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# COMPARATIVE ANALYSIS OF THE ANTHROPOMETRIC CHARACTERISTICS, PHYSICAL PREPAREDNESS AND TECHNICAL SKILLS OF 14-YEAR-OLD BASKETBALL PLAYERS – BOYS AND GIRLS

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## ABSTRACT

*Purpose:* The purpose of this study was to describe some anthropometric characteristics, to trace the physical preparedness level and the technical skills of children (girls and boys) up to 14 years old participating in competitive basketball, to make comparative analysis of the average values of both totalities, and to find the relation and dependence between the anthropometric characteristics, physical preparedness and basketball skills of both sexes.

*Methods:* One hundred twenty-nine children were subjected to study, out of which sixty-three basketball players (boys) at the age of  $13 \pm 0,7$  and 66 basketball players (girls) at the age of  $13 \pm 0,5$ . Sport-pedagogical test was applied to the participants, and a probated and standardized test battery including twenty indicators was used. The basketball players participated in the test voluntarily, they received no money or financial compensation for their contribution and their anonymity was guaranteed.

*Data analysis:* Statistical analyses were performed with SPSS-23 and variation, correlation and comparative analysis were made, t-criterion of Student and U-criterion of Mann-Whitney were used.

*Results:* As we had supposed and as it was proven by the results for that group, the gender differences had a more substantial impact on some physical development indications and greater part of the physical preparedness indications. In favor of the boys these differences were more strongly expressed in their height, degree of body mass and horizontal stretch, while in favor of the girls the differences were in the functional capacity of the chest. Boys were fully favored as far as rapidity, speed abilities, explosive strength of the lower limbs were concerned.

*Conclusion:* We have to note that the accumulated training experience and the biological ripening impact positively on the performance of young male and female basketball players. The results of this study showed that there were statistically significant differences between boys and girls in terms of technical skills (TS) only along two indicators.

**Key words:** basketball, coming up generation, puberty and basketball technical skills

## INTRODUCTION

The game's popularity is due to players' athleticism, expressed by an optimal combination of their body size, physique, motor abil-

ities, and technical skills (Drinkwater, Pyne, McKenna, 2008). These features are often represented as multivariate profiles associated with success in response to training and com-

petition, not only in senior but also in youth players (Vaeyens, et al., 2008).

The importance of basketball players' body sizes, specifically the tall stature, is well documented (Drinkwater, et al, 2009). A basketball player of excellent body structure for basketball: wide shoulders, sufficiently long arms and legs, height, strength, not very heavy, good coordination, quick and athletic is potentially a player of great physical talent but not obligatory talented in all other categories (Borukova, 2018). Sports technical qualities have to be perfected in relation to the development of the motive qualities (Sergiev, 2019).

The problem for the structural establishment of teams increases the interest towards studies related to the selection of perspective basketball players (Gyosheva, Tsarova, 1980; Tsarov, 2003; Borukova, 2018).

The existence of „individual particularities during the time children enter puberty” has to be taken in view when performing selection in child age. Around 15-20 % of the children are accelerates and enter puberty one, two or more years earlier while 10-15 % are retardants, i.e. they enter into the puberty development phase one or two years later. The rest 65-70 % are normally developing, the so-called medians (Tsarov, 2008).

It is not possible to change a person's physical development, the morphological signs and overall development as they result from the dialectic interaction between the heredity factors on one hand and the factors arising from the continuously changing conditions of the interior (biological) and exterior (nature and social) environment. Some certain physical development indications can only be changed through purposeful training. Competitors can become bigger and stronger by building up body mass, however, during that time it is obligatory that they have purposeful training towards increasing agility and speed. Quicker reaction and

better coordination can be reached by training for agility, but both the type of the body and the quicker shortening of muscle fibers cannot be changed. It is very difficult to train for speed, but even if it is trained, it cannot be improved, only certain level can be maintained. That fact requires that coaches be well aware of the modeling periods for the development of young athletes' certain motive quality and gender particularities.

The knowledge about young players' age and gender particularities is a prerequisite for a sport pedagogue to be able correctly to manage the various stages of the perennial sports preparation. It has been established in a range of studies that for boys and girls at the age of 13-14 practicing basketball regularly, statistically important differences are observed mostly in the anthropometric characteristics and the physical preparedness in favor of the boys, while as far as the technical skills of the game are concerned, experts reckon that the girls of that age are better (Gyosheva, Tsarova, 1990; Tsarova, Borukova, 2014). Today, as a result of long years of studies, we have the reason to state that there will be no statistically important differences between the boys and the girls in relation to a great part of the indicators under study. In a similar study of 13-14 year-old pupils (boys and girls) on physical preparedness level only, the differences between the sexes appear to a greater degree in the explosive strength of the lower and upper limbs and to a smaller degree in the speed abilities of the children while the advantage is totally in favor of the boys (Borukova, 2019).

The motive qualities development is in conformity with their modeling periods. Many authors have detailed studies in that respect (Slanchev, 1992; Petrov, 1995; Jeljazkov, 2002; Dasheva, 2002; Tsarov, 2008; Borukova, 2018).

G. Kirsten's (Kirsten, 1963) surveys show that for the age between 11-14 years, strength training has similar effect on both boys and girls. Krastyu Tsarov generalizes that on the basis of established facts explaining the motoric development, it is namely the middle school age (11-15 years when greater part of the future basketball players enter an organized training process), during which optimal conditions exist for the development of maximum speed, speed of the separate movements, starting speed, explosive strength, coordination abilities (in particular dexterity) and active suppleness (Tsarov, 2008).

That age is suitable for developing the strength endurance, as well as the aerobic and a little bit later – at the end of puberty – the anaerobic processes (Borukova, 2018).

The analysis of the physical fitness of basketball players through specific field tests measured with microtechnology instruments provides coaches and physical coaches with objective and reliable knowledge. That is why, physical fitness assessments are carried out through physical fitness tests. The choice of the test is important and affects the final result. Tests that are specific to the sport to be evaluated and that are carried on the court or training place must be selected in order not to affect the athlete nor produce unreliable results (Mancha-Triguero, 2020).

Although studies have not always been able to differentiate young players from finalists, semi-finalists, and lower-ranked teams (Ramos, et al., 2018) most found these attributes to be highly associated with players' competitive levels (Torres-Unda, et al., 2012) and game performance (Torres-Unda, et al., 2016). The study by Karalejić et al. (Karalejić, Jakovljević, Macura, 2011), reported that correlations between anthropometric indicators and TS in youth athletes were relatively low, ranging from 0.23 to 0.54.

A study on the connection between laboratory and field tests and the performance of young basketball players was conducted by Zaric, et al, (2018). The practical application of this study is a system designed for controlling the efficacy of the training process in the preparation stage, the selection and the creation of the model characteristics of functional, metabolic and motor abilities of young basketball players (Zaric, et al, 2018).

Reina, et al, (2019), made comparison of three methods for quantifying the training load in basketball. The research was done on paper which did not involve any costs and informed about the actual load maintained by the athletes during training (Reina et al, 2019).

Coaches' ability to select, measure and evaluate the objective status of the future junior female basketball players, to prognosticate their development, to apply the respective means and methods for training, to exert effective control on the preparedness of the competitors at the different stages of their development, is particularly important for the successful management of the educational and training process (Tsarov, 2008; Borukova, 2018).

It is confirmed that the additional effects from the training experience and the biological ripening impact positively on the young basketball players' presentation. We recommend that coaches concentrate not only on the body size of the players but on the level of their skills particularly during adolescence, when they select the teams so they can encourage a stable, lasting development (Guimarães, et al, 2019).

The analysis of the facts above, our personal experience and observations give us the reason to formulate the following working hypothesis: We assume that there are statistically important differences in relation to some anthropometric characteristics and physical preparedness for both sexes at the age of 14, but

in relation to the basketball skills there will be no such differences.

**The purpose** of the present study is to describe some anthropometric characteristics, to analyze the physical preparedness and technical skills of 14 years old children (girls and boys) participating in competitive basketball as well as to compare the average results between these two groups and to find the relations between anthropometric characteristics and physical preparedness, and anthropometric characteristics and basketball skills.

In order to fulfill the aim of this study we set the following tasks: 1) to establish the level of the physical development, physical preparedness and the level of the technical skills of both sexes of the age group under study; 2) to make a comparative analysis of the average levels of the separate indicators for both sexes; 3) to disclose the degree and character of dependence between the physical development, physical preparedness and technical skills tests.

## METHODS

The study was conducted during the period between October 2019 and February 2020.

### *Participants*

The research was done among 129 children, out of which 63 junior male basketball players listed in various clubs in Bulgaria at the age of  $13 \pm 0,7$  and 66 junior female basketball players listed in various clubs in Bulgaria at the age of  $13 \pm 0,5$ . The participants in the study had been training organized basketball for  $5 \pm 2$  years. The training sessions during the last two years had been once a day, six days per week. All 129 participants in the study had taken part in the National basketball championship for the respective age group and some of them were members of the national team project for the respective age. All clubs in

the country are working according to the Common educational methodology, introduced by the Bulgarian Basketball Federation in 2018.

### *Procedure*

The sport-pedagogical tests were applied by one and the same researcher and the coach of the respective team under terrain conditions within the frames of one regular training session (120 min); students in their last year of study in National Sports Academy "Vassil Levski" with major "Basketball coach" participated in the research process. The anonymity of the children was guaranteed by listing them under a different number, (which was known by the team coach only) with the purpose to use the results for the optimization of the school-training process after processing the data. Everybody participated in the study voluntarily and received no money or financial compensation for their contribution. Nobody from the participants refused to take part in the study except those with injuries or indisposition. Short instructions, video and demonstration of the test battery were presented prior to testing. After measuring the anthropometric parameters, each team had 10-15 minutes to warm up. The tests of all were performed according to the sequence presented in Table 1. The study was performed in standard conditions – a basketball hall with the necessary equipment; chronometer, measuring apparatuses; cones, basketball balls and a medicine ball of 2 kg. The participants performed each test twice. Their better achievements were taken in view when analyzing the results.

Sports pedagogical testing was conducted with the participants for the needs of the study, probated and standardized test battery was used, covering 20 indicators bearing information about the basic indications of the physical development, physical preparedness and tech-

nical skills in basketball. The indicators were divided into three groups: for physical development – from the 1st to the 6<sup>th</sup> indicator; for physical preparedness – from the 7<sup>th</sup> to the 11<sup>th</sup> one and for technical skills – from the 12<sup>th</sup> to the 20<sup>th</sup> indicator.

**Table 1.** *Description of the used tests in the research*

<b>№ Indexes</b>	<b>Measure. units</b>	<b>Exactness of measurement</b>	<b>Direction of growth</b>
1. Height	cm	1,0	+
2. Weight	kg	0,5	
3. Body Mass Index	kg/m <sup>2</sup>	0,01	
4. Breaststroke - Pause	cm	1,0	+
5. Breast circumference - respiratory difference	cm	1,0	+
6. Horizontal extension	cm	1,0	+
7. Sprint 20 m	s	0,01	-
8. Vertical jump	cm	1,0	+
9. Long jump	m	0,01	+
10. Running between stands (Figure1)	s	0,01	-
11. Throwing a tight ball with your face	m	0,01	+
12. Eights with a dribble	number	1,0	+
13. Leading the ball (dribble)between stands. (Figure 1)	s	0,01	-
14. Ball keeping index	s	0,01	-
15. Movement of a defense stand (Figure 2)	s	0,01	
16. Speed shooting – time (Figure 3)	s	0,01	-
17. Speed shooting – score (Figure 3)	number		+
18. Speed shooting – index (Figure 3)	s	0,01	-
19. Shooting from a position with a feeder	number	1,00	+
20. Free throw	number	1,00	+

The physical development and physical preparedness tests are standard and applied in the sports practice for many years. The tests for the technical skills are strictly specific for the different sports and for better illustration and perception of the information they should be described.

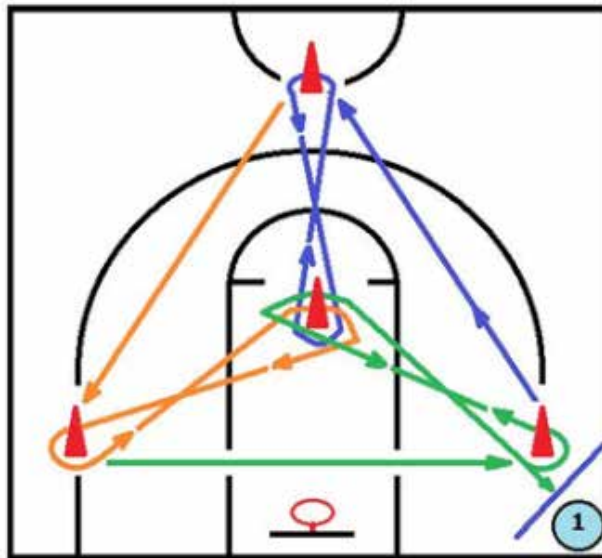
***Description of the tests for technical skills used for basketball:***

*10. Run between stands.* From high start as initial position, the player is running along equilateral triangle with 10 m length of the side. Stands are posted at the three tops of the triangle and in the center. The route is shown in Figure 6. The direction of the start is by choice – to the right or to the left. The result is recorded with exactness of 0.01 s.

*12. Eights with a dribble.* Initial position – basketball posture, feet are positioned

more widely than shoulders, the ball is positioned at the right flank. Upon a signal, dribble is performed with the right hand on the right leg side, then crossed dribble follows by moving the ball from back forward through the legs, taking the ball with the left hand, dribble on the left leg side, crossed dribble from back forward between the legs to the right hand and so on. Each tap of the ball on the ground, performed without infringing the defined consecutiveness of the movements, is counted. The exercise is 30 s. long. It is performed twice, and the better results is recorded.

*13. Leading the ball between stands.* The same exercise is performed as described for indicator 11 (running between stands) – see Figure 1 but the distance is overcome by leading the ball. The result is recorded with exactness of 0.01 s.

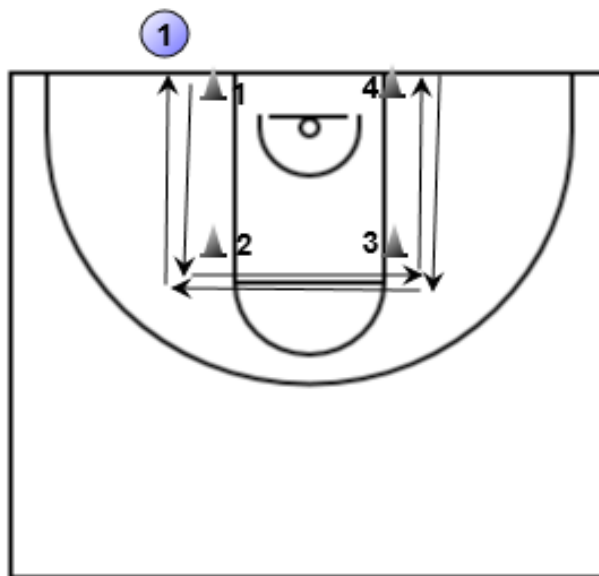


**Figure 1.** Diagram of positioning of the stands for the tests № 10 (Running between stands) and № 13 Leading the ball (dribble) between stands

14. *Leading the ball index.* It presents the difference between the results of test No.13 and test No. 10, recorded in seconds with exactness of 0.01.

15. *Moving in defense.* It is performed round a square with 5 m sides, at the angles of which stands are positioned (Figure 2). Run-

ning sprint on side 1-2, moving in defensive standing 2-3, running back on side 3-4 and then the distance is overcome in the same way in the reverse direction towards the initial position. The result is recorded with exactness up to 0.01 s.



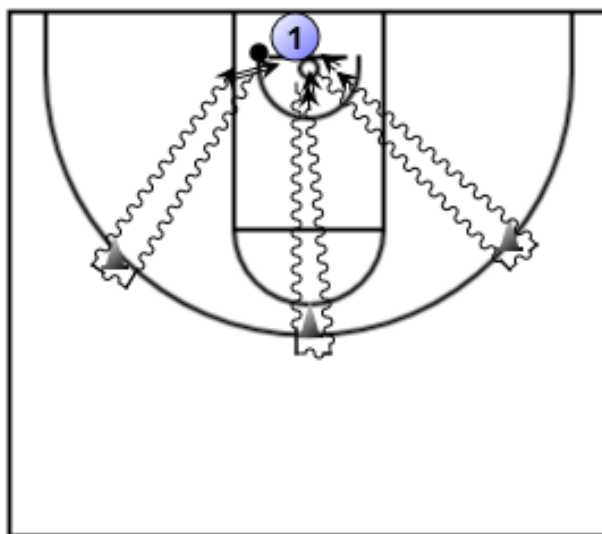
**Figure 2.** Diagram of positioning of the stands for test № 15 Moving in defense

16. *Speed shot on the run.* Initial position – high start at the base line (under the basket) holding the ball with hands. Round-

about is performed by leading the ball, then a shot to the basket while moving follows (after two steps) consecutively at each of the three stands, positioned at the 3 p line (against the basket and under angle of 45° from the left

and from the right) – (Figure 3). Two tours are performed (6 shots total). During the first round the leading and shooting are performed with the dominant hand and during the second

one – with the non-dominant one. The time of the performance is recorded with exactness of 0.01s., as well as the number of the successful shots into the basket (at correct coordination).



**Figure 3.** Diagram of positioning of the stands for test № 16 Speed-shot of the run

17. *Speed shot while moving*– number. The successful shots in the basket are recorded (correct coordination) while performing indicator No. 16.

18. *Speed shot while moving* - The coefficient of effectiveness for the speed shot while moving is calculated; the time of the performance is divided into the number of the successful shots in the basket. Exactness of up to 0,01 s is recorded.

19. *Shot with feeder.* 3 series of 10 shots into the basket from 3 positions are performed:

- ✓ perpendicular to the board;
- ✓ under angle of 45° to the board;
- ✓ under angle of 0° to the board.

The positions may be arranged in the left or right half of the playing ground (according to the executor's choice). After each series both players change positions. Shooting is performed at 3.50 m distance from the ring center projection on the ground. The total number of the successful shots into the basket for the three positions is recorded.

20. *Free throws* – number of success-

ful ones. The number of the successful shots is recorded. The relative share (in %) of the successful shots in the basket against all free throws performed is calculated as a result of the test too.

### **Data analysis**

For the realization of the purpose and tasks set for the study, the following methods of research were applied: *survey study of the specific literature and sport-pedagogical testing.*

The results from the study were subjected to mathematical-statistical processing with SPSS 23; depending on the tasks of the research the following statistical methods were applied:

- *variation analysis* – for defining the average values, normality of distribution and variety of the indicators under study;
- *comparative analysis by t-criterion of Student for independent samples* – for checking the reliability of the differences between the average levels of the indicators under study between both groups – girls and boys. The critical value of the t-criteri-

on, at high statistical reliability ( $P \geq 95\%$ ), is  $t_{\text{critical}} = 1.97$ . That satisfies the needs of the sports practice (Gigova, 2002);

- *comparative analysis* of two independent samples with U-criterion of Man Whitney about quantitative indicators with distribution of the values different from the normal ones;
- *correlation analysis* – for defining the degree of dependence between the indicators under study. Ordinary linear correlation was used according to the “everybody against everybody” method.

## RESULTS

### *Physical development*

The variation analysis results for the physical development indicators under study (Table 2) showed that the values were of normal distribution and the totalities under study were homogeneous and relatively homogeneous in relation to the indications about which these indicators bear information. It can be seen in Table 2 that for both sexes the groups were homogeneous in relation to three indications – height, chest measurement-pause and horizontal extension. Although the groups were homogeneous, we have to note an interesting fact – during similar studies held in 1990 in Bulgaria, the average height of the boys was 1.76 cm. and of the girls - 1.72 cm. (Gyosheva, et al, 1990). At that time, the children from the same age group, training basketball, were by +4 cm. higher for the boys and by +7 cm. for the girls. The last studies held by a scientific team R. Tsarova and M. Borukova during the period 2012/2015 of junior male and junior female basketball players from the age of 12 till 19 years, established that the players of today in all age groups were much shorter in comparison with the generations before them. The trend is for lower results each consecutive year (Borukova, 2018).

The higher values of the variation coefficient showed that both groups were relatively homogeneous in relation to indications bearing information about the weight, the degree of body mass and the functional capacity of the chest. For the needs of the study, the normal distribution of the quantitative values of the indicators under study, gave us the reason to apply the comparative t-criterion of Student for independent samples. Table 1 presents the comparative analysis of the physical development indicators of 14 years old junior male and female basketball players. The critical value for both totalities was compared for independent samples at guarantee probability of  $P \geq 95$  is  $t_{\text{critical}} = 1.97$ . For three of the indications the advantage was for the girls, these are the indicators related to the weight, chest measurement – pause and chest measurement – difference. Only for the chest measurement the difference between both groups was statistically important and supported by guarantee probability of  $P \geq 95$ , for the rest indicators the differences can be explained by occasional reasons. The boys had advantage in three indications too: height, body mass index and horizontal extension. It is very difficult to establish the degree of body mass of children according to the weight and height indicators only, that is why BMI was worked out to give us the idea in which zone the children were. According to World Health Organization's (WHO) standards for BMI of 14-year-old girls and boys, there were overweight children in both groups, but the number of the overweight girls was greater than that of the boys and the degree of their body mass was higher. That was proved by the t-criterion calculated values too. The empiric values were higher than the critical value provided for all the three indicators. Consequently, the existing differences in relation to these indications were statistically reliable which was supported by 95 % guarantee probability.



**Table 2.** Mean values, variability in recognition and comparison of analysis of physical development indicators

Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	t emp	P (t)
1.Height	Boys	63	1.50	1.99	1.718	.106	6.190	.321	-.388	0.069	.699	<b>4.22</b>	100.00
	Girls	66	1.45	1.79	1.649	.077	4.699	-.325	-.512				
2.Weight	Boys	63	31.50	85.00	57.10	12.941	22.66	.488	-.348	0.623	.054	.305	23.93
	Girls	66	36.00	79.00	56.48	10.125	17.93	-.062	-.0652				
3. BMI	Boys	63	14.00	26.50	19.17	2.871	14.98	.388	-.336	-1.486	.491	<b>2.865</b>	99.51
	Girls	66	13.78	29.12	20.65	3.013	14.59	.222	-.229				
4. Breaststroke - Pause	Boys	63	62.00	100.00	78.88	7.194	9.12	.126	.41	-2.464	.324	1.857	93.44
	Girls	66	66.00	95.00	81.35	7.838	9.63	.007	-.963				
5. Breast circumference - respiratory difference	Boys	63	4.00	10.00	6.75	1.399	20.73	.241	-.482	-1.029	.625	<b>3.724</b>	99.97
	Girls	66	4.00	12.00	7.78	1.714	22.04	-.189	.193				
6.Horizontal extension	Boys	63	146.00	203.00	169.32	12.822	7.57	.332	-.457	4.408	.391	<b>2.256</b>	97.42
	Girls	66	140.00	180.00	164.91	9.150	5.55	-.561	-.127				

**Physical preparedness**

The results from the variation analysis of the physical preparedness indicators under study (Table 3) showed that the values were of normal distribution while the totalities under study were homogeneous and relatively homogeneous in relation to the indications under study. It is seen from table 3 that again for both sexes the groups were homogeneous in relation

to two indications related to the speed of moving – “20 m sprint” and “run between stands”. It is scientifically proven that from 12 to 15 years speed is improved primary on the account of reaching higher dynamic force, where from 12 - 14 years it is on the account of the body growth, explosive strength and increase of the muscle strength while from 14 to 16 years it is increased thanks to the explosive strength.

**Table 3.** Mean values, variability in recognition and comparison of analysis of physical performance indicators

Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	t emp	P (t)
7. Sprint 20 m	Boys	63	4.30	2.83	3.46	.255	7.36	0.331	1.194	-.287	1.006	<b>6.595</b>	100
	Girls	66	4.22	3.16	3.75	.240	6.40	-.307	.313				
8.Vertical jump	Boys	63	21.00	63.00	40.78	9.124	22.37	.23	.016	6.838	.821	<b>5.096</b>	100
	Girls	66	22.00	53.00	33.94	5.833	17.19	.574	.787				
9.Long jump	Boys	63	135.00	254.00	194.40	26.521	13.64	.118	-.483	17.276	.689	<b>4.153</b>	100
	Girls	66	130.00	220.00	177.12	20.463	11.55	-.016	-.418				
10. Running between stands	Boys	63	27.08	19.23	21.65	1.579	7.29	.859*	.998	-.834	.542	<b>3.187</b>	99.82
	Girls	66	26.40	20.02	22.49	1.393	6.19	.693*	.154				
11. Throwing a tight ball with your face	Boys	63	2.70	7.00	4.41	.976	22.13	.563	-.128	0.266	.331	1.898	94.00
	Girls	66	2.90	5.30	4.15	.575	13.88	.059	-.629				

Both groups were relatively identical in terms of the explosive strength of the lower limbs as well as the upper limbs and shoulder girdle. In terms of mean values, boys outperformed girls by all five indicators. By applying the t-criterion of Student for independent extracts it was established that for four of them, the empiric values of the criterion were higher. Consequently, we can state by high guaranty probability that at the age of 14, boys are much quicker in relation to the speed, moving along the terrain without a ball and possess higher explosive strength at horizontal and vertical jump than girls. All four values of t are supported by high guarantee probability  $P \geq 95$ . If we have to compare the boys' and girls' values of the jump for height with those of 1990, we shall see that now the values are again lower: the boys' jump by 4 cm. and the girls' by 5.5 cm. Only along the indicator, which is related to the explosive strength of the shoulder girdle and arms, no statistically significant difference was observed between boys and girls, and the differences obtained can be attributed to random reasons. That proves G. Kirsten's statement that training for strength have similar effect on both 14-year-old boys and girls. After maturing sexually and after 14 - 15 years of age the strength is increased stormily and reaches its maximum values at 18-20 years of age (Tsarov, 2008).

### ***Technical skills (TS)***

As expected, both the boys and the girls performed with greatest pleasure all tests related to the basketball specific technical skills (TS) and managed them excellently. For the variation analysis (Descriptive statistics) in Table 4 it is seen that for three indications both groups were homogeneous. These are indications which are related both to TS and

entirely to the speed of movement, namely: dribble between stands, speed of movement in defense, and the quickest time for making a basket. Both groups were relatively homogeneous as regards the rest of the indications, but here, there were indicators along which the groups were completely non-homogeneous, such as the dribble index. In relation to the skills for ball handling, more of the experts think that the girls at that age possess better fine motor skills. Anyway, in our study the group of the boys was relatively homogeneous while the one of the girls was not homogeneous. The periods for development of the coordination capacity are formed between 7 and 12 years, and after puberty, but only if during this period work has been done to improve them, as a result of which the highest indicators appear at the age of 13 - 14 years (Tsarov, 2008; Borukova, 2018). The better ball handling by the boys might be due to the fact that in Bulgaria it is characteristic for the work with the coming up generation that the boys start practicing basketball at earlier age – 6 - 7 years while the girls enter the basketball hall at the age of 8 - 9 when they were dissatisfied with training some other sport and decided to try basketball.

When comparing the average values, it was established that from all nine indicators, the girls had advantage for three of them. Anyway, for checking the reliability of the differences, the comparative analysis of t-criterion of Student for independent extracts was again applied. For three indicators – dribble between cones, leading the ball index and shot on the run – coefficient, the distribution of the values was different from the normal one which required the application of the U-criterion of Mann-Whitney.

**Table 4.** Mean values, variability of traits and comparative analysis of technical skills indicators

Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	t	emp	P (t)
12. Eights with a dribble	Boys	63	24	108	60.57	16.509	27.26	.325	.075	15.964	.906	<b>5.755</b>	100	
	Girls	66	8	88	44.61	14.987	33.60	-.213	.828					
Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	U	P (t)	
13. Dribbling between stands	Boys	63	34.58	20.06	23.18	2.412	10.41	1.864*	6.735*	-.850		<b>2.639</b>	99,02	
	Girls	66	30.1	20.82	24.03	1.964	8.18	1.234*	1.93*					
Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	U	P (t)	
14. Ball keeping keeping index	Boys	63	-2.37	7.5	1.52	1.331	87.40	1.422*	6.995*	-.015	.012	.038	0.030	
	Girls	66	-1.72	7.29	1.54	1.196	77.73	1.885*	8.29*					
Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	t	emp	P (t)
15. Movement of a defence stand	Boys	63	14.54	9.16	10.79	1.168	10.83	.925*	.535	.068	.069	.389	30.17	
	Girls	66	12.36	8.44	10.72	.793	7.40	-.306	0					
Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	t	emp	P (t)
16. Speed shooting - time	Boys	63	45.35	31.47	35.96	2.878	8.00	.736*	.742	-.458	.181	1.026	69.29	
	Girls	66	45.77	32.54	36.42	2.164	5.94	1.338*	4.376*					
Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	t	emp	P (t)
17. Speed shooting - score	Boys	63	3	6	5.08	.921	18.12	-.432	-1.14	-.189	.232	1.320	81.07	
	Girls	66	4	6	5.27	.692	13.12	-.421	-.833					
Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	U	P (t)	
18. Speed shooting - index	Boys	63	15.12	5.25	7.37	1.852	25.13	1.618*	3.905*	.333	.213	.320	25,10	
	Girls	66	11.44	5.42	7.04	1.207	17.15	1.287*	2.024*					
Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	t	emp	P (t)
19. Shooting from a position with a feeder	Boys	63	10	28	17.52	4.399	25.11	.244	-0.472	.610	.156	.883	62.12	
	Girls	66	7	25	16.91	3.409	20.16	-.625*	1.22*					
Indexes	Gender	N	Min	Max	X	S	V	As	Ex	d	Cohen d	t	emp	P (t)
20. Free throw	Boys	63	4	19	12.83	3.10	24.19	-.507	.332	-.107	.040	.210	16.89	
	Girls	66	8	19	12.94	2.58	19.92	-.153	-.703					

It is seen in table 4 that the girls had better results for three indicators: movement of a defense stand, better time for achieving basket and execution of free throws. After the application of various comparative criteria, it was established that there were no statistically important differences between both groups for the three indications mentioned. All differences were due to occasional reasons. The boys had advantage for all the rest of the indicators, but for two of them only, the values of the comparative criterion were higher than the t-critical. With a 100 % guarantee probability, we can say that boys handled the ball better on spot, performing eights

with dribbling. The high value of the U-criterion showed that the boys were considerably quicker than the girls when moving on high speed between the stands, which was supported by 99 % guarantee probability.

#### ***Correlation of the studied indicators for the girls***

Table 5 presents the correlation matrix of the 66 girls under study which allows disclosing the interrelations and dependences between the indications of the physical development and the physical preparedness. Seventeen interrelations were established; the fact that all physical development indications enter into relation with some of the

physical preparedness indications is impressive. Anyway, indicators like “long jump” and “run between stands” did not enter into interrelation with any of the indications under study, which shows that the explosive strength of the lower limbs in horizontal plain and the speed of moving along the terrain without a ball do not depend on the anthropometry for that age group but on the degree of the motive qualities development. The height of children at this age, in addition to being significantly and highly dependent on other anthropometric features, also signif-

icantly influences the explosive strength of the upper limbs when throwing a medicine ball - forward.

Anyway, more of the relations created were of moderate dependence. That gives us the reason to consider that the physical development indicators moderately influence the specific preparedness of the young basketball players (girls of 14 years). The moderate negative dependences of the respiratory difference indicated that the greater the development of the girls’ chest, the better sprinting abilities they have ( $r_{5,7} = -.384$ ).

**Table 5.** Correlation relations between the physical development and the specific preparedness for girls

Indexes	Height	Weight	Body Mass Index	Breast-stroke - Pause	Breast circumference - respiratory difference	Horizontal extension
1 Eights with a dribble	-.032	-.15	-.106	-.175	.294*	.064
2 Dribbling between stands	-.219	-.023	-.015	-.096	-.071	-.163
3 Ball keeping index	-.121	-.087	-.139	-.06	.074	-.062
4 Movement of a defense stand	-.171	-.082	-.057	-.059	<b>-.359**</b>	-.138
5 Speed shooting - time	.013	.205	.208	.125	-.218	-.032
6 Speed shooting - score	.04	-.058	-.087	-.046	<b>.343**</b>	-.001
7 Speed shooting - index	-.03	.113	.144	.087	<b>-.352**</b>	-.017
8 Shooting from a position with a feeder	.085	.17	.213	.227	-.231	.019
9 Free throw	.163	.188	.199	<b>.322**</b>	-.280*	.105

The correlation matrix analysis of the boys under study, presented in Table 6, allows disclosing the interrelations and dependences

between the indications of the physical development and the technical skills (TS).

**Table 6.** Correlation relations between the physical development and the technical skills indications for girls

Indexes	Height	Weight	Body Mass Index	Breast-stroke - Pause	Breast circumference - respiratory difference	Horizontal extension
1 Height	1					
2 Weight	<b>.710</b>	1				
3 Body Mass Index	<b>.348</b>	<b>.862</b>	1			
4 Breaststroke - Pause	<b>.614</b>	<b>.824</b>	<b>.688</b>	1		
5 Breast circumference - respiratory difference	.009	-.194	-.265	-.152	1	
6 Horizontal extension	<b>.885</b>	<b>.700</b>	<b>.405</b>	<b>.612</b>	.057	1
7 Sprint 20 m	-.125	-.010	.041	-.041	<b>-.384</b>	-.191

8	Vertical jump	.172	-.181	-.291	-.114	<b>.422</b>	.189
9	Long jump	.150	-.173	-.270	-.115	.245	.186
10	Running between stands	-.205	.042	.098	-.083	-.164	-.176
11	Throwing a tight ball with your face	<b>.773</b>	<b>.643</b>	<b>.395</b>	<b>.681</b>	.196	<b>.736</b>

Four moderate interrelations were established - one was of negative direction, which shows that the greater the development of the girls' chest, the faster they move while dribbling between the cones and the faster they shoot in the basket while moving. From the six physical development indicators, only the two indicators for the chest measurement had interrelation with those of the technical skills.

**Correlation of the study indicators for the boys**

Table 7 presents the correlation matrix of the 63 boys under study which allows disclosing the interrelations and dependences between the indications of the physical development and the physical preparedness. Here 21 interrelations were already established while

it is impressive that most of the physical development indications enter into relation with some of the physical preparedness indications. It is impressive that the following indicators – “chest measurement – respiratory difference”, “20 m sprint” and “run between stands” do not enter into any relation. Eight relations are of great dependence, six are of considerable dependence and one is of very great dependence, all the rest are moderate. Unlike the girls', the boys' explosive strength of the lower limbs had a moderate and significant dependence on the height, weight and horizontal stretch. As it is for the girls, the explosive strength of the upper limbs and the shoulder girdle is of considerable and great dependence with the physical development indications without the “chest measurement – respiratory difference” indicator.

**Table 7.** Correlation relation between the physical development and physical preparedness indications for boys

Indexes	Height	Weight	Body Mass Index	Breaststroke - Pause	Breast circumference - respiratory difference	Horizontal extension
1 Height	1					
2 Weight	<b>.789**</b>	1				
3 Body Mass Index	<b>.358**</b>	<b>.850**</b>	1			
4 Breaststroke - Pause	<b>.607**</b>	<b>.895**</b>	<b>.869**</b>	1		
5 Breast circumference - respiratory difference	.266*	.081	-.116	.02	1	
6 Horizontal extension	<b>.945**</b>	<b>.832**</b>	<b>.460**</b>	<b>.662**</b>	.229	1
7 Sprint 20 m	-.168	-.048	.075	-.031	-.072	-.196
8 Vertical jump	<b>.499**</b>	<b>.342**</b>	.081	.182	.091	<b>.532**</b>
9 Long jump	<b>.527**</b>	<b>.300*</b>	0	.189	.112	<b>.577**</b>
10 Running between stands	-.266*	-.083	.117	.05	-.017	-.285*
11 Throwing a tight ball with your face	<b>.759**</b>	<b>.823**</b>	<b>.595**</b>	<b>.675**</b>	.109	<b>.796**</b>

The analysis of the correlation matrix of the boys under study, presented in table 8 allows disclosing the interrelations and depend-

ences between the physical development and technical skills indications.

**Table 8.** Correlation relations between the physical development and technical skills indications for boys

Indexes	Height	Weight	Body Mass Index	Breast-stroke - Pause	Breast circumference - respiratory difference	Horizontal extension
1 Eights with a dribble	.091	.025	-.054	-.032	-.038	.151
2 Dribbling between stands	-.157	-.087	.023	-.043	.093	-.198
3 Ball keeping index	.031	-.059	-.098	-.137	.189	-.022
4 Movement of a defense stand	-.238	-.087	.101	-.003	-.012	-.280*
5 Speed shooting - time	-.292*	-.172	.001	-.133	-.066	-.298*
6 Speed shooting - score	.015	-.039	-.085	.009	-.024	-.085
7 Speed shooting - index	-.085	-.007	.079	.003	.049	-.035
8 Shooting from a position with a feeder	-.185	-.161	-.1	-.088	-.185	-.19
9 Free throw	-.056	.027	.069	.068	-.021	.023

We found that there was no relationship between the boys' anthropometric indicators and their technical skills. But this was not the case for girls, where there were 3 moderate relationships among the anthropometric indicators and the technical skills. That proves that the girls are at a more advanced stage of biological development than the boys, which is normal for that age group.

## DISCUSSION

All participants presented themselves excellently at the tests. It should be mentioned that both groups were more willing to participate in the technical skills tests than in those for the physical preparedness and measurement of the anthropometry. This evidence is partially consistent with previous reports for young basketballers, as offensive TS (speed shot shooting, passing, and control dribble) have been previously shown to be strongly related with the final team classification (Brooks, Boleach, Mayhew, 1987).

Basketball game consists of two basic phases – attack and defense. Both are of great importance for the game and are irrevocably related in their development. One phase cannot exist without the other one. As game skills and

application of the various ways of playing with the ball, game in attack is much more attractive and wished by the basketball players. The reason is that game in attack is more dynamic, offers more space for various individual action which makes it more attractive for the audience. Nevertheless, in relation to the tactic of the game, attack and defense have similar value, which means that player and coach should practice both attack and defense with the same will and effort. That is particularly important for young players who have to get used to motivated and easy performance of the game tasks in defense. A tendency is observed in young players' modern play – they concentrate on the offensive measurement of the game, i.e. players and coaches are strongly focused on players' abilities to shoot, dribble, breakthrough to the basket and pass the ball. Interestingly, this novel trend is also confirmed by studies using game-related statistics as technical performance predictors. For example, Torres-Unda, et al. (2012), reported that elite players scored more points per game, i.e., they were determinant for teams' offensive success. Even so, it is also possible that coaches may play an important role in these results, because at this age category they favor/select highly skilled play-

ers (Karalejić, Jakovljević, Macura, 2011). It is very difficult to define at that age which of the boys and girls are really highly qualified. In view of that analysis of the game effectiveness should be made and the relation and its dependence on the separate groups of the indications of the physical development, physical preparedness and technical skills found.

The age of 14 - 15 is crucial for the development of young basketball competitors. They are in a period of sports development and it is important that the work during the education-training process be directed towards development and perfection both of the individual qualities as group actions, team interactions and of the play efficiency (in attack and defense) (Borukova, 2017). Whether boys or girls, purposeful work is needed for the young players at that age towards development of their physical qualities, perfection of the technical skills and their application in competitive basketball. Aerobic and anaerobic physical demands in male players increase with age and there is improvement in technical-tactical performance. The obtained results progressively increase with age in the three categories, showing the influence of maturational development and sports experience. Aerobic and anaerobic physical demands in female players progressively increase with age and stabilize from the age of 16 reaching a plateau, their growth being more gradual (Mancha-Triguero, et al, 2020).

## CONCLUSION

Upon the analysis of the study results, it was established that both groups were homogeneous and relatively homogeneous in relation to the anthropometric indicators; in relation to the physical preparedness indications both groups were also homogeneous and relatively homogeneous; as far as the technical skills indicators were concerned, no homogeneity was observed in both groups for the indication re-

lated to the ability of leading the ball with high speed – “index of leading”.

Anthropometric indicators – for the chest measurement indicator – difference; the difference between both groups was statistically significant and supported by  $P \geq 95$  guarantee probability in favor of the girls; the differences for the rest of the indicators can be explained by occasional reasons. The boys had statistically reliable advantage for three indications: height, BMI and horizontal extension. During that age, the work for motive qualities is better accepted by the boys who enter their puberty development at that period while the results of the girls show that they are already in their second phase and it is normal that their physical preparedness falls behind that of the boys.

The research on the technical skills results, not surprisingly, is of greatest interest. During the age of 13 - 14 years, the training process becomes more focused. The positions of players are defined, the sports calendar is fuller, the formation of national teams for the respective age begins. The 13 - 14-year old children enter the stage of sports perfection and basic tactical preparation starts. That requires everything learned during the introductory tactical preparation (up to 12 years) to be raised up in the time by correct selection of the means and methods both at the preparation stage and respective age group. Additional to that, coaches should take in mind the available composition of the team, the individual particularities of the players, their experience (sports length of service); all that will be impossible if the pedagogue does not possess the necessary knowledge and experience (Borukova, 2018). Basketball provides excellent opportunities for improvement of personal and social values and enrichment young players' the mental abilities (Aleksieva, 2010).

We have to note that the accumulated training experience and the biological ripening impact positively on the performance of young

male and female basketball players. We recommend that coaches should concentrate on the overall work with the coming up players – work towards motive qualities, increasing the level of the technical skills and their application in the game. That would lead to the encouragement of stable, continuous development of young male and female competitors.

Following a review, analysis and numerous studies during the last 14 years, we think that the teaching-training process with coming up children in Bulgaria is not at the necessary level for the separate age groups. The results of the coming up young male and female basketball players, which are decreasing with every coming year, are an evidence for that. The latter imposes that the Normative system for evaluation according to the offered test battery should be updated continuously.

#### LIMITATIONS OF THE STUDY

Some limitations in our study should be pointed out: we do not have comparative analysis for the most important quality of the game – speed endurance, because in the test battery the "Shuttle run" test provides different distance for both sexes – 252 m for the boys and 168 m for the girls, which did not allow us to compare the results; we could not measure the skin folds because at that period we did not have professional expert and that is the reason why BMI was calculated.

After many years of research and numerous sports and pedagogical testing with the approved test battery of 20 - 25 indicators, we believe that the testing battery is too large and if there is not a high level of organization and accumulated experience it is very difficult to be applied within 120 min with one team of  $15 \pm 3$  children. In order to perform the study properly, it is necessary to create a new test, to approbate it and to use it as a new test battery with fewer and more advanced tests.

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