child learns to navigate and becomes smarter. The child learns to quickly analyse the situation in the process of sports game playing, and therefore, it activates thinking and memory. Sports game is quite important for the moral upbringing of the child. Children learn to act collectively through obeying general requirements. The rules of the game are perceived as the law and the conscious implementation of such rules forms the will, endurance, self-control and mastery of one's own behaviour. Team sports games promote the rapprochement of children, the emergence of friendship between them [37, 38]. Therefore, the planning of physical activity during mini-basketball training sessions should be carried out taking into account the age peculiarities of 6-7-year-old children. Thus, we formulated the working hypothesis of our research: it is assumed that the introduction of the authors' program of training children in the first year of mini-basketball, developed taking into account the age peculiarities of 6-7-year-old children and current global trends in mini-basketball, will increase their physical fitness and physical development.

The Aim

The aim of the research is to investigate the level of physical fitness and physical development of 6-7-year-old boys before and after the implementation of the authors' program of mini-basketball training sessions at the stage of initial training.

3. Materials and Methods

3.1. Participants

The research was conducted in 2020-2021 on the basis of specialized children's youth sports school (CYSS) No. 5 (Dnipro, Ukraine). The research involved 32 6-7-year-old boys, who were divided into experimental (EG) and control (CG) groups of 16 each. There was no special selection. Indicators of the initial level of physical fitness and physical development of the EG and the CG boys did not have a significant difference ($p > 0.05$).

3.2. Procedure

The number of training hours in each group was 108 hours in 9 months of the experiment. The duration of one training session in both groups was 60 minutes. The CG boys were engaged in accordance with the existing Curriculum for Children's and Youth Sports School [39], the EG boys – according to the authors' program [40, 41]. Taking into account the experience of basketball and mini-basketball development in the United States and the leading countries of Europe and the world, we have developed the authors' program of mini-basketball training sessions for 6-7-year-old children called "Four-block structure and content of "Introduction-Interest-Adaptation-Habit" educational and training process of the first year basketball players". The authors' program provided a comprehensive approach to building the structure and content of the educational and training process of mini-basketball during the first year of training (6-7-year-old children), which includes four blocks: "Introduction", "Interest", "Adaptation", "Habit"; with the division of the program material into *theoretical*, *motivational*, *practical* and *check-up* sections in accordance with the tasks of the initial training stage, which improves the effectiveness of learning the basics of game technique, development of physical qualities, improving physical development, mastering theoretical knowledge and motivating children to play sports. The content of the educational material on the authors' program of mini-basketball training sessions is built in accordance with the age peculiarities of 6-7-year-old children, which includes: tools, methods and forms of education; it provides for the regulation of physical activity during the year and during a separate training session, depending on the training block; creation of the most favourable conditions for the disclosure of cognitive abilities; development of physical and specific qualities (feeling of the ball, sense of time); harmonious physical development; strengthening physical health and increasing the functional capabilities of the body; formation of motivation to play sports, taking into account the interests of the child's personality in terms of self-expression and manifestation of his / her potential in team activities.

The theoretical section was proposed taking into

account the age peculiarities of children. Improving the effectiveness of theoretical training of children depends on the methodological education of trainers on innovative forms, tools and methods of presenting theoretical material during the educational and training process. New forms of presenting theoretical material were proposed in order to qualitatively master the knowledge on mini-basketball: presentations, creative tasks, mini-lectures, etc. The acquisition of theoretical knowledge was carried out mainly at the beginning of the training session; it took from 2 to 5 minutes. In addition, a workbook called "Theoretical practicum on mini-basketball for children of the first year of training" was developed especially for young ones. The workbook presents the content of theoretical material and tasks for independent work (drawing pictures of basketball equipment, ball, playground; solving crossword puzzles; solving problems and examples of scores during a basketball game, etc.).

The main tasks of *the motivational section* were to increase children's interest in mini-basketball training sessions and to form motivation in order to involve children in various forms of physical culture and sports as well as to popularize this sport. The tasks of the motivational section were realized during the participation of children in competitions, specially organized events – basketball holidays. The main focus was on attending sports competitions of the top and Super League teams. We developed scenarios for five holidays, which were held in each of the 4 blocks during the year and had a specific focus and names: "Dedication to Young Basketball Players" (September), "Orange Ball" (October), "Basketball Birthday" (December), "Player" (March), "Team" (May). We used computer games to encourage 6-7-year-old children to play mini-basketball; they are freely available in the Playmarket on the Internet (Basketball Horse, Mini-Basketball Arcade, Shootin Hoops, Groovy Hoops, etc.) and contain visual fragments of a game of basketball, players, cartoon characters who perform basketball tricks, etc.

The practical section was aimed at solving the following tasks:

- training of skills and abilities i. e. performing various exercises and action-oriented games without a ball, with a ball, as well as with the use of other equipment (tennis ball, gymnastic hoop, inflatable balls, etc.) to teach the simplest technical elements (movement on the playground without a ball – walking, running, jumping, stopping, stance; holding and rolling a ball; catching and passing with both hands; keeping the ball in place and in motion, juggling; throwing a ball into the wall, to the partner, into the basketball hoop);
- increasing the level of physical fitness i.e. the development of physical qualities: coordination skills (orientation of the body in space; spatio-temporal perception), flexibility, strength, speed, and strength qualities;

- increasing the level of physical development i. e. the use of exercises to improve the functioning of the basic systems of the body, promote the harmonious formation of the musculoskeletal system, etc.

The check-up section included assessing the level of physical and theoretical fitness of 6-7-year-old children, as well as monitoring the regularity of attending training sessions and participating in activities.

Verbal, repetitive and game teaching methods were used during the educational and training sessions. The main attention was paid to the rational distribution of physical activity during the training session, taking into account the peculiarities of adaptation of the body of 6-7-year-old children. Specially created balls for mini-basketball of the 5th (weight of 470-500 g) and 3rd size (weight of 300-330 g) and additional equipment were used during the training sessions. The task of the training was to create a motor vision of techniques, but special attention was paid to the formation of motor skills and abilities in children, as further detailed training will take place during the next years of education.

The key in authors' program is to plan the load for the year according to the block system for the first year of training sessions, taking into account the age characteristics of 6-7-years-old children, which is different compared to other years of training (e. g. 7-8-years-old

children) and the organization of which determines further attitude of the child to sports, healthy lifestyle and motor activity. The program is designed so as to rouse interest in children to play mini-basketball, to create a base for further mastery of the basics of the game, development of coordination skills, speed skills, work with the ball and various equipment, increasing communication skills between coaches – children – parents of children, as well as between children in a team (group), revealing the potential of each child in team activities, forming motivation and interest in training sessions through the right tools, forms, including organized basketball holidays, the use of theoretical workshops and more.

The main differences between the content of the authors' program and the curriculum for CYSS were: distribution of hours by sections during the year; planning according to 4 blocks ("Introduction", "Interest", "Adaptation", "Habit"); division of educational material into 4 sections (theoretical, motivational, practical, check-up); lack of division of physical training into general and special as separate subclasses; distribution of the content of the practical section in three areas: skills and abilities, physical qualities, physical development; inclusion into the educational and training process of modern forms and tools for the formation of interest and motivation to mini-basketball training sessions; inclusion of innovative forms and tools of theoretical training (Table 1) [40, 41].

Table 1. Distribution of hours during the first year of training in mini-basketball for 6-7-year-old boys in the EG and the CG

EG			CG		
Training sections	Total for the year		Training sections	Total for the year	
	hrs.	%		hrs.	%
Theoretical section	10	9.26	Theoretical training	2.5	2.27
Practical section	70	65.28	General physical training	27	25
physical training	28	25.93	Special physical training	16	14.77
technique training	26	24.07	Technique training	36	32.95
physical development	16	14.81	Tactical training	11	10.23
Motivational section	18	16.66	Game (integral) training	7	6.82
Check-up section	10	9.26	Result-rating examinations, testing	2.5	2.27
			Competitions	6	5.68
Total number of hours for the year	108	100	Total number of hours for the year	108	100

Table 2. Distribution of hours during the first year of training in mini-basketball for 6-7-year-old EG boys

Training sections	Months										Total number of hours for the year
	IX	X	XI	XII	I	II	III	IV	V		
	Block No. 1 “Introduction”		Block No. 2 “Interest”		Block No. 3 “Adaptation”			Block No. 4 “Habit”			
Theoretical section	3		2		3			2		10	
Practical section	14		15		26			15		70	
<i>skills and abilities</i>	3		4		12			7		26	
<i>physical qualities</i>	6		8		8			6		28	
<i>physical development</i>	5		3		6			2		16	
Motivational section	5		5		4			4		18	
Check-up section:	2		2		3			3		10	
<i>theoretical training</i>	+		+		+			+			
<i>physical training</i>	+		+		+			+			
<i>physical development</i>	+		+		+			+			
Total number of hours for the blocks	24		24		36			24		108	

The proposed structure of the educational and training process consisted of 4 blocks, the duration of which corresponded to four quarters in the general institution of secondary education (school), which in our opinion is a rational combination during the first year of adaptation to educational and training sessions and is convenient for attending classes, which take place in gyms on the basis of schools. Thus, the 1st block was called “Introduction” (September-October), the 2nd block – “Interest” (November-December), the 3rd block – “Adaptation” (January-March), the 4th block – “Habit” (April-May), which were proposed taking into account the adaptation processes to physical activity (Table 2).

3.3. Methods

The following scientific methods were used during the research: analysis and generalization of literature sources, pedagogical observation, pedagogical testing, pedagogical experiment and methods of mathematical statistics.

The analysis and generalization of special literature, documentary materials, information on the Internet allowed to determine the problem field of the research, get a general idea of the degree of development of the research problem, to identify basic data on children’s age peculiarities, the impact of basketball training sessions on children’s bodies, to analyse experience of the predecessors on the different construction of the training process at the stage of initial training in team sports games. The analysis of literature data also allowed studying the current state of mini-basketball in the curriculum for CYSS.

The pedagogical observation was conducted to study the peculiarities of the organization of the educational and training process of young basketball players at the stage of initial training, namely: tools and teaching methods used in practice; peculiarities of mastering the game technique; peculiarities of physical activity.

The pedagogical testing of physical fitness was carried out according to the tests (Table 3).

Table 3. The content of 6-7-year-old boys' physical qualities testing

Tests	Testing procedure
3x10 m shuttle run with running around stuffed balls, s	The test is designed to determine coordination skills. Equipment: a 10 m long track bounded by two parallel lines; there are 2 semicircles behind each line with a radius of 50 cm with the centre on the line; 2 stuffed balls, each weighing 2 kg; stopwatch. Carrying out the test: the participant comes to a standing starting position behind the starting line on either side of the stuffed ball upon "On your marks!" command. He, upon "Go!" command, runs the first 10 m, runs around the stuffed ball, which is in a semicircle from a convenient side. He returns back, runs around the stuffed ball in the second semicircle again. He runs 10 m for the third time and finishes. The result is the time of overcoming the shuttle distance, determined to the nearest 0.1 s. The task is performed in sports shoes. The track should be smooth, not slippery, and in good condition. High level of coordination abilities is achieved at < 9.9 s, higher than average – 10.0 - 10.2 s, average – 10.3 - 10.8 s, lower than average – 10.9 - 11.1 s, low – > 11.2 s.
4x9 m shuttle run, s	The test is designed to determine coordination skills. Equipment: a 9 m long track, bounded by two parallel lines; 2 wooden cubes; stopwatch. Carrying out the test: a participant begins to run at the maximum speed upon "Go!" command. He reaches the cubes, turns and begins to move in the opposite direction. The result is the time of overcoming the shuttle distance, determined to the nearest 0.1 s. The task is performed in sports shoes. High level of coordination abilities is determined at < 12.3 s, higher than average – 12.4 - 13.0 s, average – 13.1 - 13.8 s, lower than average – 13.9 - 14.5 s, low – > 14.6 s.
Running to numbered stuffed balls, s	The test is designed to determine coordination skills. Equipment: 5 stuffed balls of 3 kg each; 1 stuffed ball of 4 kg; stopwatch; tape-measure; chalk. Carrying out the test: a boy is standing in front of a 4 kg stuffed ball. There are 5 stuffed balls of 3 kg with numbering from 1 to 5 (arbitrary numbering) in circles behind him at a distance of 3 m and 1.5 m from each other. The coach calls the number, the boy turns 180°, runs to the appropriate stuffed ball, touches it with his hand and returns back to the 4 kg ball. As soon as he touches the ball, the coach calls another number, etc. The exercise ends after the boy has done it three times and then touched the 4 kg stuffed ball. The result is the time of the exercise to the nearest 0.1 s. After explanation and demonstration, the participant performed one attempt. The position of the balls must be changed before each new participant. This test is performed both in the air and in the gym. High level of coordination abilities is determined at < 11.0 s, higher than average – 11.1 - 11.9 s, average – 12.0 - 13.3 s, lower than average – 13.4 - 14.3 s, low – > 14.4 s.
Assessment of the sense of time, 5 s, 10 s	The test is designed to assess the sense of time. Equipment: stopwatch. Carrying out the test: a boy runs in place at a moderate pace, bending the knees to a right angle between the thigh and shin, upon the signal of the coach, for 5 seconds. After that, the test participant reproduces the duration of the run for 5 seconds. The coach checks the correctness of run time reproduction using the stopwatch. Then it is suggested to do the same for 10 seconds. Result. The deviation from the reproduction of the time interval is determined to the nearest 0.1 s. A value with a "plus" sign means exceeding the time interval, with a "minus" sign – not reaching the set time. The test participant should not count the time. Only one attempt is in progress. The norms of deviation of the sense of time in 6-7-year-old boys are: typical – 0.5 – 1 s, excessive – more than 1 s.
Standing long jump, cm	The test is designed to determine the explosive strength. Equipment: tape-measure, chalk. Carrying out the test: preparatory position – standing, toes are in front of the starting line. The arms are pulled back, bending the legs at the knees and, pushing off with both feet, making a sharp swing of the arms forward, you need to jump along the mark. 3 attempts are given; the best result is entered in the protocol. The result is the distance from the starting line to the extreme point of the foot (behind). High level of explosive strength of legs is determined at > 130 cm, above average – 129-117 cm, average – 116-105 cm, lower than average – 104-93 cm, low – < 92 cm.
Standing high jump, cm	The test is designed to determine the speed and strength qualities. Equipment: tape-measure, chalk. Carrying out the test: preparatory position – standing, raise your hands up and make a mark on the wall with your fingers. The arms are pulled back, bending the legs at the knees and, pushing off with both feet, making a sharp swing of the arms up, you need to jump up and touch your fingers as high as possible above the mark on the wall. 3 attempts are given; the best result is entered in the protocol. The result is the distance from the original mark to the highest possible. High level of speed and strength qualities is determined at > 27 cm, higher than average – 26-24 cm, average – 23-20 cm, lower than average – 19-17 cm, low – < 17 cm.
10 m run, s	The test is designed to determine the speed qualities. Equipment: straight flat track with a dense surface of at least 15 m. Carrying out the test: a participant performs running at the maximum speed upon "Go!" command. The speed decreases after the finish line. The result is the time to overcome the distance, determined to the nearest 0.1 s. High level of speed qualities is determined at < 1.8 s, average – 1.9-2.5 s, low – > 2.5 s.
Angle body from a sitting position, cm	The test is designed to determine flexibility. Equipment: ruler. Carrying out the test: a participant sits on the floor with his legs straight. The participant leans forward and tries to get his feet upon "Go!" command. The torso and head actively lean forward and down. The distance between the fingers and toes is measured using a ruler. Score: good flexibility – touching the feet with your fingers; average – the distance between the fingers and toes is 10-15 cm; low – the distance is over 15 cm.
Romberg test, s	The test is designed to determine static coordination. The participant is standing with his feet joined (the heels and toes together), eyes are closed, arms are outstretched, toes are slightly apart. The time of stability in this position is determined. When the balance is lost, the test is stopped and the time of its execution is recorded. Rocking, and even more rapid loss of balance indicate a violation of coordination. Assessment: high level of static coordination is determined at more than 13 s; average level – 13 s; low – 13 s and less.

Table 4. The content of 6-7-year-old boys' physical development testing

Indices	Testing procedure
Robinson index, c.u.	The index allows you to assess the functionality of the cardiovascular system. It is defined as a product of heart rate and systolic blood pressure. High level of functionality of the cardiovascular system in 6-7-year-old boys is determined at < 70 c.u., above average – 71-75 c.u., average – 76-85 c.u., lower than average – 86-95 c.u., low – > 96 c.u.
Vital index, ml kg ⁻¹	The index allows you to assess the functionality of the respiratory system. It is defined as the ratio of lung capacity to body weight. High level of functionality of the respiratory system in 6-7-year-old boys is determined at > 76 ml kg ⁻¹ , above average – 75-66 ml kg ⁻¹ , average – 65-56 ml kg ⁻¹ , below average – 55-51 ml kg ⁻¹ , low – < 50 ml kg ⁻¹ .
Rufier index, c.u.	The index allows you to assess the level of physical working capacity of a boy. It is defined as $(4(\text{heart rate}_1 + \text{heart rate}_2 + \text{heart rate}_3) - 200) / 10$. A boy's heart rate (heart rate ₁) is determined at rest. He then performs 30 deep squats, throwing his arms forward for 45 seconds. The heart rate for the first 15 s after exercise (heart rate ₂) is calculated, and then for the last 15 s of the first minute after exercise (heart rate ₃). High level of physical working capacity of 6-7-year-old boys is determined at < 3.9 c.u., above average – 4.0-5.9 c.u., average – 6.0-9.9 c.u., below average – 10.0-14.9 c.u., low – > 15.0 c.u.
Kettle index, g cm ⁻¹	The index allows you to estimate the ratio of weight and height of a boy. It is defined as the ratio of body weight to body length. High level of Kettle index in 6-7-year-old boys is determined at > 260.0 g cm ⁻¹ , above average – 259.9-237.0 g cm ⁻¹ , average – 236.9-220.0 g cm ⁻¹ , below average – 219.9-195.0 g cm ⁻¹ , low – < 194.9 g cm ⁻¹ .
Strength index, %	The index allows you to assess the strength capabilities of a boy. It is defined as the ratio of the wrist dynamometry to body weight. High level of strength capabilities of 6-7-year-old boys aged is determined at > 66.0 %, higher than average – 65.0-61.0 %, average – 60.0-51.0 %, lower than average – 50.0-46.0 %, low – < 45.0 %.

Physical development of boys was assessed by indicators of height, body weight, wrist dynamometry, vital capacity of the lungs, heart rate and arterial blood pressure. As a result, the Robinson, Rufier, Kettle, vital and strength indices were calculated (Table 4).

During the *pedagogical experiment*, we implemented the authors' program and tested its impact on the level of physical fitness and physical development of 6-7-year-old boys of the EG, who attended mini-basketball training sessions for 9 months (from September 2020 to May 2021).

3.4. Statistical Analysis

During the research, the authenticity of difference between the indicators of boys by means of Student's t-test was determined. The dynamics of indicators in each of groups was also estimated. The significance for all statistical tests was set at $p < 0.05$. All statistical analyses were performed with the SPSS software, version 22, adapted to medical and biological researches.

3.5. Study's Limitation

We did not monitor the workload of EG boys during physical education training sessions at school, at home, during other sports classes, so we assessed only the impact of 108 hours of mini-basketball training sessions for 9 months.

3.6. Ethical Approval

The research was carried out according to the requirements of the Code of Ethics of Prydniprovsk State Academy of Physical Culture and Sports. This document

was approved by the Academic Council of Prydniprovsk State Academy of Physical Culture and Sports (protocol No. 12 of 29 December 2019) and implemented by the order of the Rector of the Academy. According to its provisions, the members of the scientific community are guided by the principles of self-sufficiency, independence in the dissemination of knowledge and information, conducting scientific research and the application of results. At the same time, the principles of upholding honesty, fairness, respect, responsibility, following ethical principles and rules of creative activity are taken into account in order to establish confidence in the results of scientific achievements. The research was performed in accordance with the research thematic plan of Prydniprovsk State Academy of Physical Culture and Sports for 2016-2020 on the topic: "Theoretical and methodological foundations of planning and control in sports games in the process of long-term improvement", state registration number 0116U003012. Informed consent was received from all individuals who took part in this research and who could refuse participation at any time.

4. Results

As a result of the implementation of the authors' program, the EG boys showed a significant increase in the indicators of physical fitness and physical development compared with the CG boys. The indicators of physical fitness of 6-7-year-old boys who played mini-basketball (before and after the pedagogical experiment) are presented in Table 5.

Table 5. Indicators of physical fitness of 6-7-year-old boys who play mini-basketball (before and after the pedagogical experiment)

Check-up tests	Stages	Mean \pm SD		t	Rate of growth, %	
		EG (n = 16)	CG (n = 16)		EG	CG
3x10 m shuttle run with running around stuffed balls, s	Before	11.35 \pm 0.12	11.47 \pm 0.12	0.72	12.37	3.63
	After	9.94 \pm 0.35***	11.00 \pm 0.04***	9.63		
4x9 m shuttle run, s	Before	14.21 \pm 0.06	14.15 \pm 0.15	0.35	11.17	3.45
	After	12.62 \pm 0.09***	13.66 \pm 0.13*	6.85		
Running to numbered stuffed balls, s	Before	13.55 \pm 0.06	13.61 \pm 0.13	0.43	13.06	3.88
	After	11.78 \pm 0.07***	13.07 \pm 0.15*	8.04		
Assessment of the sense of time, 5 s	Before	6.97 \pm 0.44	7.14 \pm 0.44	0.28	16.89	7.80
	After	5.79 \pm 0.21*	6.58 \pm 0.33	2.08		
Assessment of the sense of time, 10 s	Before	12.19 \pm 0.57	12.23 \pm 0.55	0.05	13.72	2.22
	After	10.52 \pm 0.47*	11.96 \pm 0.42	2.36		
Standing long jump, cm	Before	105.69 \pm 0.87	105.75 \pm 0.95	0.05	5.56	4.02
	After	111.56 \pm 0.81***	110.00 \pm 0.88**	1.34		
Standing high jump, cm	Before	21.13 \pm 0.50	21.31 \pm 0.40	0.03	13.02	11.14
	After	23.88 \pm 0.42***	23.69 \pm 0.43***	0.31		
10 m run, s	Before	3.04 \pm 0.05	3.09 \pm 0.05	0.70	3.91	3.46
	After	2.91 \pm 0.03	2.98 \pm 0.03	1.42		
Angle body from a sitting position, cm	Before	3.69 \pm 1.09	3.31 \pm 0.90	0.27	81.36	64.15
	After	6.50 \pm 1.05	5.44 \pm 0.78	0.84		
Romberg test, s	Before	13.10 \pm 0.74	12.95 \pm 0.77	0.14	35.43	19.50
	After	17.73 \pm 0.87***	15.47 \pm 0.98	1.79		

Note: n: number of subjects; Mean: arithmetical average; SD: standard deviation; t: t-test value that shows the significance of the difference between the indicators of the EG and the CG, p: the significance of the difference between the indicators of the studied groups at the beginning and at the end of the experiment (* – p < 0.05; ** – p < 0.05; *** – p < 0.001)

Thus, the EG boys had a significant increase in most indicators of physical fitness ($p < 0.05-0.001$) (3x10 m shuttle run with running around stuffed balls, 4x9 m shuttle run, running to numbered stuffed balls, 5 and 10 s sense of time, standing long jump, standing high jump, Romberg test). There was also a significant improvement in the CG, but only in five tests ($p < 0.05-0.001$) (3x10 m shuttle run with running around stuffed balls, 4x9 m shuttle run, running to numbered stuffed balls, standing long jump, standing high jump), and rate of growth in percent is much smaller, than in the EG. During the pedagogical observation of the tests, it was found that not only the speed of their performance has improved, but also the quality of mastering the simplest technical elements by the EG children, such as keeping the ball, catching the ball, stopping and turning. There is a decrease in the percentage of children (from 75 % to 25 %) who made gross mistakes; improved coordination of physical actions; formed

coordination of work of hands and feet; decreased number of uncoordinated movements, losses in holding, catching and passing the ball, etc.

In addition, there is a positive effect of the authors' method on the level of physical development in the EG children (significant increase in the Robinson index; Ruffier index; body mass index ($p < 0.05-0.001$)). There was also a tendency to improve the results in other indicators, but the difference is insignificant ($p > 0.05$). A significant increase is observed only in the Ruffier index and the strength index ($p < 0.05$; $p < 0.01$) in the CG. It was found that all indicators of physical development are significantly better in the EG boys than in the CG boys ($p < 0.05-0.001$) at the end of the experiment. At the same time, the physical development of the EG and the CG boys was within the age norm. The indicators of physical development indices in 6-7-year-old boys who played mini-basketball (before and after the pedagogical experiment) are presented in Table 6.

Table 6. Indicators of physical development of 6-7-year-old boys who played mini-basketball (before and after the pedagogical experiment)

Studied indices	Stages	Mean \pm SD		t	Rate of growth, %	
		EG (n = 16)	CG (n = 16)		EG	CG
Robinson index, c.u.	Before	86.05 \pm 2.03	86.21 \pm 2.51	0.72	8.02	5.79
	After	79.15 \pm 1.51*	81.22 \pm 1.72	9.63		
Vital index, ml kg ⁻¹	Before	53.07 \pm 2.30	52.14 \pm 1.57	0.35	7.82	6.01
	After	57.22 \pm 2.09	55.28 \pm 1.35	6.85		
Rufier index, c.u.	Before	13.20 \pm 0.26	13.45 \pm 0.50	0.43	15.53	12.08
	After	11.15 \pm 0.39***	11.83 \pm 0.23**	8.04		
Kettle index, c.u.	Before	187.29 \pm 5.32	191.21 \pm 3.74	0.28	2.01	3.53
	After	191.06 \pm 3.16	197.95 \pm 3.31	2.08		
Strength index, %	Before	33.79 \pm 1.48	32.92 \pm 0.96	0.05	10.42	9.10
	After	37.32 \pm 1.31	35.92 \pm 1.10*	2.36		

Note: n: number of subjects; Mean: arithmetical average; SD: standard deviation; t: t-test value that shows the significance of the difference between the indicators of the EG and the CG, p: the significance of the difference between the indicators of the studied groups at the beginning and at the end of the experiment (* – p < 0.05; ** – p < 0.05; *** – p < 0.001)

5. Discussion

It is contradictory that the mini-basketball curriculum documents operating in the Ukrainian sports system practically do not reflect the mass of knowledge and practical world experience accumulated in the field of rational construction of long-term training aimed at full disclosure of individual capabilities of each athlete in the optimal age zones [10, 15, 17]. The national Curriculum for Children's and Youth Sports School [39] state that the minimum age for starting basketball training sessions at CYSS is 8-9 years. In addition, the curriculum document for children's and youth sports schools, which recommends the enrolment of children in primary basketball training groups, does not meet current trends in basketball development, differs significantly from the methodological approaches used in leading countries of the world on such grounds as age of training sessions beginning, the sequence of learning techniques, methods of training sessions, and is not effective enough and requires further improvement [11, 18, 20].

As a result of the analysis of foreign normative documents, many differences in the content and age from which children start playing basketball were revealed. Thus, in the USA and European countries, the selection for sport classes begins at the age of 6-8 (the first period of the sports and health stage), and at the age of 9 the standards for physical and technical training of the first stage of initial training are met. In contrast, the CYSS program in Ukraine is designed for children from 8-9 years. In foreign countries, the work of various basketball organizations is carried out without a single curriculum for 6-7-year-old children, i. e. each club has the right to develop its own curriculum taking into account sensitive periods of physical development, age peculiarities of

children, with emphasis on basic motor skills and abilities, etc.

The analysis of scientific and methodological literature [1, 4, 9, 13] shows different opinions of experts about the age of children to start playing basketball. Some scientists consider early sports specialization and accompanying intense training sessions and active competitive activities extremely dangerous, violating the objective laws of long-term improvement, premature wear of the body of a young athlete [4, 14]. In addition, this approach often deprives athletes of the opportunity to achieve really high results in the optimal age zone for a particular sport, to develop those physical qualities in the appropriate sensitive period [15, 25]. At the same time, many scientists [12, 17, 22, 40] consider age of 6-7 years as successful to start training sessions. This is an ideal way to involve children in basketball, whereupon a fundamental approach in building the educational and training process of children is to take into account the peculiarities of development and level of preparedness of the growing organism under the condition of rational construction of the educational and training process taking into account age peculiarities of children and exercise control. The scientific substantiation of our authors' program "Four-block structure and content of "Introduction-Interest-Adaptation-Habit" educational and training process of the first year basketball players" was due to the global trend to reduce the age of team sports, modern recommendations of national leading scientists of sports theory and innovative training methods in the leading basketball countries of the world [40, 41].

The age of 6-7 years coincides with the first year of study in general secondary education, and is a transitional stage of adaptation of children from kindergartens (preschools) to primary school, in this regard, the program

is built on four sections of loads: theoretical, practical, motivational and check-up, the content and focus of which are divided into four blocks with conditional names: "introduction", "interest", "adaptation", "habit", which correspond to the gradual adaptation of children to regular training sessions, promote children's development not only in terms of physical qualities and motor skills, but also affect the development of cognitive functions (memory, attention, intelligence, etc.), which are necessary for further training and competitive activities in basketball.

An integrated approach to the presentation of educational material, the use of the theoretical workbook practicum, organization and holding of sports festivals according to the authors' program increases children's interest in regular training, and accomplishing independent tasks and their demonstration at the next training session increases communication between children in the team, between the coach and parents and contributes to the formation of "basketball consciousness", when the mini-basketball section becomes more than just motor activity, it becomes the formation of the child's personality.

This program, namely its block structure and various components, can be used with 7-9-years-old children who first started playing mini-basketball, but in this case the coach needs to complicate the content of each block and training section, according to age peculiarities, sensitive periods of development of physical qualities, the state of their initial level of physical fitness, so as not to lose children's interest in their performance.

The use of the authors' program by the coaches gives them significant advantages in that:

- the coach has a clear action plan for the first year of mini-basketball training;
- the coach has the opportunity to see and analyse the various abilities of the child, not only physical but also intellectual, communicative and others;
- the coach has the opportunity to change the attitude of children's parents to sports in general, and to mini-basketball in particular, through a clear organization of the educational and training process, involving parents in sports festivals and helping children with independent tasks, deepening their knowledge of sports, success in sports and in particular in basketball, because the choice of sports section also depends on parents;
- this program can be used in the so-called basketball academies, summer camps, or basketball movements, which have the opportunity to conduct not only physical exercises but also individual training sessions aimed at developing theoretical knowledge in interesting forms for this age group of children (drawing, colouring, solving puzzles, crosswords, rebuses, etc.);
- this program can be used in a complex and remote

mode of training sessions on mini-basketball during the Covid-19 pandemic.

As a result of the introduction of the authors' program into the educational and training process and testing its effectiveness for 9 months, we confirmed the data of many scientists [4, 6, 23, 42, 43] that coordination skills are intensively developing in 6-7-year-old children that promotes effective mastery of motor skills as well as abilities and is a prerequisite for reducing the age of beginning of team sports games to improve the quality of the initial training phase. The data of scientists [11, 12, 16, 17, 20] on the organization of the educational and training process in mini-basketball, planning the training process and methods of teaching sports games at the stage of initial training have been supplemented. The results of our research confirm the findings of many scientists [44-55] and expand them.

The practical significance of the results of our research is that these results were implemented in the practice of the Basketball Federation of Ukraine and the work of many children's and youth sports schools in Ukraine. The results of the research were presented at licensed courses for 784 coaches of the Basketball Federation of Ukraine, as well as online on Youtube at the link <https://www.youtube.com/watch?v=J-V84fmot3o>.

The theoretical significance of the work is that the results and conclusions became the basis for the development of a new Academic Programme in Ukraine for children's and youth sports schools (initial training groups of the 1st year of study from 6 years, not 8, as was the case before 2021), used by CYSS coaches and used by physical education teachers in lectures on the theory and methods of basketball.

The effectiveness of the authors' program is also confirmed by the fact that more than 70 % of children who started playing mini-basketball at the age of 6 continued to play basketball in the next stages of many years of training, many of them later join professional youth teams and are characterized by high game performance. Thanks to the introduction of the program in children's and youth basketball of Ukraine, the number of primary training groups and the total number of children interested in basketball increased from 18365 people in 2016 to 23450 people in 2021. The number of basketball academies and clubs that provide training for children from 6-7 years, organize special basketball holidays, summer basketball camps, etc. increased in Ukraine. Among them are: "Dnipro" Dnipro, "Junior" Kharkiv, "Interchim" Odesa, "Veneto" Cherkasy, "Avanhard" Kyiv and others..

6. Conclusions

The authors' program in mini-basketball was developed and experimentally implemented, which was built

according to the age peculiarities of 6-7-year-old boys, which creates the most favourable conditions for the development of physical qualities in boys, their harmonious physical development, improvement of body function and revealing cognitive abilities. For the first time we have scientifically substantiated a comprehensive approach to building the structure and content of the educational and training process in mini-basketball during the first year of study (6-7-year-old boys), which includes four blocks: "Introduction", "Interest", "Adaptation", "Habit"; with the division of program material into theoretical, practical, motivational and check-up sections in accordance with the tasks of the initial training stage, which helped to increase the effectiveness of learning the basics of game technique, development of physical qualities, preservation and strengthening of physical health, mastering theoretical knowledge, motivation of children to sport activities, which provides a basis for its practical implementation in the system of preparation of the basketball reserve at the stage of initial training.

It was determined during the pedagogical experiment that the use of the authors' program in the first year of mini-basketball training sessions is effective due to the fact that a significant rate of growth ($p < 0.05-0.001$) in the indicators of physical fitness was revealed in the EG, compared with the CG, in 8 out of 10 tests: standing long jump – by 5.56 %; standing high jump – by 11.24 %; Romberg test – by 35.43 %; 3x10 m shuttle run with running around stuffed balls – by 12.37 %, 4x9 m shuttle run – by 11.17 %, running to numbered stuffed balls – by 13.06 %; assessment of the sense of time, 5 s, 10 s – by 16.89 % and 13.72 %. A significant increase ($p < 0.05$) was determined in the CG only in the indicators of 5 tests: 3x10 m shuttle run with running around stuffed balls, 4x9 m shuttle run, running to numbered stuffed balls, standing long jump and standing high jump.

The introduction of the authors' program in the first year of mini-basketball also had a positive effect on the level of physical development of 6-7-year-old boys. The EG boys improved their indicators, such as the Robinson index by 10.15 % and the Ruffier index by 19.51 %. The indicators improved in other indices, but not significantly. The CG revealed an increase in the Ruffier index by 12.08 % and the strength index by 9.02%.

Prospects for further research are to test the effectiveness of the authors' program on the impact of mini-basketball training sessions upon the level of physical fitness and physical development of 6-7-year-old girls and to develop a curriculum for children's and youth sports schools (for 6-12-year-old children), which makes provision for the sequence of training in accordance with modern world trends in the development of mini-basketball.

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Conflict of Interest

The authors state no conflict of interest.

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