

NATIONAL SPORTS ACADEMY
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**DEVELOPMENT OF SPEED AND STRENGTH
ABILITIES IN YOUNG MALE BASKETBALL PLAYERS**

Abstract book

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The dissertation contains 200 standard typed pages. It's illustrated with 40 diagrams, 25 data sheets, 1 testing protocol and 5 applications. The Bibliography includes 184 literary sources, from which 152 are in Cyrillic, 22 in Roman alphabet and 7 are internet sources.

The dissertation has been discussed at an extended session of the "Basketball, Volleyball, Handball" Department, NSA "Vassil Levski" on 02.03.2021 and it has been dedicated to a defence in front of the Scientific Committee of professional tendency 7.6 Sport.

The dissertation defence would take place on 16.06.2021 at 14:00 in hall A3, NSA "Vassil Levski" at a session of the Scientific Committee of professional tendency.

Introduction

Contemporary basketball is an exceptionally spectacular and attractive sport, which demands serious requirements toward the elite athletes. With the latest new changes that The International Basketball Federation (FIBA) has introduced, namely, an increase in distance for 3 points to 6.75 m., shortening the attack time to 24 s. and with the new 14 s. for re-attack, the game became much faster, more dynamic and extremely spectacular. This inevitably raises the requirements for those who do practice, therefore the level of speed-strength training gets within the attention of sports professionals. A complex development of motor skills is needed, at the basis of which is the priority work for the development of speed and power capabilities, which, combined with virtuoso technique, add beauty and magic to this game and turn it into a favorite sport of many. Of course, this cannot be possible without the introduction of and usage by the coaches of theoretical and methodological programs and their practical applications.

The changes that are taking place worldwide in terms of planning, training, control and evaluation of the work of the players, requires the introduction of even more flexible training and coaching programs, tailored to the capabilities of the competitors.

Basketball specialists notice that after the age of 14, on both European and World scale, the peers of the Bulgarian athletes surpass them in all categories of sports training. This applies both to the level of the physical preparation, and to the level of technical, which naturally has its impact and on the level of their tactical and psychological preparedness.

In order to cover all aspects of sports training it is necessary to have proper annual programming and planning. Unfortunately, many of the Bulgarian coaches do not work on an up-to-date and modern program for preparing basketball players of all ages.

Over the years, a unified methodology for working with adolescents in different age groups have been introduced, and up to today BSE requires clubs to conduct a training process in accordance with the Unified Program of basketball (the program of

Kiril Semov from 1973 is used, adapted by Peter Klechkov). In 2020, the sports specialists were provided with guidelines by the coach of the men's national team - Rosen Barchovski, regarding the work with adolescents, distributed by age, in both tendencies - male and female.

An interesting fact is that there are no requirements for coaches in terms of programming and periodization of sports training, there is no fixed sports calendar that meets the needs of young players, but only a set of desired number of training hours by age groups for the development of physical qualities in children and a recommendation to the coaches for "more time and strictness".

For the development of speed and power abilities when working with adolescent's basketball players, coaches need to be persistent because constant repetition of concentrated physical exercise requires children to maintain strong-willed efforts in order to focus their attention. All this to a large extent makes it difficult for sports educators, who when working with adolescents have as a priority to master the technical techniques, precise training in the tactics of the game and all this in accordance with the adequate development of motor skills for the different age groups. This requires updating of the specialized knowledge in terms of the theory and methodology of sports training in basketball, and their implementation in practice.

I. FORMULATION OF THE PROBLEM

Basketball is a game of high speed and continuous action. It requires both a high level of psychological preparedness and specialized physical skills such as shooting, bouncing, passing, jumping and running (Holland, T., B. Foster, 1991).

Improving the physical qualities of the basketball player is the basis for achieving high sports results. Analyzing motor activity in basketball shows that physical qualities do not manifest individually, but always in conjunction - in a complex matter. The other special feature of physical qualities is their specificity of manifestation. And this

specificity is determined by the needs of the game itself, by the basketball motor activity (Semov, K., 1975).

Basketball technique includes a set of techniques, methods and their varieties that have developed in the process of game evolution and allow the most successful solutions of specific game problems.

The basis of the basketball technique is movement. The movement of a basketball player on the court is part of an integrated system of actions aimed at solving attacking problems and formed in the course of the realization of specific game positions (Gomelsky, A., 2006).

A characteristic feature of basketball is the emphasized role of movements in the content of the game (running, jumping, throwing, passing and catching the ball, resistance, etc.). The motor actions are aimed at overcoming various difficulties and obstacles that hinder the achievement of the game goal. In addition, natural movements and individual skills and abilities are developed and improved in games (Filin, M., 2008).

To increase the efficiency of the training process it is especially important to take into account the relationship between the physical and technical training of the basketball player.

Technical training is a process aimed at mastering sports technique, according to the tasks of the sport (Dasheva, D., 2017). Within the perennial practical process technical preparation goes through two stages (Matveev, LP, 1977). These are the stages of basic technical preparation during which initial training is carried out, a rich background of sports and technical skills and habits are being created, which serve as a basis for technical improvement, and a stage of in-depth technical improvement and overcoming of sports and technical mastery (Dasheva, D., 2017).

The development of speed and power capabilities requires persistent, constant repetition of concentrated physical exercises. Volitional efforts are also necessary for focusing attention, mobilizing speed abilities at the right time or for maintaining speed until the end of the exercise (Yakhontov, E., 2006).

In recent years, the early sports specialization, ie. specialized sports training is more and more associated with younger age groups (Tsarov, Kr., 2018). This is a period of initial sports training in which the foundations of the individual technique and the individual tactics of the game are being laid. In order for high sports results to be

achieved, it is necessary the mastering of the technical and tactical skills of the game to be done in parallel with the development of motor skills.

Learning the technique of the game is a pedagogical process aimed at perfectly mastering the game techniques and ensuring the reliability of the game actions of the athlete during competitions. Perfect mastery of the game technique is one of the central training tasks for competitors. This is a difficult process that takes a long time, requires the specialized lessons to take place in childhood, while the technique training takes a central place during long-term training (Bogen, M., 1985).

The coach of these basketball players must forget about tactics while his players learn the technique, because the cunning tactics without the mastering of the technique turn into a bad basketball product (Tsvetkov, VI., 2003).

In order for the training to be successful in its initial stage it is necessary to take into account the following: the trainees must master the rational, most appropriate technique, and this technique must be provided to them in the most accessible way, in accordance with their age and individual capabilities. First condition is:

- ❖ the development of the special physical abilities on which the mastering the technique depends;

The second condition is:

- ❖ the skillful use of leading exercises and their specialized upgrading during the training process.

The properly selected exercises and their application in the methodological sequence aim to present the execution of the complex technique, which is available for beginners, without distorting its essence.

Main factors that determine the improvement of technical skills of athletes and should be taken into account in the training and teaching of the basketball game are:

- high level of development of special physical abilities (motor potential), on which the effectiveness of the realization of techniques depends;
- perfect mastery of all techniques (in attack and in defence) and methods for their realization, a high degree of reliability of the technique in difficult conditions of play and competition;
- high level of mastery of individual tactical actions when performing techniques;

- high degree of reliability of the musculoskeletal system (bones and muscles) and body systems (cardiovascular, respiratory, endocrine, reproductive and nervous systems), which carry the main load in case of repeated performance of game techniques;
- possession of the special knowledge system (Yakhontov, E., Z. Genkin, 1978).

The technical and tactical skills of modern good players are perfected to such an extent that for them aggression and speed during an attack play is something quite routinely. This is largely due to changes in the rules of the game, which are stimulating the spectacular and active game, both in defense and attack. This requires optimization of the educational and training process in basketball for adolescents.

The study, done on specialized literature on the subjects problems gives us reason to formulate the following **WORK HYPOTHESIS** of the study: the purposeful development of speed and strength abilities in young 15-16 year old basketball players will increase the efficiency of the realization of technical and tactical actions and their implementation in competitive conditions.

II. PURPOSE, TASKS AND METHODOLOGY OF THE RESEARCH

The aim of the present study is to increase the efficiency of the training process and the realization in competitive conditions through specialized and purposeful development of speed and strength abilities in young 15-16 year olds basketball players.

In connection with the stated purpose of the study, it is necessary for the following *main tasks* to be solved:

1. Establishing the state of the researched problem (according to literature data and documentary sources).
2. Surveying the opinion of specialists on the annual planning and the work traits of developing the physical qualities in adolescent basketball players.
3. Collection of information on the level of physical development and specific working capacity of 15-16-year old teenage basketball players, and disclosure of the specific characteristics of the age group.

4. Establishing the effect of a specialized methodology on the speed and power capabilities of adolescent basketball players.

5. Disclosure of the correlation-factor structure and identification of the main factors of physical development and the specific working capacity of 15-16-year old basketball players at the beginning and end of the study.

6. Derivation of methodological recommendations for improving the physical training of 15-16-year old basketball players.

This study covers the period from September 2018 to December 2020.

The object of the study is the educational training process in 15-16-year old basketball players.

The subject of the study are the changes in the indicators of physical development and the specific training of 15-16-year-old basketball players under the influence of specialized concentrated methodology for developing speed and power qualities.

65 adolescent basketball players at the age 15-16 were studied. For the realization of the sports-pedagogical experiment two groups were formed - experimental (EG), this is the team of BC „Beroe“ and control group (CG), this is the team of BC „Tundzha“, which include the same number of basketball players - 14. The remaining 37 basketball players are athletes from the teams of BC "CSKA" and BC "Academic", who have also held sports and pedagogical testing. The obtained results are applied to the derivation of the factor structure in 15-16-year old basketball players.

37 basketball coaches were interviewed, licensed by BSE, who are working with different age groups.

To achieve the set goal and objectives of the study the following research methods are applied: *thorough survey and theoretical analysis of specialized literature and documentary sources; survey method; anthropometry; sports-pedagogical testing and sports-pedagogical experiment.*

To prove the effectiveness of the experimental methodology with the subjects groups (EG and CG) two sports-pedagogical tests were conducted - at the beginning and end of the experiment. A test battery with 20 indicators is used, presented on Table 6.

Table 6.

List of indicators for determining the level of physical development and sports preparedness in basketball

№	Indicators / Parameters	Measuring units	Measurement accuracy	Direction of growth
1.	<i>Height</i>	cm	1,0	+
2.	<i>Weight</i>	kg	0,5	
3.	<i>Body Mass Index</i>	kg/m ²	0,01	
4.	<i>Stretch (horizontal)</i>	cm	1,0	+
5.	<i>Running 20 m sprinting</i>	s	0,01	-
6.	<i>Vertical rebound</i>	cm	1,0	+
7.	<i>Triple jump</i>	m	0,01	+
8.	<i>Running between stands</i>	s	0,01	-
9.	<i>Throwing of solid ball</i>	m	0,01	+
10.	<i>Occipital leg press (crunches)</i>	number	1,0	+
11.	<i>Running «Shuttle» 252 m</i>	s	0,01	-
12.	<i>Leading the ball between stands</i>	s	0,01	-
13.	<i>Index of leading a ball</i>	s	0,01	-
14.	<i>Defense</i>	s	0,01	-
15.	<i>Eights with dribble</i>	number	1,0	+
16.	<i>High-speed shooting in motion - time</i>	s	0,01	-
17.	<i>High-speed shooting in motion - number</i>	number	1,0	+
18.	<i>High-speed shooting in motion – coefficient</i>	s	0,01	-
19.	<i>Rebound shooting with a passer</i>	number	1,0	+
20.	<i>Penalty shots – number of successful ones</i>	number	1,0	+

Strength is in the foundation of speed capabilities, and purposeful work for their improvement should also improve speed and power capabilities.

Until the beginning of the experiment, the studied team from EG has participated in republican championship, where he has not won and has ranked last. The aim of the research is to purposefully develop the speed-power abilities in young basketball players. We assume that in this age group this will lead to an increase of the efficiency of the training process and the successful realization of young athletes in competitive conditions.

We found out that at the world-famous and proven Serbian basketball school, a methodology of strength training with 12 exercises for 15-16-year old basketball players exists (Jakovljevic, S., 2009). The same was adapted and applied in the training process of EG within one sports-competitive year. The emphasis in there is on 17 special-preparatory exercises (5 are added by the dissertator), distributed in two sets. The described exercises form two basic sets for developing the speed and strength qualities of adolescent basketball players (Tables 7 and 8). The sets are applied twice a week on the

days: Monday and Wednesday or Monday and Thursday. The dosage and the degree of loading of the EG during the strength work are presented in Table 8, while taking into account the individual power capabilities of the competitors.

Table 7.

Sets of exercises for developing strength in 15-16- year old basketball players

№	Monday
1.	Squat – one warming-up set + 3x10
2.	Bench press Z + 3x10
3.	Seated row Z + 3x10
4.	Bulgarian squat Z + 3x10 on the leg
5.	Seated dumbbell overhead press Z +3x10
6.	Barbell Deadlift Z + 3x10
7.	Close-Grip Bench press Z + 3x10
8.	Leg press calf raise Z + 3x10
9.	Crunches/ abdominal presses 3x20 (15)
10.	Hyperextension (back presses) - 3x15
	Wednesday or Thursday
1.	Incline Dumbbell Bench Press 45° Z + 3x10
2.	Half back squat Z + 3x10
3.	Lat pull-down Wide Grip Z + 3x10
4.	Barbell Deadlift Z + 3x10
5.	Barbell upright row Z + 3x10
6.	Triceps Pushdown on a lat pulldown machine Z + 3x10
7.	Pull ups – supinated/ underhand grip 3 x max number
8.	Crunches/ abdominal presses – 3 x 20 (15)
9.	Hyperextension (back presses) – 3x15

The approach, which is applied to determine the working weights of each competitor, is the one of the repeated maximum (how many times a given resistance can be overcome in one approach), in our case - a weight that can be lifted 10 times. According to R. Berger (1960) this corresponds to 89.8 and 78.9% of one PM, i.e. of the maximum resistance, which the corresponding muscle can overcome. The following methodical sequence is attached: 1 series of 10 with 50% of Pmax (or lever only); 1 x 10 with 75% of Pmax; 1 x 10 with 90% Pmax and 1 x 10 at 100%.

Table 8.

*Characteristics of the training load during the exercises
for developing strength in 15-16-year old basketball players*

№	Exercises	Components of the load				
		Number of repetitions in a series	Number of series	Rest between series	Degree of loading	Number of workouts per week
1	Back squat	10	1 + 3	1 min.	Average	One
2	Bench press	10	1 + 3	1 min.	Average	One
3	Incline Dumbbell Bench Press	10	1 + 3	1 min.	Average	One
4	Seated row	10	1 + 3	1 min.	Average	One
5	Bulgarian squat	10	1 + 3	1 min.	Average	One
6	Seated dumbbell overhead press	10	1 + 3	1 min.	Average	One
7	Barbell Deadlift	10	1 + 3	1 min.	Average	One
8	Dumbbell Deadlift	10	1 + 3	1 min.	Average	One
9	Close-Grip Bench press	10	1 + 3	1 min.	Average	One
10	Leg press calf raise	10	1 + 3	1 min.	Average	One
11	Half back squat	10	1 + 3	1 min.	Average	One
12	Lat pull-down Wide Grip	10	1 + 3	1 min.	Average	One
13	Triceps Pushdown on a lat pulldown machine	10	1 + 3	1 min.	Average	One
14	Barbell upright row	10	1 + 3	1 min.	Average	One
15	Pull ups – supinated/underhand grip	Until the refusal	3	1-2 min.	Maximum	One
16	Crunches/ abdominal presses	20 (15)	3	1 min.	Average	Two
17	Hyperextension -back presses	15	3	1 min.	Average	Two

The team from BC Tundzha, Yambol, which forms the control group, has so far participated in all national championships for different ages and uses an established, in the club, standart training methodology, tailored to the age of the children. The control group is currently preparing according to the club's established methodology for developing speed and strength qualities, which includes a visit to the gym, where each time the same specialized set of exercises is performed: squat / half squat; lunges;

inverted; barbell bench press; biceps exercises; triceps exercises; shoulder presses and bounces.

The dosage of the load is 3 sets of 10 repetitions for each exercise, and the weights are determined by the coach according to the individual strength capabilities of the athletes.

During the preparatory period, before the beginning of the school year, the two groups (EG and CG) train two times a day, 4 times a week. During the competition period, which coincides with the beginning of the school year, the EG competitors continue with four training sessions per week, twice a day, in which the first training (the combination of days "Monday-Wednesday" or "Monday-Thursday", depending on the sports calendar) is in the gym, where the sets presented in Table 7 are performed, and the dosage of the load is presented in Table 8. Before entering the gym, for a month EG performed strength exercises with their own weight in the basketball hall every day (attacks, Bulgarian squats, push-ups, pull-ups, for this purpose a lever was installed in the basketball hall, abdominal and back presses as well as various isometric exercises).

The goal is to build basic skills and master the correct technique of performing the exercises. On Tuesdays and Fridays, the trainings for speed, coordination and speed endurance were held; for individual equipment; for group and team technical and tactical actions.

CG athletes also train twice a day, but on two consecutive days "Monday and Tuesday", they also have a workout in the gym during the week, where they perform the set presented above.

The experiment continues within one school-training year 2018/2019.

The results of the research are subjected to mathematical and statistical processing through: *Frequency analysis; Descriptive statistics; Student's comparative t-test* for dependent and independent samples; *Cohen d; Correlation analysis; Factor analysis and Index method.*

III. RESULTS ANALYSIS

III.1. Survey of the opinion of sports specialists regarding the planning of the training process

After surveying the opinion of sports experts regarding the planning of the training process, we found out that 74.30% of respondents control the training process during the year with sports-pedagogical tests. However, there are 14.30% who do not have an answer to the question. Nearly 100% define the level of speed and strength training in adolescents in Bulgaria as low and weak.

III.2. Sports-pedagogical experiment

III.2.1. Average value and variability of the studied features at the beginning of the sports-pedagogical experiment

At the beginning of the experiment, we conducted the first test with both groups.

The results of the variational analysis of the signs of physical development are presented in Table 9 and Table 10. With regard to the indicators of physical development in both groups are observed close average values for most signs, but there are also those in which one group has greater advantage.

Table 9.

Average values and variability of signs of physical development of EG at the beginning of the experiment

№	Indicators	N	min	max	R	X	S	V	As	Ex
1.	Height	14	1.68	2.02	0.34	1.87	0.099	5.29	-0.502	-0.187
2.	Weight	14	50.00	88.8	38.8	72.27	12.113	16.76	-0.339	-0.499
3.	BMI	14	17.72	25.11	7.39	20.66	2.235	10.82	0.445	-0.628
4.	Horizontal stretch	14	1.62	2.05	0.43	1.87	0.119	6.39	-0.418	-0.033

Table 10.

Average values and variability of signs of physical development of CG at the beginning of the experiment

№	Indicators	N	min	max	R	X	S	V	As	Ex
1.	Height	14	1.75	2.03	0.28	1.83	0.071	3.87	1.813 *	4.949 *
2.	Weight	14	57.10	81.10	24.00	66.10	7.999	12.10	0.594	-0.676
3.	BMI	14	17.69	23.33	5.65	19.75	1.536	7.78	1.037	0.812
4.	Horizontal stretch	14	1.69	2.11	0.42	1.83	0.102	5.55	1.406*	3.783 *

The results of the descriptive statistics of the signs of physical preparedness are presented in Table 11 and Table 12. An analysis of Table 11 shows that the distribution of values in the experimental group is normal, but in indicator №11 it is different from normal. This is an indicator that informs about the speed endurance of young basketball players ("Running Shuttle 252 m").

Table 11.

Average values and variability of the signs of physical fitness of EG at the beginning of the sports-pedagogical testing

№	Indicators	N	min	max	R	X	S	V	As	Ex
5.	Running - 20 m	14	3.84	3.06	0.78	3.54	0.221	6.25	-0.973	0.659
6.	Vertical rebound	14	43	63	20	49.64	5.652	11.38	1.126	0.806
7.	Triple jump	14	5.92	7.82	1.9	6.68	0.558	8.35	0.689	-0.198
8.	Running between stands	14	21.69	18.50	3.19	20.23	0.773	3.82	-0.228	1.578
9.	Throwing of a solid ball - forward	14	5.00	7.60	2.6	6.30	0.832	13.22	-0.029	-1.237
10.	Occipital leg press	14	17	27	10	22.64	2.649	11.70	-0.418	0.144
11.	Running „ Shuttle“ 252m	14	61.19	74.76	13.57	70.74	3.850	5.44	-1.617 *	2.389 *

As can be seen from the high value of R, the difference of 13.57 s between the lowest and highest value indicates that there are very fast children in the group, but also

some who run the 252 m a little slower. Given the irregular training process so far and the fact that we are at the beginning of the experiment, we can consider this normal.

An analysis of Table 12 shows that in the control group for all indicators, the distribution of values is normal and close to normal. This is an indicator of "Vertical rebound" and triple jump, in which the EG has better results. In terms of indicators: running between stands, crunches, running "Shuttle", eights with dribble and shooting from a position, CG has better achievements.

Table 12.

Average values and variability of the signs of physical fitness of CG at the beginning of the sports-pedagogical testing

№	Indicators	N	min	max	R	X	S	V	As	Ex
5.	Running - 20 m	14	2.86	3.25	0.39	3.07	0.129	4.19	-0.229	-1.284
6.	Vertical rebound	14	38.00	61.00	23.00	45.79	6.327	13.82	0.928	1.203
7.	Triple jump	14	6.00	7.40	1.40	6.60	0.363	5.51	0.638	0.746
8.	Running between stands	14	17.31	20.73	3.42	19.21	0.948	4.94	-0.103	-0.367
9.	Throwing of a solid ball - forward	14	6.00	9.20	3.20	7.98	0.864	10.83	-0.768	0.525
10.	Occipital leg press	14	23.00	31.00	8.00	26.21	2.517	9.60	0.258	-0.777
11.	Running „ Shuttle“ 252m	14	58.01	69.00	10.99	63.79	2.990	4.69	0.224	0.312

After the applied variational analysis of the data from the indicators of technical and tactical preparedness, it was established that in both groups the distribution of values is normal and close to normal. The results of the variational analysis of the indicators of technical and tactical preparedness, in both groups before the experiment, are presented in Tables 13 and 14.

An analysis of Tables 13 and 14 shows that in this group of indicators the largest differences in the homogeneity of the features between the two groups are observed. The experimental group is highly homogeneous in only three of the features. They are related to the fast movement on the field without the ball ($V_{12} = 5.27\%$), the rapid achievement of a goal when shooting on the move ($V_{17} = 5.03\%$), and when realizing the penalty

shots ($V_{20} = 11.79\%$). For the other five features, the group is relatively homogeneous, and for indicator № 13, the value of V is very high and shows that the group is heterogeneous on this basis ($V_{13} = 76.52\%$).

Table 13.

Average values and variability of the signs of the technical-tactical preparedness of EG at the beginning of the sports-pedagogical testing

№	Indicators	N	min	max	R	X	S	V	As	Ex
12.	Dribble b/w stands	14	18.9	23.47	4.57	21.46	1.132	5.27	-0.328	1.37
13.	Index of leading a ball	14	-0.45	3.21	3.66	1.24	0.945	76.52	0.484	0.509
14.	Movement in defense	14	1.50	10.40	8.90	8.80	2.147	24.39	-3.463	2.587
15.	Eights with dribble	14	40	80	40	15.43	2.848	18.46	-0.205	-0.541
16.	Shooting in motion - number	14	4	6	2	5.21	0.699	13.41	-0.321	-0.633
17.	Shooting in motion - time	14	28.94	34.41	5.47	31.66	1.592	5.03	-0.198	-0.443
18.	Shooting in motion – coefficient	14	4.82	8.31	3.49	6.21	1.136	18.29	0.56	-0.258
19.	Shooting from position		8	10	18	13.93	2.673	13.20	-1.280	-0.080
20.	Penalty shots	14	5	11	16	13.79	1.626	11.79	-0.225	-1.243

Table 14.

Average values and variability of the signs of the technical-tactical preparedness of CG at the beginning of the sports-pedagogical testing

№	Indicators	N	min	max	R	X	S	V	As	Ex
12.	Dribble b/w stands	14	18.28	22.16	3.88	20.18	1.094	5.42	0.095	-0.270
13.	Index of leading a ball	14	-0.10	2.28	2.38	0.98	0.639	65.47	0.037	0.218
14.	Movement in defense	14	8.86	10.63	1.77	9.66	0.669	6.92	0.395	-1.462
15.	Eights with dribble	14	48.00	79.00	31.00	67.50	8.742	12.95	-0.617	0.310
16.	Shooting in motion - number	14	4.00	6.00	2.00	5.21	0.802	15.38	-0.437	-1.229
17.	Shooting in motion - time	14	29.04	34.42	5.38	31.77	1.327	4.18	-0.105	0.806
18.	Shooting in motion – coefficient	14	4.84	8.61	3.77	6.27	1.237	19.75	0.765	-0.548
19.	Shooting from position	14	10.00	22.00	12.00	16.93	3.496	20.65	-0.485	-0.133
20.	Penalty shots	14	10.00	17.00	7.00	13.86	2.179	15.72	0.004	-1.068

III.2.2. Significance of differences in the experimental and control groups at the beginning of the study

The presence of differences between the average values in the two groups does not give us the right to draw general conclusions, it is necessary to apply Student's t-test for independent samples. The results are presented in Table 15.

Table 15.

Significance of the differences between the average levels of all studied traits at the beginning of the sports-pedagogical experiment

№	Indicator	Experimental group			Control group			Difference		Statistical significance	
		n1	X1	S1	n2	X2	S2			t emp	P (t)
1.	Height	14	1.87	0.099	14	1.83	0.071	0.038	0.438	1.168	74.65
2.	Weight	14	72.27	12.113	14	66.10	7.999	6.171	0.585	1.591	87.63
3.	BMI	14	20.66	2.234	14	19.75	1.536	0.907	0.468	1.251	77.80
4.	Horizontal stretch	14	1.87	0.119	14	1.83	0.102	0.036	0.324	0.852	59.81
5.	Running 20 m	14	3.54	0.221	14	3.07	0.129	0.466	1.572	6.807	100.00
6.	Vertical rebound	14	49.64	5.652	14	45.79	6.327	3.857	0.622	1.701	89.92
7.	Triple jump	14	6.68	0.558	14	6.60	0.363	0.081	0.174	0.454	34.63
8.	Running b/w stands	14	20.23	0.773	14	19.21	0.948	1.023	1.027	3.128	99.57
9.	Throwing of a solid ball	14	6.30	0.832	14	7.98	0.864	-1.682	1.408	5.246	100.00
10.	Occipital leg press	14	22.64	2.649	14	26.21	2.517	-3.571	1.145	3.657	99.89
11.	Running Shuttle 252 m	14	70.74	3.845	14	69.53	3.500	1.216	0.332	0.875	61.03
12.	Dribble b/w stands	14	21.46	1.132	14	20.18	1.094	1.282	1.008	3.048	99.48
13.	Index of leading a ball	14	1.24	0.945	14	1.05	0.597	0.184	0.234	0.600	44.61
14.	Movement in defense	14	9.45	0.534	14	9.66	0.669	-0.214	0.355	0.937	64.26
15.	Eights with dribble	14	61.71	11.391	14	67.50	8.742	-5.786	0.557	1.508	85.63
16.	Shooting in motion - number	14	5.21	0.699	14	5.21	0.802	0.000	0.000	0.000	0.00
17.	Shooting in motion - time	14	31.66	1.592	14	31.77	1.327	-0.112	0.078	0.202	15.89
18.	Shooting in motion – coefficient	14	6.21	1.135	14	6.27	1.237	-0.055	0.047	0.123	9.70
19.	Shooting from position	14	13.93	2.674	14	16.93	3.496	-3.000	0.879	2.550	98.30
20.	Penalty shots	14	13.79	1.626	14	13.86	2.179	-0.071	0.038	0.098	7.76

The results show that at the beginning of the study the control group was statistically significantly better than the experimental group, in terms of signs related to speed capabilities, rapid movement on the field with a change of direction without the ball, explosive power of the upper limbs and shoulder girdle, and of the abdominal muscles.

As stated in the Methodology, the aim of the present study is to focus the training process of the experimental group on the priority development of speed and strength abilities of young athletes. The results show that the competitors from the experimental group lag behind statistically significantly in some aspects related to these abilities compared to their peers from the control group. We believe that this is not a problem for the correct conduct of the experiment. It is important for us to determine whether there are statistically significant differences between the average values of the two tests according to the characteristics we studied. To prove the significance of the differences between the average levels in the two studies, a comparative analysis was applied using Student's t test for dependent samples with a guarantee probability of $P \geq 95\%$, degree of freedom at $k = (n1-1)$ and $t_{critical} = 2.16$.

The significance of the differences obtained is shown in Figure 29.

An analysis of Figure 29 shows that there are no statistically significant differences between the two studies in just eight traits. These are the signs associated with anthropometric indicators - height, weight and horizontal extension. The other three are related to speed endurance, the ability to run the ball at high speed, the speed of realizing a goal and the execution skills in penalty shots.

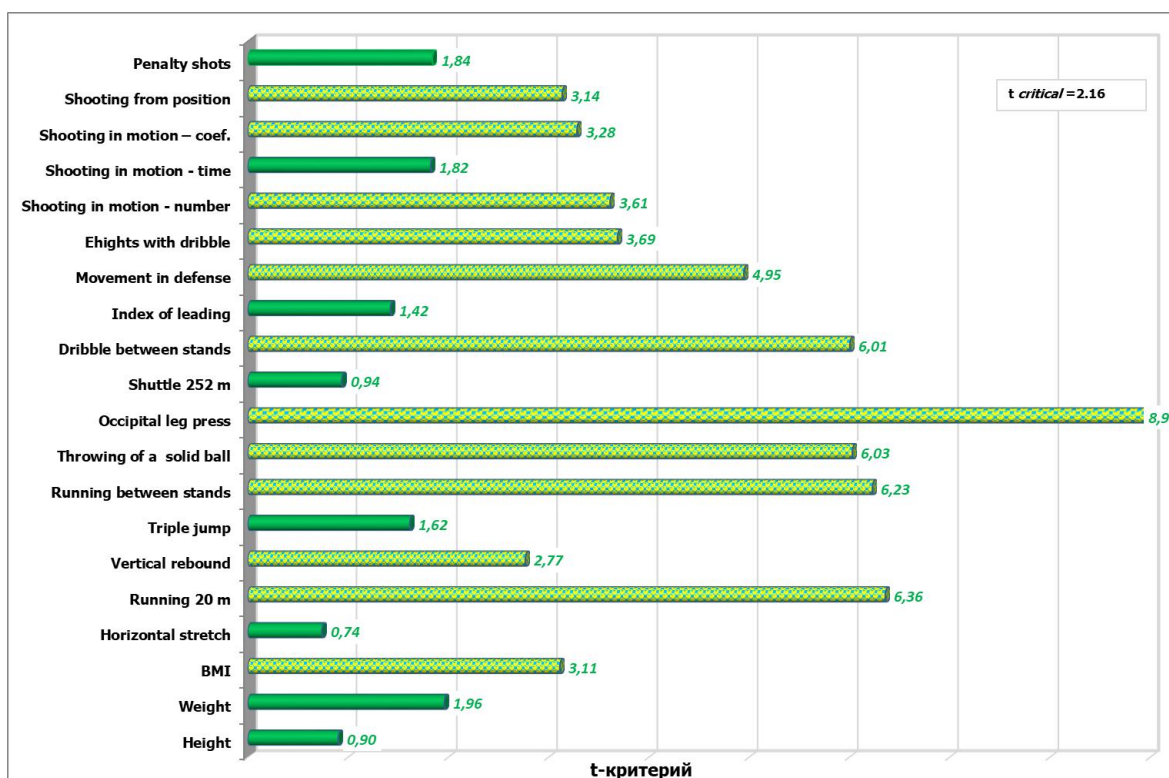


Fig. 29. Significance of the differences between the average levels of the examined traits after the second study

Higher values of the t-test than the critical one ($t_{\text{critical}} = 2.16$) were observed in 12 of the examined traits. These are the signs related to the degree of security - $t_3 = 3.11$, with the speed capabilities - $t_5 = 6.36$, with the explosive force of the lower limbs at vertical efforts - $t_7 = 2.77$, with the fast movement between stands - $t_8 = 6.23$. The strength of the upper limbs and shoulder girdle, as well as that of the abdominal muscles has improved, which has been shown to be statistically significant ($t_9 = 6.03$ and $t_{10} = 8.96$). Higher values of t ($t_{12} = 6.01$; $t_{14} = 4.95$; $t_{15} = 3.69$; $t_{16} = 3.61$) are also observed for all signs related to the handling of the ball on the spot and in motion, as well as when achieving a goal ($t_{18} = 3.28$ and $t_{19} = 3.14$), which gives us a reason with a high guarantee probability ($P_t \geq 95\%$) to accept as true the alternative hypothesis, according to which the differences between the two studies on these indicators are reliable and statistically significant. It is interesting that according to most indicators, in which there are statistically significant differences, are related to the speed and strength abilities of the players. We attribute this to the purposeful work for their development during the experiment within a sports-competitive year.

III.2.4. Establishing the influence of the applied standard training methodology and the significance of the growth in the control group

The significance of the obtained differences and the growth of the results are presented in Table 18. An analysis of Table 18 shows that by the most important sign for the physical development of young basketball players - height, the athletes do not show significant growth, but only a difference of almost one centimeter.

Table 18.

Significance of differences and results growth in the control group after the second test

Indicator	Beginning			End			Difference (growth)	Statistical significance		
	N1	X1	S1	N2	X2	S2	d	d%	t	P (t)
1.Height	14	1.836	0.073	12	1.844	0.131	0.007	-0.363	0.136	10.60
2.Weight	14	66.66	8.211	12	74.00	11.631	7.342	11.014	1.634	86.96
3.BMI	14	19.72	1.507	12	21.78	2.340	2.058	10.434	3.979	99.78
4.Horizontal stretch	14	1.84	0.106	12	1.89	0.087	0.048	2.622	1.170	73.32
5.Running 20 m	14	3.08	0.135	12	2.80	0.132	-0.276	-8.970	4.428	99.90
6.Vertical rebound	14	46.25	6.744	12	54.17	6.337	7.917	17.117	2.895	98.54
7.Triple jump	14	6.60	0.392	12	7.12	0.457	0.528	8.011	2.526	97.18
8.Running between stands	14	19.22	1.030	12	19.63	1.000	0.409	2.129	1.294	77.80
9.Throwing of a solid ball	14	7.99	0.903	12	7.66	0.460	-0.333	-4.171	1.145	72.35
10.Occipital leg press	14	26.25	2.701	12	27.92	3.450	1.667	6.349	1.854	90.93
11.Shuttle 252 m	14	63.75	3.221	12	70.45	2.797	6.696	10.503	7.369	100.00
12.Dribble between stands	14	20.10	1.119	12	20.23	1.194	0.130	0.647	0.302	23.17
13.Index of leading	14	0.96	0.512	11	0.51	0.742	-0.449	-46.692	1.429	81.65
14.Movement in defense	14	9.74	0.692	12	12.19	0.990	2.452	25.167	7.392	100.00
15.Eights with dribble	14	66.25	8.843	12	76.00	7.816	9.750	14.717	3.283	99.27
16. Shooting in motion - number	14	5.25	0.754	12	5.58	0.669	0.333	6.349	1.483	83.39
17. Shooting in motion - time	14	31.84	1.405	12	32.18	1.441	0.343	1.076	0.825	57.32
18. Shooting in motion – coef.	14	6.22	1.189	12	5.87	1.010	-0.348	-5.591	1.093	70.23
19.Shooting from position	14	17.50	3.119	12	17.75	4.003	0.250	1.429	0.224	17.32
20.Penalty shots	14	14.00	2.296	12	15.50	1.977	1.500	10.714	1.494	83.68

There are 14 signs of improvement in the results after the second study, only in five of them there are statistically significant differences. These are indicators: $t_3 = 3,979$, $t_5 = 4,428$, $t_6 = 2,895$, $t_7 = 2,526$, $t_{15} = 3,283$, which gives us a reason with a high guarantee probability ($P_t \geq 95\%$) to accept as true the alternative hypothesis, according to which the differences between both studies on these indicators are statistically significant. These are the signs related to body mass index, speed capabilities, explosive force of the lower limbs in the vertical and horizontal planes and the ability to handle a ball on the spot. In the five indicators, on which the average values are lower after the second study than those from the first one, there are statistically significant differences in only two of them, which are related to the ability to move quickly on the court in a defensive position and speed endurance. But these statistically significant differences are in favor of the first test, which shows that in terms of these two traits, the team was better at the beginning of the experiment. Apart from these two signs of the first test, the young basketball players performed better when moving fast on the court without a ball, when throwing a solid ball and when performing dribble between stands. The results achieved with the control group show that this well-established methodology of work has a positive impact on the physical development and specific performance of young basketball players.

III.2.5. Significance of the differences between the average levels of traits in the experimental and control groups at the end of the experiment

In order to solve the tasks of the research and in order to establish the effectiveness of the methodology applied by us, aimed at priority development of speed and strength abilities in 15-16-year old basketball players, we must prove the statistical significance of the results. For this purpose, Student's comparative t-test for independent samples with a high guarantee probability $P_t \geq 95\%$ degree of freedom at $k = (n_1 + n_2) - 2$ and $t_{critical} = 2.07$ was applied.

The results of the comparative criteria of differences between the average levels of the studied traits in the two groups at the end of the study are presented in Table 19. An analysis of Table 19 shows that after the second testing of young basketball players, the

final results have close average values, where most of them are in favor of the team of the experimental group.

Table 19.

Significance of the differences between the average levels of four of the studied traits in the experimental and control groups at the end of the experiment

Indicators	Group	n	min	max	R	X	S	V	As	Ex	t emp
5. Running 20 m	EG	11	2.79	3.30	0.51	3.07	0.175	5.70	-0.315	-1.066	-4.24
	KG	12	2.49	2.97	0.48	2.80	0.132	4.71	-1.004	1.657	
	Total	23	2.49	3.30	0.81	2.93	0.205	7.00	0.153	-0.256	
8. Running between stands	EG	11	17.62	19.11	1.49	18.43	0.437	2.37	-0.473	-0.278	3.66
	KG	12	18.27	21.29	3.02	19.63	1.000	5.09	0.124	-1.029	
	Total	23	17.62	21.29	3.67	19.05	0.980	5.14	0.83	-0.071	
9. Throwing of a solid ball	EG	11	6.50	9.40	2.90	8.02	0.971	12.11	-0.065	-1.244	1.15
	KG	12	7.00	8.50	1.50	7.66	0.460	6.01	0.073	-0.569	
	Total	23	6.50	9.40	2.90	7.83	0.754	9.62	0.429	-0.279	
10. Occipital leg press	EG	11	24.00	32.00	8.00	28.82	2.676	9.29	-0.222	-0.793	0.70
	KG	12	23.00	34.00	11.00	27.92	3.450	12.36	0.483	-0.796	
	Total	23	23.00	34.00	11.00	28.35	3.069	10.83	0.136	-0.954	

As noted earlier, after the first study between the average values of the two study groups, the control group outperformed the experimental group in terms of some features of the indicators category that carry information about the physical preparedness of basketball players. It was established that in four indicators - "Running 20m", "Running between stands", "Throwing a solid ball" and "Lifting from the back of the head", the control group was statistically significantly better than the experimental group. These are the signs related to speed capabilities, fast movement on the field without a ball, the explosive power of the upper limbs and shoulder girdle, as well as the abdominal muscles. According to these signs, the boys from the control group at the beginning of the experiment were superior to those from the experimental one. At the end of the study, after applying the specialized methodology for priority development of speed and strength abilities of young athletes, it became clear that in three of them the experimental group already surpasses the control group, and in one feature there is a statistically significant difference.

The significance of the differences between the two groups at the end of the study is illustrated in Figure 30.

An analysis shows that the experimental group (right part of the diagram) surpasses the control group in 15 of the 20 indicators studied. These are the indicators of physical development, which are related to height ($t_1=1.19$), weight ($t_2 = 0.57$), horizontal stretching ($t_4 = 0.13$) and the degree of nutrition ($t_3 = 0.91$).

By comparing the obtained values of the t-test of the studied signs of physical development with the table value of the samples ($t_a = 2.07$), we establish that for these signs between the two groups, the existing differences are statistically insignificant and can be explained by random reasons. Figure 30 shows that of the six signs of physical capacity, the boys in the experimental group have an advantage in five of them. They are associated with better explosive power of the lower limbs in vertical bounces ($t_6 = 1.41$), with faster movement of competitors between stands without a ball ($t_8 = 3.66$) with the explosive force of the upper limbs and shoulder girdle ($t_9 = 1.15$) and with better strength of the abdominal muscles ($t_{10} = 0.70$), as well as with speed endurance ($t_{11} = 1.23$).

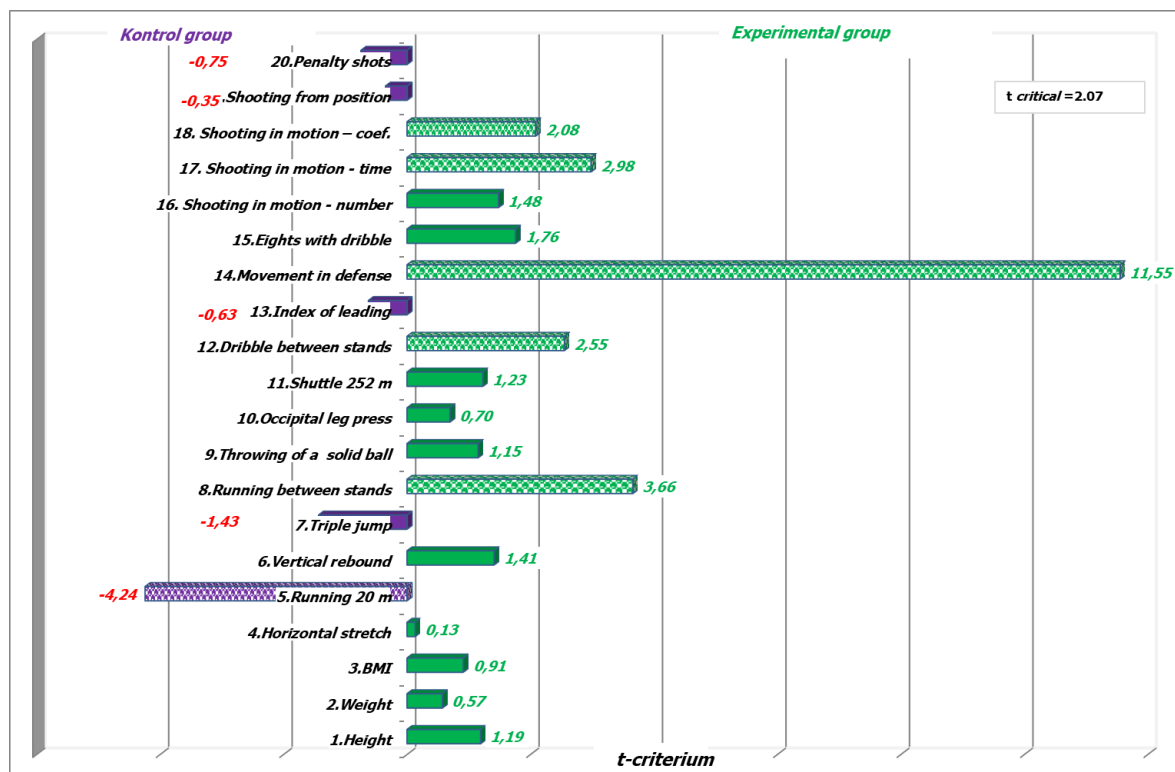


Fig. 30. Significance of the differences between the average levels of the studied traits in the experimental and control groups at the end of the experiment

Competitors from the experimental group statistically significantly surpass their peers from the control group in one of the signs of physical performance, which is associated with the ability to move much faster between stands on the field without a ball. The values of the t-test are supported with a high guarantee probability $P_t \geq 95\%$. On other grounds, the empirical values of the t-test are lower than the table one ($t_a = 2.07$), therefore the existing differences between the studied totalities can be explained by random reasons.

According to the other nine indicators related to the technical and tactical skills of the competitors (Fig. 30), the boys from the experimental group surpass those from the control group in four of them. The high values of the criteria show that the experimental group is statistically significantly better than the control group in terms of the ability to move quickly with a ball ($t_{12} = 2.55$), to perform a movement, which is characteristic to basketball, in a defensive position ($t_{14} = 11.55$), to score faster and more points when shooting in motion ($t_{17} = 2.98$; $t_{18} = 2.08$). The values of the t-test are supported with a high guarantee probability $P_t \geq 95\%$. On other grounds, the empirical values of the t-test are lower than the table ones ($t_a = 2.07$), therefore the existing differences between the studied populations are insignificant and can be explained by random reasons.

The left part of the figure (Fig. 30) shows the results by which the control group surpasses the experimental group. They are five in number, but the empirical values of the t-test are lower than the table values ($t_a = 2.07$), therefore the existing differences between the studied populations are insignificant and can be explained by random reasons on the studied traits. Only in terms of speed capabilities, the high value of $t_4 = 4.24$ shows that the difference between the two groups is statistically significant and is supported by a high guarantee probability $P_t \geq 95\%$.

After the application of a specialized training methodology in the training process, the basketball players from the experimental group surpass the control group in 15 out of 20 studied indicators. Statistically significant differences were proved in five of them, which shows that the applied specialized methodology for developing speed and strength abilities in young athletes has had a positive result.

In addition to the evidential part of the positive effect of the applied methodology in the experimental group, we must note the progressive development in the realization of the team. At the end of the training and sports-competitive year, after the end of the experiment, during which the work of the coach was aimed at developing speed and

strength abilities, the results show that when participating in the national championship for age U16, the experimental group presents at a very high level and ranks fifth. This confirms the working hypothesis set by us at the beginning of the study, according to which the development of speed and strength abilities will increase the effectiveness of technical and tactical actions and their implementation in competitive conditions for young basketball players.

III.3. Factor structure and main components of the studied traits

In order to achieve the purpose and solve the tasks of the research, the results of the conducted sports-pedagogical tests are subjected to processing with the help of correlation analysis. It reveals the relationships between the studied features and establishes their strength and direction in order for correct factor analysis to be applied.

In order to achieve the purpose and solve the tasks of the research, two factor structures were derived for 15-16-year old athletes - one at the beginning of the study (at the beginning of the sports-competitive year) and one at the end of the study (at the end of the sports-competitive year).

The application of factor analysis allowed to derive the main components and on this basis factor models of physical development and specific performance of the studied totality to be built, as well as to reveal the features of each factor structure, depending on age and level of preparedness of the basketball players.

The relative shares of the initial dispersion explained by each factor at the beginning of the study are illustrated in Fig.33. The first derived factor explains 26.70%, the second explains 19.24%, the next two have a lower contribution to the overall physical development and specific performance of the basketball players (10.90% and 9.08%, respectively), and the last three are additional and the dispersion explained by them is less than 10%.

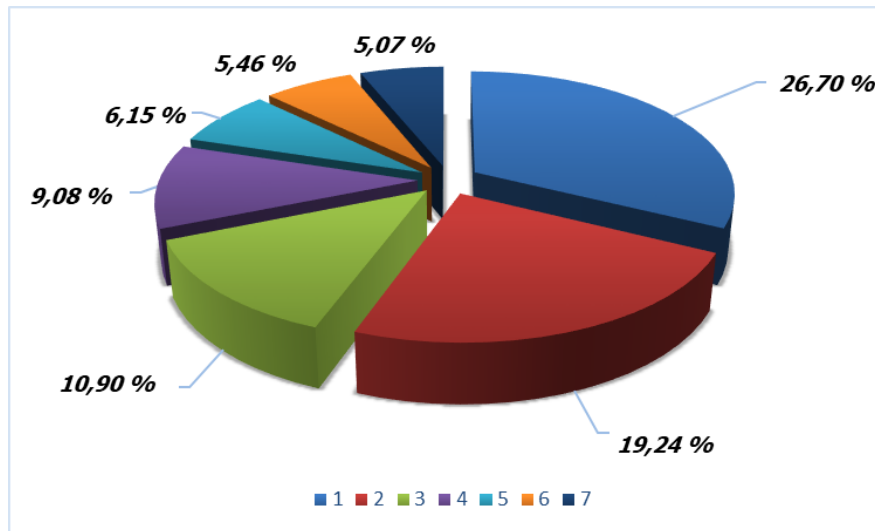


Fig.33. Relative share of the initial dispersion explained by each factor in 15-16-year-old basketball players at the beginning of the study.

Fig. 34 presents the first factor of the factor structure, which is determined by four main indicators, they explain the highest percentage of the initial dispersion of the studied phenomenon (26.70%). This factor reveals the high importance of the skills and speed of realization of a point by shooting on the move, as well as the realization of penalty shots for the general preparedness of the basketball players from the studied totality. This allows it to be identified as a technical-tactical factor.



Fig.34. Factor structure of 15-16-year-old basketball players at the beginning of the study - factor I and II

The second factor (19.24%) can be defined as morphological because it reveals the place in the factor structure of the height and weight indicators, which are a prerequisite for higher achievements in performing a triple jump.

The third factor (10.90%) determines the place in the factor structure of speed and strength abilities, of 15-16-year-old basketball players, and their positive influence on the ability to score a goal when shooting from a position with a passer (Fig. 35).

The fourth factor (9.08%) can be identified as a special speed of movement in attack both with and without the ball, which largely depends on the skill of basketball players to masterfully lead the ball on the spot (Fig. 35).

The fifth factor (6.15%) determines the ability to handle the ball on the spot and the speed of movement in defense.

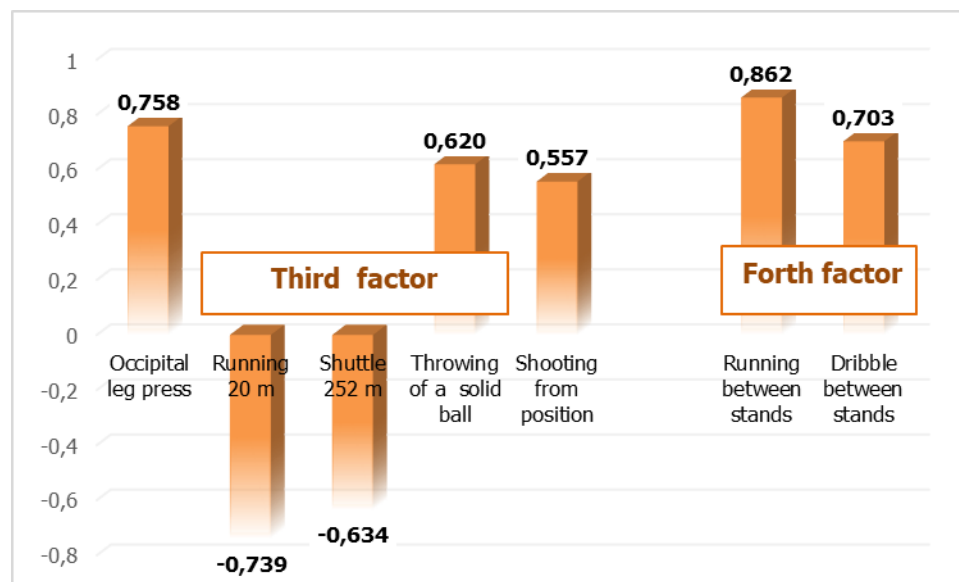


Fig.35. Factor structure of 15-16-year-old basketball players at the beginning of the study - factors III and IV

The sixth factor (5.46%) determines the influence of the body mass index on the explosive force of the lower limbs during vertical muscular effort.

The seventh factor is the last factor in the factor structure and is 5.07 %. It includes only one indicator that determines the ability to lead the ball at high speed. This means that this feature does not give any advantage to the studied basketball players.

After a sports-competitive year in the factor structure of physical development, and the specific working capacity of 15-16-year old basketball players, significant changes occur. The basketball players' factor structure is now made up of 5 main factors.

Compared to the factor structure of 15–16-year-old basketball players at the beginning of the study and at the end of the study, the first (24.61%) and the second component have the highest percentage (21.25%) and explain almost 46% from the sample (Fig. 37).

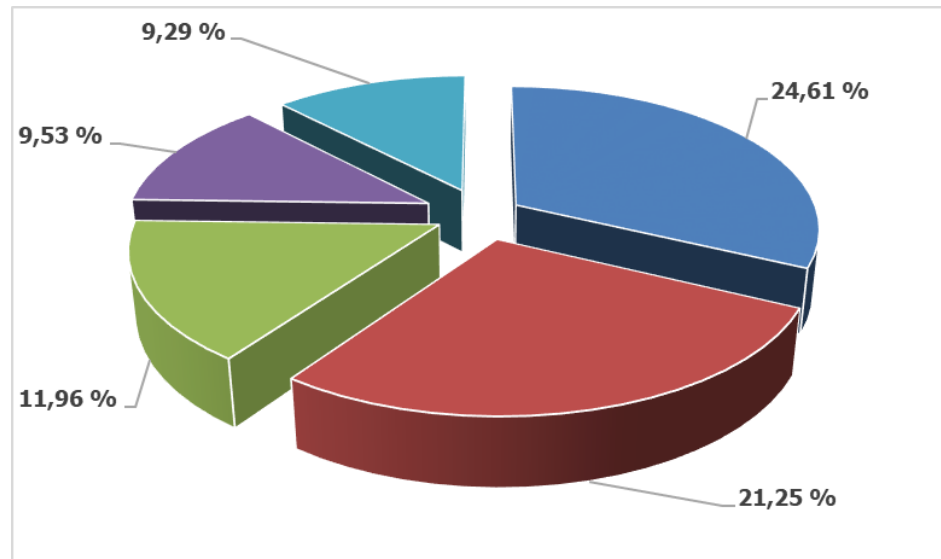


Fig.37. Relative share of the initial dispersion explained by each factor in 15-16-year-old basketball players at the end of the study

In the first component, shown on Figure 38, there is an increase in the contribution of the speed of movement on the field with and without a ball, the performance of the defence, the speed endurance and the strength of the abdominal muscles. At the beginning of the study, these variables are located in the third and fourth factor component.

The second component can be considered as morphological, because it includes all anthropometric indicators, as well as at the beginning of the study, but here we already have an indicator, related to the explosive power of the upper extremities, which shows that the height and weight indicators are a prerequisite for higher achievements when throwing the solid ball.

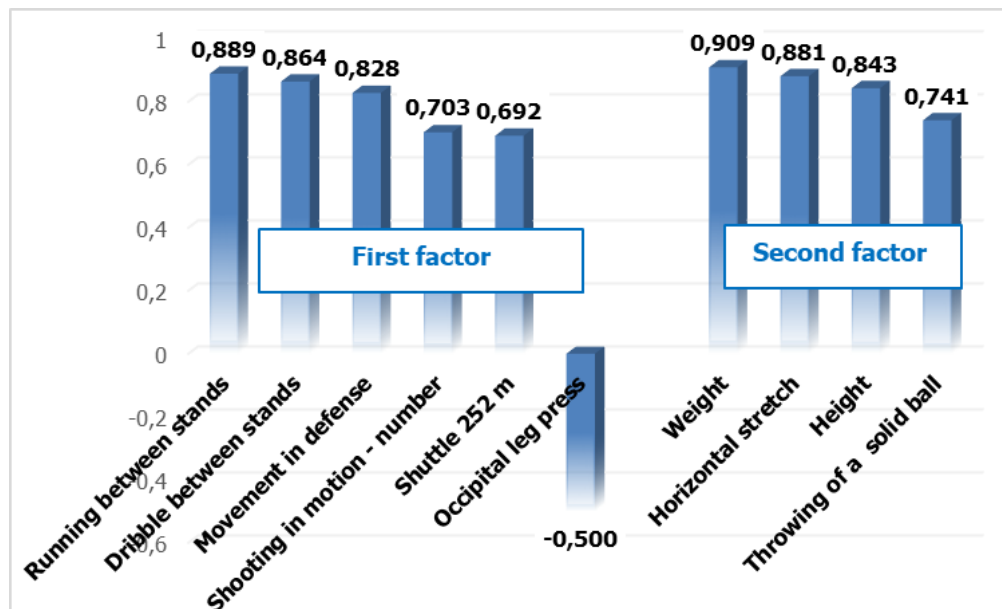


Fig.38. Factor structure of 15-16- year old basketball players at the end of the study - factors I and II

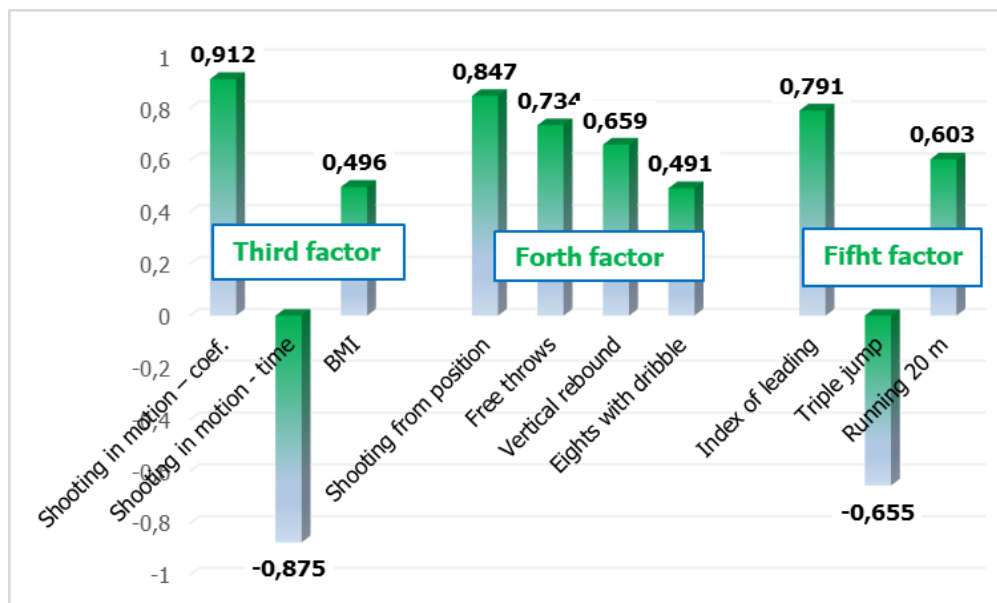


Fig.39. Factor structure of 15-16-year old basketball players at the end of the study - factors III, IV and V

The *third component* of the general physical and technical-tactical preparedness at the end of the study, presented in Fig. 39, includes the ability to quickly score shots and the body mass index.

Although the last two components have the lowest percentage of the explained dispersion ($F4 = 9.53\%$ and $F5 = 9.29\%$), ***the fourth component*** (Fig. 39) determines the second to last place in the factor structure, of the accuracy of shooting from the penalty line, shooting from a position, explosive force of the lower limbs at vertical efforts, as well as the skill of the basketball players to keep the ball in place. They show that at the end of the study, the effectiveness of shooting from the penalty line and shooting from a position loses its significance as one of the most important signs of physical development and specific performance.

The fifth component (Fig. 39) determines the place in the factor structure of the special speed of movement, of guiding the ball and the explosive force of the lower limbs at horizontal muscular efforts.

The factor analysis made at the beginning and at the end of the study shows that in this age group within a sports-competitive year there is a dynamic in terms of physical development of basketball players. At the beginning of the study, athletes are in a period when strength is growing rapidly and this should be used rationally by coaches. At the end of the study, some of the basketball players are in their late 16s, the age when the topography of muscle strength is shaped like an adult's and strength increases. The methodology applied by us for the development of speed and strength qualities in 15-16-year old basketball players is suitable and can be applied in the annual training cycle.

III.4. Planning model of speed and strength training for 15-16-year old basketball players during the annual training cycle

To achieve the goal and solve the tasks of the research, a planning model during the annual cycle is presented, in which means for purposeful development of the speed and strength abilities of adolescent 15-16-year-old basketball players are derived.

Paired two-cycle periodization is effective for basketball training. This is determined by the dynamics of the game and the specific requirements for the competitions (Peltekov et al., 1993). This structure creates conditions for greater dynamics of the training process (Zhelyazkov, Tsv., D. Dasheva, 2017).

Table 25 presents a model of periodization of paired two-cycle training for 15-16-year old basketball players. The preparation period (1st mesocycle) has a basic nature. The work during the first stage is related to building a basic condition, mainly general endurance, strength and strength endurance. During the second part (the special-preparatory stage) the tasks related to the special physical and technical preparation are being solved, the basics of the tactics are being laid. The degree of pressure increases gradually, reaching a high level of tension at the end of the period. During the pre-competitive period (2nd mesocycle) the load reaches its maximum. During this mesocycle in both microcycles there are two workouts. During the first microcycle there is one strength training with 70-85% of max and one training for maximum strength with intensity 85-95% of max. During the second there are two training sessions for maximum strength with intensity 85-95% of max. The number of special exercises is increasing, as is their intensity. The emphasis in the training is focused on tactical training (studying tactical combinations and variations of the game in attack and defense). Control matches and tests are conducted (intermediate examination for EG). The first competitive period is nearly 90 days. At this stage, the goal is to maintain the level of training and gradually get into shape. Explosive force is being trained twice a week during each microcycle. The combination of days is "Monday and Wednesday" or "Monday and Thursday".

Figure 40 shows a weekly training cycle of BC "Beroe" cadets during the competitive period in a combination of days "Monday and Thursday" for developing explosive power.

During the year there are single cases when the matches are held on Sunday. The program remains the same as everything is moved for the day after. On the days when there is no official competition, a control matches or a two-side game is held, but it is also possible to work for: individual technique and special physical training, endurance (aerobic running).

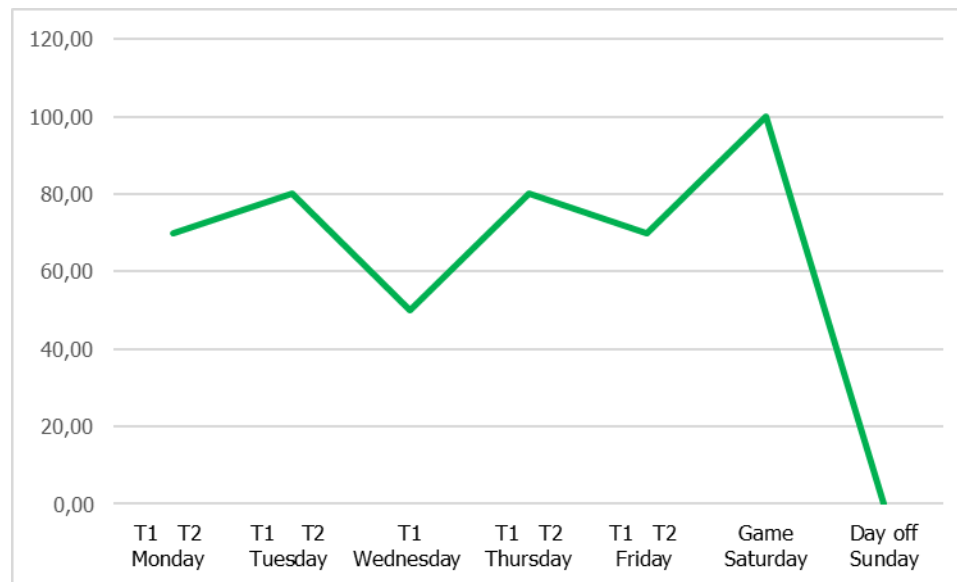


Fig. 40. Degree of loading in the weekly cycle during the competition period of EG

In order to better understand Fig.40, we have presented an example model of a microcycle during the competitive period with a match on Saturday and in the combination of the days for priority strength development "Monday-Thursday" of EG:

- **Monday** - T1 - SFP - strength (one of the two sets applies); individual technique and group actions; T2 - technical and tactical training - GTD and OTD;
- **Tuesday** - T1 - SFP-speed and coordination (see Appendix 5); individual technique and GTD; T2 - technical and tactical training - GTD and OTD;
- **Wednesday** - T1 - technical and tactical training - GTD and OTD; recovery;
- **Thursday** - T1-SFP- strength (one of the two sets is applied); individual technique and GTD; T2 - SFP-speed endurance; technical and tactical training - GTD and OTD;
- **Friday** - T1 - individual technique and GTD; T2 - modeled training;
- **Saturday** - competition;
- **Sunday** - day off.

During the weeks when there are no official matches, control or friendly matches are held.

The lack of a transitional period, which merges with the preparatory one is typical for the paired two-cycle preparation. Here the main differences come in the duration and content of the stages. The preparation is highly specialized. The second racing period is the longest in the annual planning - about 150 days. The main competition is at the end of the period and the goal is to reach the highest peak in the development of sports form by then. During each microcycle, the work on explosive power continues twice a week. The combination of days is again "Monday and Wednesday" or "Monday and Thursday".

When the Republican Championship is over, during the transitional period (5 weeks), in which, after a short active rest (3 days), there are two training sessions; 6 workouts for hypertrophy (the amount of work done, series and repetitions) at a certain intensity is what stimulates it. Relatively large volume training schemes are used. If the goal is to gain muscle mass, a minimum amount of work with a relatively high or medium intensity is needed); 2 training sessions for F_{max} , in which the load is determined by the individual needs of the basketball player. Individual training sessions for technique are also included. When working with adolescents, the training process should not be stopped, but with a properly measured load in order for a basic level of functional capabilities of the body to be maintained. It is worked mainly for the improvement and perfection of elements of the individual technique, and the development of the physical qualities.

Table 25.

MODEL OF PERIODIZATION OF DOUBLE TWO-CYCLIC TRAINING IN 15-16-YEAR-OLD BASKETBALL PLAYERS

[illegible]

[illegible]

Introductory (adaptive) training

Intensity: 40-60% of max., because they are experienced (short adaptation, because it is assumed that they have done fitness before)

Method: roundabout or by stations

Means: classic exercises, mostly with free load

Hypertrophy

Intensity: 70-85% of max, maybe "split"

Method: by stations ("split" or whole body)

Means: classic exercises, mostly with free load

Maximum force

Intensity: 85-95% of max

Method: by stations ("split" or whole body)

Means: classic exercises, mostly with free load

Explosive power - options:

1. Low load, but with fast movement

Intensity: 65-75% of max

Method: by stations (whole body)

Means: classic exercises, mostly with free load

2. Balancing exercises (turning, pushing, throwing)

Intensity 50-65% of max

Method: by stations (whole body)

Means: a combination of classic exercises, mostly with free load, and ballistic (turning, pushing, throwing)

3. Plyometric training (bounces, medicine ball, ...)

Intensity: own weight, medicine ball

Method: by stations (whole body)

Means: different types of bounces, different throws and catching a medicine ball

4. Complex training sessions

Intensity: 1 set of intensity 85-95% of max, and then 2 or 3 with little load and fast movements

Strength endurance -

Intensity: 60-75% of max, but fast movements

Method: by stations (whole body)

Means: classic exercises, mostly with free weight + bounces

Maintaining maximum force - intensity 80-85% of max

Intensity: 70-80% of max, fast movements with medium speed

Method: by stations (whole body)

Means: classic exercises, mostly with free load.

CONCLUSIONS AND RECOMMENDATIONS

The analysis of the results of the conducted research and the made summaries give grounds to formulate the following main conclusions:

1. The interviewed coaches underestimate the importance of control in the annual training cycle and define as medium and low the level of speed and strength training of young basketball players.
2. The established significance of the differences in the studied traits in adolescent basketball players at the beginning of the study, is evidence that:
 - a. In terms of physical development, EG and CG basketball players do not differ statistically significantly;
 - b. The control group was statistically significantly better than the experimental group in terms of speed capabilities, rapid movement on the field with a change of direction without the ball, the explosive force of the upper limbs and shoulder girdle, as well as the strength of the abdominal muscles.
3. The established significance of the differences of the studied features in EG at the end of the experiment gives us reason to accept as true the alternative hypothesis, according to which the positive increase in the speed and strength abilities of basketball players is statistically significant.
4. The established significance of the differences of the studied features in CG at the end of the experiment gives us reason to believe that they also have a positive effect on the level of physical development and specific work performance, but the increase in speed and strength is smaller. This is probably due to the smaller amount of strength and speed training work.
5. After applying a specialized training methodology during the training process, the basketball players from EG significantly surpass those from CG. The proven statistically significant differences show that the applied specialized methodology for the development of speed and strength abilities in young athletes has had a positive effect. This fact is confirmed by the ranking at a prestigious place of the team of BC Beroe at the national basketball championship for the respective group, as well as by the inclusion of two players in the national team for U16.

6. The derived correlation-factor structure of the studied indicators for the physical development, physical, technical and tactical preparedness of adolescent basketball players, before and after the tested training program, led to some shifts in the significance of the indicators:
 - a. At the beginning of the study for 15-16-year-old athletes the greatest contribution to the general physical and specific training has the high efficiency in high-speed shooting in motion and in the execution of penalty shots. Height and weight indicators are a prerequisite for higher performance when performing a triple jump.
 - b. At the end of the study, the speed and strength abilities are crucial and again the height-weight indicators are a prerequisite for higher achievements, but when throwing a solid ball - forward.
7. After the pedagogical experiment, conducted and tested in practice, our statement was confirmed that the purposeful development of speed and strength abilities in young basketball players will increase the efficiency of technical and tactical actions and their realization in competitive conditions.

Recommendations:

1. In order to prioritize the development of speed and strength abilities, we propose the developed one-year training program to be implemented in the annual planning of the training process for 15-16-year-old basketball players.
2. When developing training programs to improve the speed and strength potential of adolescent basketball players it is necessary:
 - ❖ when working for strength to be careful with regard to the loads, the dosage and repetitions must be individualized;
 - ❖ when working for speed, to emphasize on the speed of reaction and the beginning of the movement, which are especially important for the game of basketball;
 - ❖ when working on the explosive force of the lower limbs in coordination with complex movements in the area, it is necessary to emphasize on the technique of execution.

3. In this age group when forming the training process, it is necessary to include a larger number of means in order to improve the effectiveness of shooting from different distances and from the penalty lin

CONTRIBUTIONS TO THE DISSERTATION

1. A periodization system has been established for a one-year training program for 15-16-year-old basketball players, with a proposed specialized methodology for purposeful development of speed and strength abilities.
2. The factor significance of the physical development and the specific preparedness in basketball of 15-16-year old basketball players at the beginning and at the end of the annual cycle is derived.
3. The influence of the specific factor and its content has been established, which gives the name and significance of the factor, typical for 15-16-year old basketball players.
4. A model of periodization of paired two-cycle training for 15-16-year-old basketball players has been developed, as well as an example model of a microcycle during the competitive period with a competition on Saturday and in the combination of days for priority strength development "Monday-Thursday".

PUBLICATIONS RELATED TO THE TOPIC OF THE DISSERTATION

1. **Borukova, M., Asparuhov Y.**, Survey of the opinion of basketball coaches regarding the planning of the annual sports training of young players, Pedagogical Almanac, Pedagogical Magazine of the University of Veliko Tarnovo “St. St. Cyril and Methodius”, ISSN: 2367-9360 (Online) ISSN: 1310-358X (Print).2019, Volume 27, issue 1. pp.97-102.
2. **Borukova, M., Asparuhov Y.**, Variability of the signs of physical development and the specific working capacity of 15-16-year-old basketball players. NC "Optimization of the pedagogical process in basketball, volleyball, handball"; May 17, 2019, Yearbook of the National Sports Academy "Vassil Levski": Volume 1, Sofia: NSA PRESS, 2019, p.321-327.
3. **Asparuhov, Y., M. Borukova**, Comparative analysis of the physical development and sports preparedness of “Beroe” basketball club (BC) cadets'16 team, 2nd International Scientific Congress „Applied Sports Sciences“, N 978-954-718-601-9.Sofia.NSA PRESS, 2019, p. 70-76.