

Improving the protective technique of 13-14-year-old basketball players using rubber bands and unstable platforms

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Abstract: *The aim of the work* is to experimentally substantiate the method for improving the protective movements of basketball players 13-14 years old using rubber bands and unstable platforms. *Material and methods.* Basketball players of Children's and Youth Junior School No. 13 (aged 13-14 years) took part in the experiment: experimental group (n = 18); control group (n = 18). The experiment was conducted in August 2018 during three months. Before and after the experiment, athletes were tested for physical fitness (running 6 m, shuttle running 2x28 m, flexing their arms in the resting position, jumping on a skipping-rope), technical readiness (speed of defensive movements, throws from different distances, high-speed dribbling). To determine the psychophysiological state of the athletes of the experiment, psychophysiological indicators were recorded using the "Psychodiagnosics" computer program (the speed of a simple and complex reaction in various testing modes). To determine the speed of the hand motility was used the test "shifting chips." *Results.* An experimental technique has been developed and introduced into the training process of young basketball players. The technique includes performing defensive movements with a rubber band, exercises using unstable platforms, and running from non-standard starting positions. Revealed a significant (p <0.05) improvement in the tests: the speed of defensive movements, shuttle run, high-speed ball dribble, throws from different distances of the experimental team athletes compared to the control group. *Conclusions.* The positive influence of the developed method of improving the technique of protective movements on the level of physical, technical preparedness and psycho-physiological state of female basketball players aged 13-14 years is shown.

Keywords: basketball, unstable platform, rubber tape, protective movements.

Introduction

In the system of sports training for basketball players aged 13–14 years, the work on defensive movement techniques (Frolova at. al., 2018) is of particular importance. High-quality defense actions allow basketball players to achieve high and stable results. Researchers emphasize the lack of effectiveness of individual protective actions of young basketball players, although the movements are the basis for organizing group and team defense actions (Leite, Leser, Goncalves, 2014). In this case, the defenders must not only neutralize the attacking team of the opponent, but also fight for the ball bounced, to insure the front line players. Defenders should be aggressive in their play, have specific feelings of their body, ball and opponents, be able to quickly navigate on the court, combine the maximum speed of movement and accuracy of the techniques, be able to prevent the rapid development of the attack.

At the same time, at the age of 13–14, rapid growth and development of the organism occurs, the muscular apparatus is improved, the skeleton is ossified, an intensive process of puberty occurs. Therefore, sports training of young basketball players requires a constant search for new, more effective means of improving techniques and developing physical qualities.

Over the past decade, a great deal of attention has been focused on the use of exercises with unstable platforms in the training process of athletes in various sports (Chaouachi, Makhlof, Issam at al., 2017; Makhlof at al. 2018). Erkmén at al. (2012) note the positive effect of exercises on unstable platforms on the balance indicators of basketball players. Artiuh, Kozina, at. al. (2019) show an improvement in the level of psycho-physiological capabilities, physical and technical readiness of archers, as a result of the use of special equilibrium development tools. Marsh, at. al. (2004) revealed a close relationship between balancing capabilities and the power of baseball player transfer. Hammami at al. (2016) show an increase in indicators of reactive

strength, jumping ability, maneuverability and speed as a result of a combination of plyometric exercises and balance exercises in the training process of football players 12-13 years old.

Also, one of the new means of sports training is exercises with the use of rubber bands to increase the strength and elasticity of muscles and strengthen the muscular system. Peltonen, H., Hakkinen, K., Avela, J., 2012 investigated the neuromuscular responses of qualified athletes to strength exercises with or without rubber tape resistance.

However, the question of the effectiveness of the use of exercises on unstable platforms, as well as exercises using rubber bands, on the speed of defensive movements of basketball players remains to be studied. It is logical to assume that the use of rubber bands to improve the technique of protective movements can be carried out in various ways. For example, the question of the effectiveness of the use of a rubber tape to maintain a constant level of the center of gravity of female basketball players when performing defensive movements is not studied.

In this regard, the goal of our research was the development and experimental substantiation of the technique for improving the protective movements of basketball players aged 13-14 years using rubber tape and unstable platforms.

Material and methods

The participants. The research participants are 36 basketball players aged from 13 to 14 years. They have five years of experience in basketball and are included in the basic training group of the Children and Youth Junior School №13. 18 athletes were included in the experimental group and 18 in the control group. Athletes of both groups did not significantly differ in most indicators of technical and physical readiness.

To determine the speed of fine motor skills of hands, the test of "shifting chips" was used (Kharitonova & Suyangulova, 1996). Testing scheme: in a limited space (in a plastic box with a size of 15x19 cm) dibs of various diameters are scattered: large - 20 mm, medium - 15 mm, small - 5 mm. Ten dibs of each diameter are used. After the "Start" team, the teste, taking a large-diameter dib with his hand, should put it in a box next to it. Then he performs a similar action with the second dib of the same size, etc., until all the dibs are collected. After all the large-diameter dibs have been collected, they are mixed with the remaining dibs, and the teste begins to collect dibs of the next diameter on a signal. The test is carried out until the task is completed with the use of dibs of all proposed diameters. Fixed time shifting dibs of each diameter.

To determine the psycho-physiological state of athletes, psycho-physiological indicators were recorded using a computer program. "Psychodiagnostics" (Kozina, Iermakov, Bartík, Yermakova, Michal, 2018). The following parameters were fixed:

- a set of indicators for the rate of a simple visual-motor reaction (mean of 30 attempts (ms), standard deviation (ms), number of errors); duration of exposure (signal) - 900 ms;
- complex indicators of a complex visual-motor reaction of selecting two of the three elements (average of 30 attempts (ms), standard deviation (ms), number of errors); duration of exposure (signal) - 900 ms; s.

To determine the level of development of physical readiness of athletes, the following tests were used:

- Running 20 m with a fixation of the running time of the 6-meter segment (s).
- Shuttle run 2 by 28 m with a stop, touching the front line and returning back. The execution time was fixed (s).

- 30 s. push-ups (number of times).
- Jumping skipping-rope for 1 minute (the number of times).

To determine the level of technical development of athletes, the following tests were used:

• Test №1 "The speed of protective movements." There were points in the middle of the front line, at the intersection of the front and 3-point lines, on the 3-points line on both sides of the shield at an angle of 45 degrees and on the 3-point line opposite the shield. Protective movements were performed from the first point to all others, with a return to the first point near the front line; facing forward to the points located at an angle of 45 degrees with the return to the protective rack, running forward to the point opposite the shield with the back to back. When performing the test - be sure to touch the marked points. Fixed test run time (s)

• Test №2 "Speed ball dribble". The sideline was guided to the center, then the player moved in a protective stance to the other sideline with the ball in his hands, then ran backward with the ball in his hands, back and moved with the lead to the ring, making a throw into the basket with a hit. The execution time of the entire test (s) was recorded. At a miss, the result was not counted.

Test №3 "Throws for a while." There were 10 points: on two sides at the intersection of the front and 3-point line at a distance of 4.5 m and 6.5 m from the ring, at a distance of 4.5 m and 6.5 m on both sides of the shield at an angle of 45 degrees and 4.5 m and 6.5 m opposite the shield. Within 5 minutes the player moved points from the left edge to the right of the shield, performing first a medium and then a long throw. Balls were alternately served him by 2 partners. Fixed the number of hits.

• Accuracy of throws from an average distance. We performed throws from the middle line at a distance of 4.5 m from the ring, 3 episodes of 21 throws. The best result was recorded.

- Accuracy of throws from long range. Throws were made from a long distance at a distance of 6.5 m from the ring, 3 episodes of 21 throws. The best result was recorded.
- Accuracy of free throws. Performed free throws 3 series of 21 throws. The best result was recorded.
- The number and accuracy of throws from an average distance of 40 s. Throws were taken from the midline for 40 s. The number of throws and hits was determined.

Statistical analysis. Digital material was processed using traditional methods of mathematical statistics using Microsoft Excel, SPSS. We calculated indicators of descriptive statistic and compared samples by Student's method.

Organization of research.

Studies were conducted from August 2018 to October 2018. To improve the quality of the training process, a technique has been developed to improve the protective movements of basketball players 13-14 years old. Exercises were included in the training process 3 times in a weekly micro cycle after the main part of the lesson. The content of classes, the volume and intensity of the load of the additional part of the training session were regulated on the basis of the orientation of the main part of the training and the current state of the athletes. The load of the training session consisted of 4-8 exercises with the number of series from 2 to 4, performed by the interval method.

The control group performed standard exercises to improve defensive movements: movements in a protective stance at different distances, multiple starting jerks on a signal, jerks from different starting positions, somersaults, jumps with turning 90 ° and 130 °, falling forward or backward and fast rising and acceleration on 6-10 meters, serial jumps through barriers in combination with defensive movements, outdoor games with movements in a defensive stance, relay races, etc.

The experimental group applied the proposed experimental method of improving the protective movements (Fig. 1).

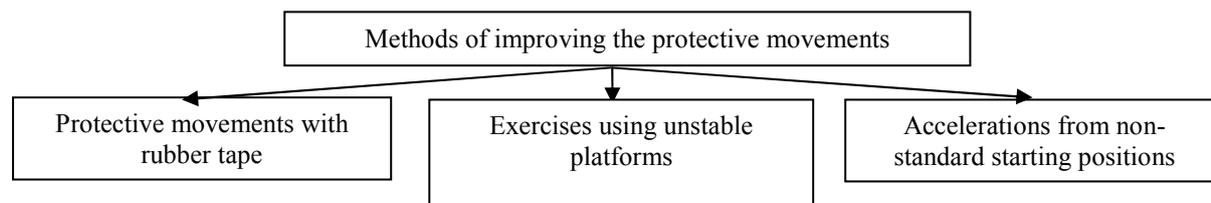


Fig. 1. Method of improving the protective movements

In our work we used:

1. Balancing hemisphere BOSU BS-1524B. The hemisphere is a soft dome on a dense round base. BOSU is equipped with two expanders on both sides to maintain balance. The diameter is 58 cm, the height of the "dome" is 23 cm. The complexity of the exercises was regulated by the volume of air inside the hemisphere and the use of flat or convex surfaces of the hemisphere.

2. Ball for fitness with a diameter of 100 cm.

3. Rubber band. The tape was stretched between two uprights of 6 m. The height of the tape was set at the level of the hip joint of the player standing in the protective rack. Racks were located on the front line of the basketball court. Players moved in a protective rack from one rack to another. The players were given the task to maintain the position of the center of gravity at the level of a rubber band (Fig. 2).



Fig. 2. Illustration of exercises

Exercises with changing directions from different starting positions. On a signal, a dash forward was made to a dib, a rack of a certain color, or to a player who moved, changing direction. Various running and jumping exercises were also performed. The speed of doing the exercises varied according to the complexity of the movement's movement structure. The number of repetitions and the intensity of performing cross-country movements and jumping exercises was determined by the focus of work on improving speed and coordination and motor endurance.

Exercises on the balancing platform.

Experimental group athletes performed the exercises:

- for the lower part of the body (squats, lunges, rolls, stands on a rigid support with one leg, the second leg was located on the balancing hemisphere or on the ball, with the use of dumbbells);
- for the shoulder girdle (push-ups on the balancing hemisphere);
- for the body (flexion-extension of the body in a sitting position in the balancing hemisphere).

To improve the technique of performing a protective stand, static exercises were used to hold the position of the crouch back, touching the wall, hemisphere, ball. Also exercises were used in pairs, standing with their backs to each other in a protective stance, a support on the ball. Exercises were performed on one, on two legs, bent at a right angle to the body. After the signal short jerks were performed. (Fig. 3).



Fig. 3. Illustration of exercises

The athletes of the experimental group had no experience training on an unstable surface. Therefore, in the early stages, learning the technique of performing exercises on unstable surfaces was carried out with additional support. Particular attention was paid to the position of the back, pelvis, and the bending angles of the legs. Violation of the biomechanics of movement, as a rule, reduces or nullifies the training effect of the exercises performed, which may cause a lack of the expected result (Sedaghati, 2018). After mastering the technique of basic exercises with the use of an unstable support in lightweight conditions, coordination difficulty gradually increased in classes: the absence of additional support with hands, single-support positions, the inclusion of an additional mobile support with a ball.

Results

At the beginning of the experiment, the control and experimental groups did not significantly differ from each other in all test indicators ($p > 0.05$) (Table 1). After the experiment, significant differences were found in the speed of defensive movements and in the results of the "Shuttle run 2x28, s" test of female athletes of the experimental group compared to female athletes of the control group ($p < 0.05$) (Table 2). The results of the test "Push-ups for 30 s, the number of times" of the female athletes of the control group after the experiment were significantly better compared with the athletes of the experimental group ($p < 0.05$). Indicators of technical readiness in the experimental group after the experiment were significantly higher compared with the athletes of the control group in the tests "Test 2, s", "2-point throws 40 s, number of hits" ($p < 0.05$, $p < 0, 01$) (table 2).

Table 1 - Results of testing of athletes of the experimental ($n = 18$) and control ($n = 18$) groups before the experiment

Name of metrics	Group	Statistical Indicators				
		\bar{x}	S	m	t	p
Running 6 m, s	E	3,83	0,23	0,05	-0,06	0,95
	K	3,84	0,24	0,06		
Shuttle run 2x28,s	E	8,93	0,51	0,12	-0,3	0,76
	K	8,97	0,16	0,04		
Push-ups 30 s, number of times	E	6,89	1,75	0,41	-1,2	0,24
	K	7,83	2,83	0,67		
Jumps with skipping-rope, number of times	E	141,56	29,38	6,92	-1,07	0,29
	K	150,72	21,62	5,10		
Test 1, s	E	14,05	0,93	0,22	0,25	0,8
	K	13,98	0,70	0,17		
Test 2, s	E	25,36	1,77	0,42	0,95	0,35
	K	24,90	1,01	0,24		
Test 3, number of times	E	20,33	7,97	1,88	-0,41	0,68
	K	21,39	7,40	1,74		
2-points throws, number of times	E	13,61	3,29	0,78	-0,06	0,96
	K	13,67	2,61	0,62		
3-points throws, number of times	E	5,11	2,05	0,48	-1,92	0,06
	K	6,33	1,75	0,41		
2-point shots for 40 s, the number of shots	E	10,61	0,98	0,23	-0,31	0,76
	K	10,72	1,18	0,28		
2-point shots 40 s, number of hits	E	5,00	1,28	0,30	-0,52	0,60
	K	5,22	1,26	0,30		

1-point shots, number of times	E	10,28	4,23	1,00	0,52	0,61
	K	9,67	2,66	0,63		
Dibs shifting time 20 mm, s	E	6,86	0,63	0,15	1,88	0,07
	K	6,50	0,52	0,12		
Dibs shifting time 15 mm, s	E	6,88	1,16	0,27	1,31	0,20
	K	6,47	0,65	0,15		
Dibs shifting time 5 mm, s	E	13,55	3,53	0,83	0,21	0,83
	K	13,30	3,54	0,83		
"Simple visual-motor reaction" is the time of the latent period., ms	E	302,25	71,43	16,83	0,70	0,94
	K	286,45	62,65	14,76		
"Simple visual-motor reaction" errors, number	E	3,72	0,79	0,18	-0,70	0,60
	K	3,91	0,82	0,17		
"Reaction of choice 2-3" time of latent period, ms	E	503,78	123,67	29,14	3,13	0,85
	K	499,11	121,9	25,98		
"Reaction of choice 2-3", errors, number	E	21,92	5,98	1,40	1,63	0,06
	K	19,07	4,34	0,92		

After the experiment, significant differences were found between the control and experimental groups according to the results of tests "Dib transfer time 20 mm, s", "Dib transfer time 5 mm, s", «Simple visual-motor reaction" is the time of the latent period, ms», «Reaction of choice 2-3" time of latent period, ms»; in the experimental group, these figures were significantly higher compared with athletes of the control group ($p < 0.05$, $p < 0.01$) (Table 2).

Table 2 - Results of testing of athletes of the experimental ($n = 18$) and control ($n = 18$) groups after the experiment

Name of metrics	Group	Statistical Indicators				
		\bar{x}	S	m	t	p
Running 6 m, s	E	3,79	0,44	0,10	0,06	0,48
	K	3,8	0,48	0,11		
Shuttle run 2x28,s	E	8,48	0,35	0,08	-	0,02
	K	8,79	0,44	0,09		
bending and unbending arms in the supine position for 30 s, the number of times	E	8,61	1,69	0,39	-	0,04
	K	10,67	2,81	0,59		
Jumps with skipping-rope, number of times	E	151,06	24,01	5,66	-	0,65
	K	154,50	20,93	4,93		
Test 1, s	E	13,32	0,44	0,10	-	0,01
	K	13,71	0,37	0,09		
Test 2, s	E	22,91	0,66	0,16	-	0,01
	K	23,82	0,57	0,13		
Test 3, number of times	E	26,50	5,93	1,40	0,98	0,33
	K	24,39	6,94	1,64		
2-points throws, number of times	E	15,56	2,59	0,61	1,45	0,16
	K	14,44	1,98	0,47		
3-points throws, number of times	E	7,50	1,38	0,33	0,86	0,39
	K	7,11	1,32	0,31		
2-point shots for 40 s, the number of shots	E	11,50	0,79	0,19	1,73	0,09
	K	10,94	1,11	0,26		
2-point shots 40 s, number of hits	E	6,17	0,79	0,19	3,39	0,01
	K	5,33	0,69	0,16		
1-point shots, number of times	E	12,66	3,20	0,75	2,63	0,05
	K	10,28	2,11	0,50		
Dibs shifting time 20 mm, s	E	5,97	0,62	0,15	-	0,03
	K	6,40	0,51	0,12		
Dibs shifting time 15 mm, s	E	5,85	0,55	0,13	-	0,09
	K	6,19	0,60	0,14		
Dibs shifting time 5 mm, s	E	11,32	2,18	0,51	-	0,01
	K	13,74	3,19	0,75		
"Simple visual-motor reaction" is the time of the latent period., ms	E	251,12	51,98	12,25	2,48	0,04
	K	295,6	55,23	11,77		
"Simple visual-motor reaction" errors, number	E	1,61	0,44	0,10	5,3	0,60
	K	2,45	0,51	0,10		
"Reaction of choice 2-3" time of latent period, ms	E	484,23	112,34	26,47	3,26	0,05
	K	471,34	105,67	22,52		
"Reaction of choice 2-3", errors, number	E	14,58	3,56	0,83	0,58	0,06
	K	15,33	4,12	0,87		

When comparing the results of testing the physical readiness of the experimental group before and after the experiment, a significant decrease in the execution time of the shuttle run 2x28 m and the speed of protective movements was revealed (Fig 4).

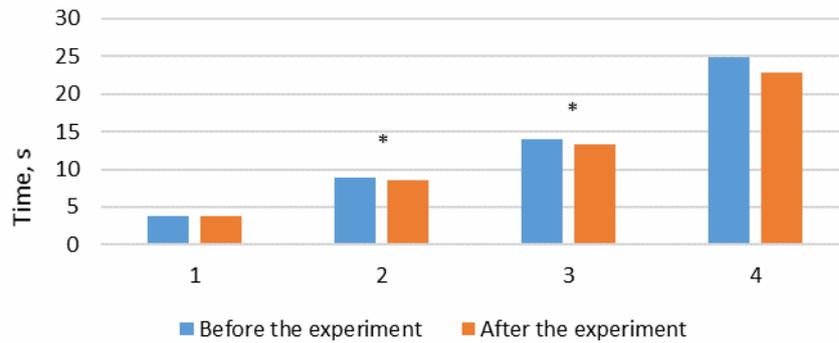


Fig. 4. Results of testing physical training of athletes of the experimental (n = 18) group before and after the experiment

- 1 – Running 6 m, s;
- 2 – shuttle run 2x28 s;
- 3 – test 1, s;
- 4 – test 2, s;

* – differences are significant if $p < 0,05$.

In the control group, when comparing the results of testing physical readiness before and after the experiment, no significant differences were found. (Fig. 5).

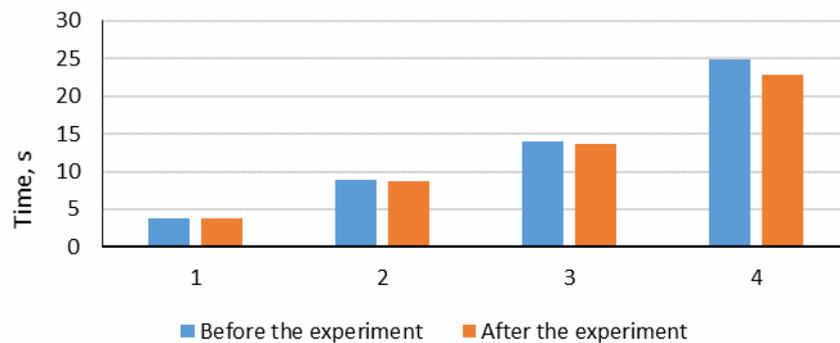


Fig. 5. Results of testing physical training of athletes of the control (n = 18) group before and after the experiment

- 1 – running 6 m, s;
- 2 – shuttle run 2x28, s;
- 3 – test 1, s;
- 4 – test 2, s.

An analysis of the test results of an experimental group of female basketball players on the level of technical readiness before and after the experiment shows the positive impact of the application of the experimental methodology on the development of throw accuracy (Fig. 6).

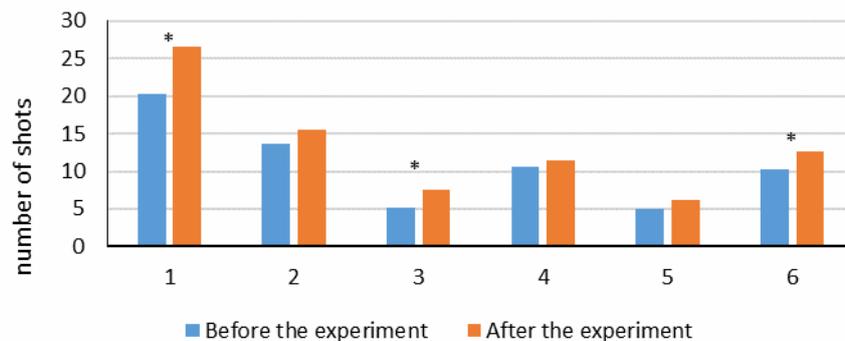


Fig. 6. Results of testing technical training of athletes of the experimental (n = 18) group before and after the experiment

- 1 – test 3 number of times;
 2 – 2-point throws, number of times;
 3 – 3- point throws, number of times;
 4 – 2-point shots for 40 s, the number of shots;
 5 – 2-point shots 40 s, number of hits;
 6 – 1- point throws, number of times;
 * – differences are significant if $p < 0,05$.

In the control group, when comparing the results of testing technical readiness before and after the experiment, significant differences were found in only one test “Throws for time» (Fig. 7).

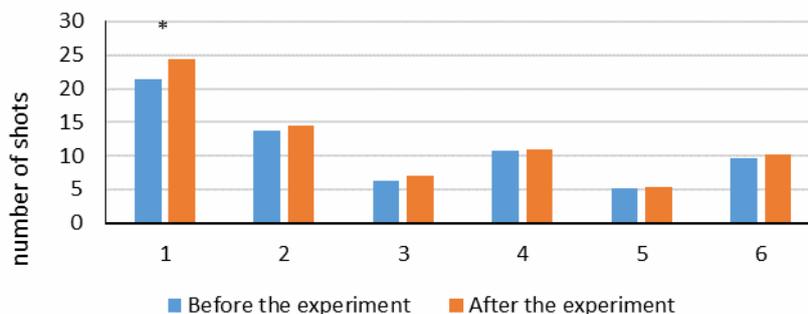


Fig. 7. Results of testing technical training of athletes of the control (n = 18) group before and after the experiment

- 1 – test 3 number of times;
 2 – 2-point throws, number of times;
 3 – 3- point throws, number of times;
 4 – 2-point shots for 40 s, the number of shots;
 5 – 2-point shots 40 s, number of hits;
 6 – 1- point throws, number of times;
 * – differences are significant if $p < 0,05$.

Discussion

In the study, it was hypothesized that the use of exercises on unstable platforms in combination with rubber tape exercises would improve the protective movements of basketball players aged 13-14 years. This hypothesis was fully confirmed. The results obtained are consistent with the studies of Leite, Leser & Goncalves, (2014) at this particular age, special attention should be paid to the improvement of individual defense actions.

The results can be explained by the improvement of muscle sensitivity when performing exercises on unstable platforms. According to Keisuke et al. (2014), when improving the technique of protective movements, accurate perception of the movements being performed is of great importance, and this is possible only on the basis of muscle sensitivity. Developing in athletes a sense of complete "ownership" of movements and confidence in them, will provide an opportunity to more subtly and precisely regulate their movements. Athletes move in different directions, all the time changing directions of running, when moving from defense to attack, they need a quick reaction to partners, opponents, speed and trajectory of the ball (Hardman, 2017). In this connection, it is necessary to use exercises for balance, due to which the muscle mass increases and intramuscular coordination improves, and, consequently, the technique of performing movements improves. (Mohammadi, Alizadeh & Gaieni, 2012).

The complexity of the development of the speed and effectiveness of defensive movements at the age of 13-14 years among basketball players is increasing. This can be explained by the fact that at this age, the production of growth hormone prevails. This affects the formation of ligaments and tendons, growing bones are deformed due to increasing loads and weakness of the muscular system (Frolova et al., 2018). This provision complements the data of Molics et al. (2017) on the need for a special approach to the physical and technical training of young athletes. In this regard, in our study, we selected exercises using unstable platforms to improve the protective equipment movements of athletes. The results obtained are consistent with data from a number of authors (Anderson & Behm, 2005) in that performing such exercises helps coordinate movement and contributes to the development of numerous small stabilizing muscles. In turn, the developed muscle stabilizers allow you to move more technically and economically. In our opinion, this explains the improvement of the defensive movement technique of young female basketball players as a result of the experiment.

Our observations and data from other researchers (Shafiee, Rahim, Hakime & Vahid, 2016; Kozina et al., 2017) show that a basketball player has a position that the defender holds in relation to his character and opposition. It is located at different distances depending on the game situation. Esteves, Araujo, Vilar, Travassos, Davids, Esteves, (2015). We assume that the position of the center of gravity of athletes can be adjusted with a

rubber band when performing a protective stance. This will give an additional incentive for the formation of the correct technique of protective movements. As a result of the use of exercises, all mobile movements in basketball are performed on bent legs, without straightening, while maintaining continuous balance, which allows them to move with the speed of their movements, quickly stop and start moving in any direction. The study revealed a significant ($p < 0.05$) increase in the indices of testing the technical and physical preparedness of the experimental group. Thus, the proposed hypothesis was confirmed.

At the same time, as a result of the experiment, female athletes in the experimental group significantly ($p < 0.05$) increased the test results: 2-point, 3-point, free throws. The improvement of these indicators can be explained by the positive effect of exercises on unstable surfaces on deep muscles, body stabilizers, which are responsible for adjusting the direction of movement, balance and coordination of athletes. Indeed, the accuracy of throwing into the basket is determined by rational technique, stability of movements and the correct alternation of tension and muscle relaxation, strength and mobility of the hands (Kozina, Sobko, Vilvitskii, Xiaofei, Tymko, Glyadya & Minak, 2018). Also, as a result, the performance of exercises using a rubber band in combination with exercises using unstable platforms and acceleration from non-standard starting positions, significantly ($p < 0.05$) improved the psycho-physiological state of the basketball players of the experimental group compared to the control.

The higher rates in the “Push-ups” test in the control group compared to the experimental group after the experiment can be explained by the fact that during the experiment the control group female athletes performed this exercise on a solid support. The experimental group performed the exercise, relying with two hands on the balancing hemisphere. Nonspecific conditions for the exercise did not lead to an increase in the maximum number of push-ups.

Thus, we can conclude that the use of an experimental technique effectively influenced the technique of defensive movements and the accuracy of shots in the basket of 13–14-year-old basketball players.

Conclusions

A method for improving the protective movements of young basketball players using rubber bands and unstable platforms is proposed. It was revealed that as a result of the experiment in the experimental group, the test performance improved significantly ($p < 0.05$): shuttle run 2x28 m, speed of defensive movements, high-speed equipment, penalty and 3-point throws. The control group significantly ($p < 0.05$) improved the indicators in the test “Throws for a while”. It is shown that there is a significant ($p < 0.05$) difference between the experimental and control groups after conducting the experiment in terms of tests of the speed of protective movements, shuttle run, high-speed technique of dribbling, the number of 2-point hits for 40 s. It was established that a significant ($p < 0.05$) difference in test scores is the speed of a simple and complex reaction and fine motor skills of the athletes of the experimental group compared to the athletes of the control group. It has been established that the developed method has a positive effect on improving the technique of protective movements on the physical and technical preparedness of female basketball players aged 13-14.

Conflicts of interest. The authors have no conflicts of interest.

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