

Junior skeet shooters' physical conditioning

ROSTYSLAV HRYBOVSKYY¹, IHOR ZANEVSKYY², MARYAN PITYN³, IRYNA HRYBOVSKA⁴,
BOGDAN VYNOGRADSKYY⁵, NATALIYA STEPANCHENKO⁶, OLHA PAZYCHUK⁷
^{1,2,3,4,5,6,7}Lviv State University of Physical Culture, Lviv, UKRAINE

Published online: June 20, 2019

(Accepted for publication: June 13, 2019)

DOI:10.7752/jpes.2019.02183

Abstract.

Top sports results in shooting relate to the high athlete's capacity, which is based on his physical conditioning. The purpose of the work was to study the effect of simulation exercises on the physical conditioning of junior skeet shooters at the stage of preliminary basic training. The following methods were used: analysis and generalization of library resources, pedagogical observation, pedagogical testing, pedagogical experiment and methods of mathematical statistics. To assess the conditioning of athletes, a set of tests was used to determine stamina and coordination abilities.

The study involved 22 athletes of the Olympic Reserve Junior Special School "Signal" and Complex Junior Sport School "Kolos" in Lviv (Ukraine), specializing in skeet shooting. The skeet shooters were divided into experimental and control groups.

It is revealed that theoretically and practically shotgun shooting needs solving the requirements and tasks that relate to various aspects of shooters' training, including physical ones. The positive dynamics of the shooters' physical conditioning in the experimental group was found: the probable differences between the experimental and control groups were determined by the following indices: lifting the body from the lying position during 30 seconds ($p = 0.030$), the test "ten eights" ($p < 0.001$) and throwing tennis ball at the target ($p = 0.017$).

The necessity of applying pedagogical tests is grounded, which allow defining such physical qualities as: stamina and coordination abilities. The need to take into account the shooters' physical conditioning for planning and correction of the training process is proved.

Key words: shotgun shooting, skeet, physical conditioning, juniors.

Introduction.

Analysis of the available library resources shows that in the shooting sports, the cost of even the only fault is growing today because of the high density of sports results available. Accordingly, the requirements for the shooters' technical and physical conditioning, as well as the provision of shotgun, ammunition and equipment are increasing. This leads to the need to improve the various aspects of shooters' training (Vahner, 2012; Korostylova et al., 2009, 2012; Hrybovskyy R., 2015).

Modern methods of shooters' training provide for the implementation of a large amount of training load. According to the sports practice, a skilled shooter performs up to 300 shots for one training session. Well-conditioned shooters better bear heavy loads both training and competitive. It should also be taken into account that the athlete must carry out shooting with a gun, the weight of which is at least 3.5 kg, feeling the kickback of the arms (Mononen K., Kontinen N., Viitasalo J., Era P., 2007). However, the movements of the shooter must be fast and accurate. Therefore, the shooter, in addition to the exact reaction, must have sufficient physical conditioning (Polyakov M., 1984; Sobko I., 2012; Peljha Z., Gut V., 2014).

In the previous stages of the study, to improve the effectiveness of competitive activities of skeeters, a technique, which included the use of simulation exercises, was proposed for improving the technical training of athletes, (Hrybovskyy R., Zanevskyy I., Hrybovskyy V., 2015; Hrybovskyy R., 2016; Hrybovskyy R., Zanevskyy I., Briskin Yu., Pityn M., Hrybovska I., Matviyas O., 2017). The use of simulation exercises ("dry" training) included exercises not only in front of the mirror, in front of the wall and at the shooting position, but also the implementation of simulation exercises using a special device (patent number 112060 issued in Ukraine) during sixteen-week microcycles in the preparatory period of the macrocycle.

Thus, the shooters' physical conditioning is one, along with others, factor that influences the development of shooting techniques.

Purpose of the research is to study the effect of simulation exercises on the junior skeet shooters physical conditioning at the stage of preliminary basic training.

Materials and Methods.

The research was conducted at the sports base "Lviv Shotgun Shooting School of High Sports Skills". Twenty two athletes (stage of preliminary basic training) of Lviv Olympic Reserve Junior Special School "Signal" and Complex Junior Sport School "Kolos", who specialize in skeet shooting, were involved. The shooters were randomly divided into the experimental (EG) and control (CG) groups. Statistically, the same effectiveness of these groups was provided at the beginning of the experiment ($p > 0.05$).

Physical conditioning testing was carried out in accordance with the recommendations of the leading specialists in the sphere of physical culture and sports (Polyakov M., 1982; Sergienko L., 2001; Wahner P., 2012; Peljha Z., Gut V., 2014). To evaluate such physical qualities as: stamina and coordination capabilities, the following tests were applied:

- lifting the body from the lying position during 30 s;
- press-ups;
- "ten eights";
- throwing a tennis ball at the target (Sergienko L. P., 2001).

For the first test - lifting the body from the position lying during 30 s, which is aimed at measuring the strength of the body muscles, a mat and a stopwatch were used. An athlete sits on the mat, kneeling legs at 90; the feet do not loose touch with the rug, the distance between feet is up to 30 cm. The hands are connected at the back, the fingers are interlaced, and the elbows touch the knees. The partner holds his feet. On command, the athlete lies on his back, touches the mat with his shoulder, and then rises and returns to the starting position. During the test, the position of the hands on the back is unchanged. Within 30 seconds, you must practice the maximum number of the exercise. Thus, the result was the number of rises from a position lying in position sitting in 30 seconds. General recommendations during the test:

- bend your legs approximately at the right angle;
- to control the correctness: the back completely touches the mat in the lying position, and the hands are held at the neck; elbows touch knees in sitting position;
- to make correction of movements if there is an error;
- perform a test without stops;
- perform a test only once.

Pedagogical test – press-ups - are used to control stamina. The athlete is lying on an even surface; hands are straightened and dilated to the width of the shoulders with the hands forward, the toes rest against the floor. In general, the torso and legs form a straight line. On command, the athlete with full amplitude rhythmically begins to bend and straighten his arms; elbows are set perpendicularly to the torso. Thus, the result was the maximum number of error-free press-ups.

General recommendations during the test:

- it is necessary to touch the surface with the chest when bending hands;
- you can not lie on the surface, straighten your arms in turn, bend and straighten your arms with incomplete amplitude (the test is not valid if there are errors).

Pedagogical test - the "ten eights" - was used to determine the manifestation of the coordination of movements. A tennis ball and a stopwatch were required for testing.

The athlete takes the starting position - the body tilt forward, the ball is held in one hand. On command, passing the ball from hand to hand, you should make the imaginary "eight" between the legs at the level of the knees with a ball as quickly as possible.

General recommendations during the test:

- the amplitude of hands is free;
- do not tear your feet off the floor;
- you can make four or five full "eights" in advance;
- one attempt is given.

According to the results of the tests, for the given age group of the surveyed athletes, normative evaluations were used: "excellent", "good", "satisfactory" and "unsatisfactory" with the result limits of 10, 12 and 14 sec.

The test - throwing a tennis ball at a 75cm diameter target - was aimed at estimation the coordination abilities found in ballistic (throwing) movements with accuracy determination. A tennis ball and a target with a diameter of 75 cm were used for this test. The athlete is located on a throwing point, at a distance of ten meters from the wall where there are a target with a diameter of 75 cm at the height of one and a half or two meters above the floor. Then twelve tennis ball throws at the target are carried out with a take-off hand. A throw is valid if an athlete hits the target (not only the center).

General recommendations during the test:

- the target should be clearly visible;
- one attempt is given.

The following research methods were used: analysis and generalization of library resources, pedagogical observation, pedagogical testing, pedagogical experiment and methods of mathematical statistics.

The relative difference between the results of the group at the beginning (M_a) and at the end of the experiment (M_b) was determined by the formula:

$$\delta = \frac{|M_a - M_b|}{M_b} 100\%.$$

The statistical significance of the difference between the results of the group at the beginning and at the end of the experiment is estimated by the Wilcoxon method.

The relative difference between the experimental (M_e) and control (M_c) groups was determined by the formula:

$$\delta = \frac{|M_e - M_c|}{M_e + M_c} 200\%.$$

The statistical significance of the difference in results between the groups is estimated by the Mann-Whitney method.

The total amount of training load for performing simulation exercises (both with and without a special device) during the first three weeks was accomplished by reducing the amount of loads planned for firing with the use of cartridges. And for the first six weeks of training for athletes, it was planned to perform the largest number of simulation exercises. However, the share of simulation exercises using a special device was 3.5 times larger. The total time allocated for performing simulation exercises was the largest during the first two training weeks and was 210 minutes. Subsequently, the time dropped slightly for the third week to 194 minutes and for the fourth, fifth and sixth it was 171 minutes. This is due both to the decrease in the number of traditional simulation exercises, and to the increase in the number of shots performed by an athlete on shooting using cartridges. During the next ten microcycles of the training sessions, athletes performed simulation exercises using a special device, simulating shooting at individual firing positions.

Results.

As noted above, the physical training of the shooter is one of the factors influencing the mastery of the exercise technique. Therefore, changes in the shooters' physical conditioning, along with other factors, also served as the basis for determining the effectiveness of the modified method with the use of simulation exercises. The results of the pedagogical experiment are systematized and presented in Tab. 1.

Table 1

Dynamics of shooters' physical conditioning results

Statistics parametres	Ten "eights", s		Press-ups, number		Lifting the body from the lying position during 30 s		Throwing a tennis ball at the target, number	
	before	after	before	after	before	after	before	after
Experimental group								
M_e	11.9	9.7	16.3	20.3	17.8	23.0	5.9	8.6
SD	1.1	0.5	2.5	2.8	1.7	2.8	0.7	0.7
$\delta, \%$	18.0		24.5		29.2		45.8	
Control group								
M_e	12.7	11.3	16.0	19.5	17.5	20.5	5.4	7.6
SD	0.3	0.5	2.1	1.7	1.8	1.9	0.8	0.9
$\delta, \%$	11.0		22.2		16.6		42.4	
Difference between groups								
$\delta, \%$	7.1	15.2	1.9	3.8	1.4	11.7	9.5	11.9
Z	1.801	3.874	0.902	1.003	0.609	2.165	1.552	2.393
P	0.072	0.001	0.367	0.316	0.542	0.030	0.121	0.017

Before the experiment there was no statistically significant difference in any of the four tests ($p = 0.072 - 0.542$) between the results of the experimental and control group athletes. At the end of the experiment, the results of the athletes in the experimental group were significantly better than the results of the athletes in the control group by the test of ten "eights" (1.6 s), lifting the body from the lying position during 30 seconds (2.5 s) and throwing the tennis ball at the target (1.0 times) A statistically significant difference was not detected in the press-up test (0.8 times).

Athletes of the experimental group in the press-up test showed the following average results before and after the pedagogical experiment: 16.3 ± 2.5 times and 20.3 ± 2.8 times respectively. The relative difference between the results of the groups (δ) is 24, 5%. In the control group, athletes showed the following results before and after the pedagogical experiment for the same test: 16.0 ± 2.1 times and 19.5 ± 1.7 times respectively. The relative difference between the results of the group (δ) is 22.2% (Fig. 1).

Thus, the relative difference between the test results in the experimental and control groups at the beginning and at the end of the experiment (δ) is 1.9% and 3.8% respectively. The statistical significance of the

difference in the results of both the experimental and control groups at the beginning and at the end of the experiment reached: $Z = 0.902$; $p = 0.367$ and $Z = 1.003$; $p = 0.316$ respectively.

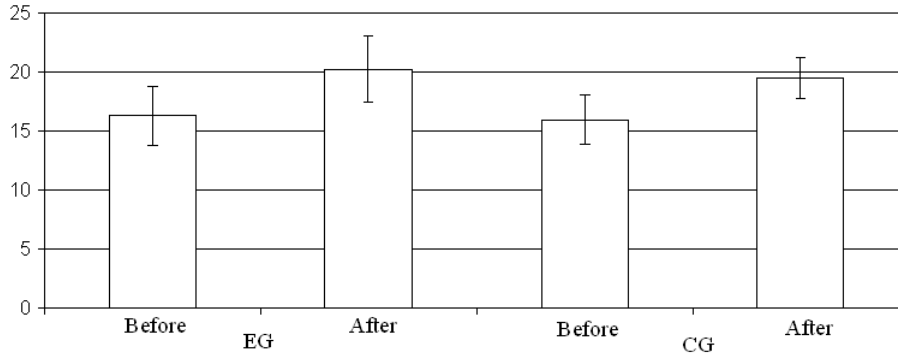


Fig. 1. The results of the “press-up” test before and after experiment, the number of times

In the test “lifting the body from the lying position during 30 seconds”, the shooters of the experimental group showed the following average results before and after the pedagogical experiment: 17.8 ± 1.7 times and 23.0 ± 2.8 times respectively. The relative difference between the results in the group (δ) is 29.2%. In the control group, athletes showed the following results for the same test: 17.5 ± 1.8 times and 20.5 ± 1.9 times in accordance with before and after the pedagogical experiment. The relative difference between the results in the group (δ) is 16.6% (Fig. 2).

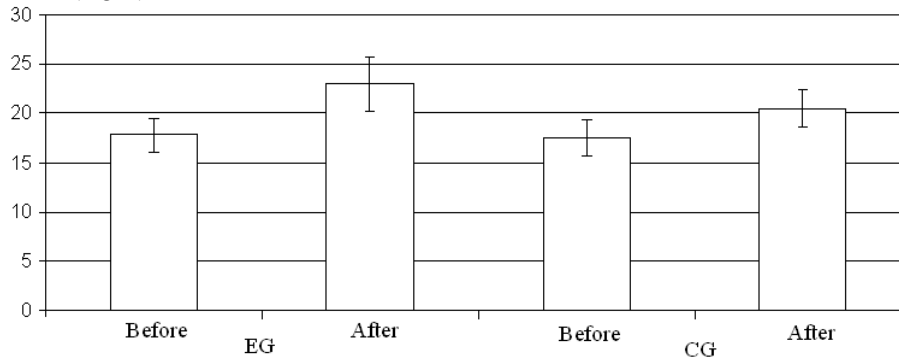


Fig. 2. Results of the test "lifting the body from the lying position for 30 seconds" before and after the experiment, the number of times

The relative difference between the results of the experimental and control groups at the beginning and at the end of the experiment was $\delta = 1.4\%$ and $\delta = 11.7\%$, respectively. The statistical significance of the difference between the results of the experimental and control groups at the beginning and at the end of the experiment is: $Z = 0.609$; $p = 0.542$ and $Z = 2.165$; $p = 0.030$ respectively.

In the test “throwing tennis ball at the target”, the shooters of the experimental group had the following average results before and after the pedagogical experiment: 5.9 ± 0.7 times and 8.6 ± 0.7 times respectively. The relative difference between the results of the group (δ) is 45.8%. In the control group, athletes showed the following results before and after the pedagogical experiment: 5.4 ± 0.8 times and 7.6 ± 0.9 times respectively. The relative difference between the results of the group (δ) is 42.4% (Fig. 3).

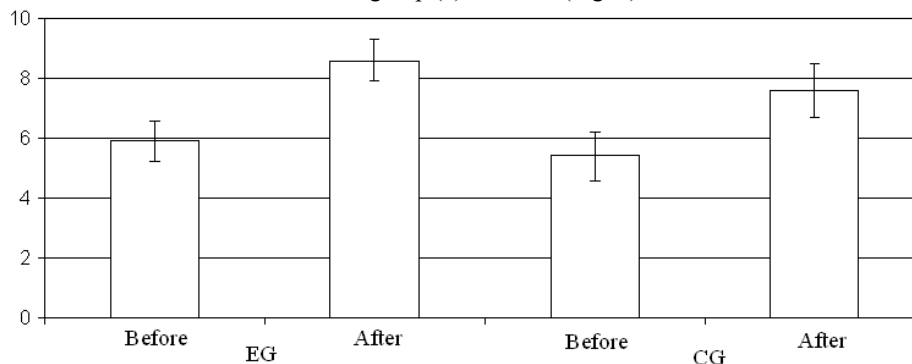


Fig. 3. The number of hits in the test "throwing of the tennis ball at the target" before and after the experiment

The relative difference between the test "throwing the tennis ball at the target" results in the experimental and control groups at the beginning and at the end of the experiment was $\delta = 9.5\%$ and $\delta = 11.9\%$ respectively. The statistical significance of the difference between the results in the experimental and control groups at the beginning and at the end of the experiment is: $Z = 1.552$; $p = 0.121$ and $Z = 2.393$; $p = 0.017$ respectively.

The following average results were detected for the "ten eights" test in the experimental group shooters before and after the pedagogical experiment: 11.9 ± 1.1 s and 9.7 ± 0.5 s, respectively. According to the rating scale, this corresponds to the estimates "good" and "excellent". The relative difference between the results of the group (δ) was 18.0%. In the control group, the athletes doing the same tests before and after the pedagogical experiment, showed the following results: 12.7 ± 0.3 s and 11.3 ± 0.5 s, respectively. According to the rating scale, this corresponds to the estimates "satisfactory" and "good". The relative difference between the results of the group (δ) is 11.0% (Fig. 4).

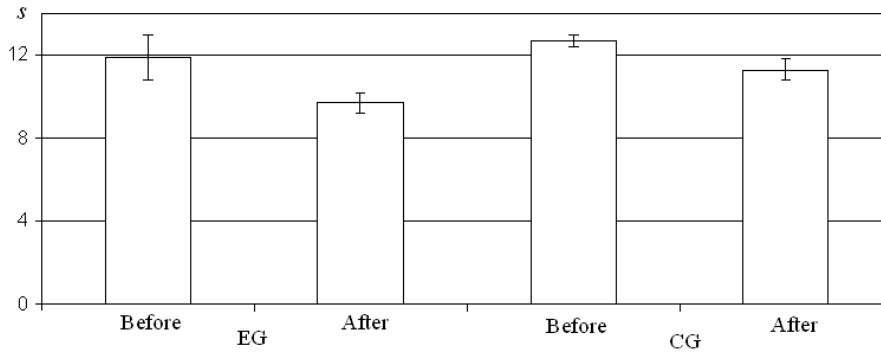


Fig. 4. Results of the "ten eights" test before and after experiment, s.

The relative difference between the "ten eights" test results in the experimental and control groups at the beginning and at the end of the experiment was $\delta = 7.1\%$ and $\delta = 15.2\%$, respectively. The statistical significance of the difference between the results of the experimental and control groups at the beginning and end of the experiment is: $Z = 1.801$; $p = 0.072$ and $Z = 3.874$; $p = 0.001$, respectively.

Thus, the probable differences between the experimental and control groups were ascertained: lifting the body from the lying position during 30 seconds ($p = 0.030$), ten eights ($p < 0.001$) and throwing the tennis ball at the target ($p = 0.017$). According to the indices of press-ups, there was no statistically significant difference ($p = 0.316$). The results of physical conditioning convincingly testify to the advantage of the modified method with the use of simulation exercises using a skeet.

Discussion.

The analysis and generalization of the data obtained from scientific and methodical literature makes it possible to state that today there is a need to find various ways to improve the shooters' training. It was found that determination of shooters' physical conditioning indices will allow trainers to make corrections in training process timely. After all, the training content must correspond to the level of a shooter's conditioning, and the tasks to be performed must be designed for a particular athlete that he is able to solve. In addition, in order to achieve a high result (the maximum possible number of hit targets) there is a need to increase the amount of training work. Just shotgun shooting reveals the difference between the number of shots and the quality of the shot - the target hits. Therefore, shooting training sessions put forward the relevant requirements to the physical conditioning of the shooters.

Thus, our research deepens the scientific information on the need to take into account the athletes-shooters' physical conditioning indices during the training process (Polyakov M., 1982; Maglovanyy A., Pazichuk O., 2012; Wagner P., 2012; Sobko I., 2012; Peljha Z., Michaelides M., Collins D., 2018).

Conclusions.

1. Theoretically and practically shotgun shooting needs solving some new requirements and tasks that relate to different aspects of the shooters training improvement, including physical ones, due to changes in the rules of the competition.

2. Positive dynamics in the shooters' physical conditioning under the influence of training according to the modified method with the use of simulation exercises is established. In particular, this is evidenced by the probable differences between the experimental and control groups according to the following indicators: lifting of the body from the lying position during 30 seconds ($p = 0.030$), ten eights test ($p < 0.001$) and throwing the tennis ball at the target ($p = 0.017$).

3. In order to evaluate the skeeters' physical conditioning, the need to apply stamina and coordination abilities tests has been substantiated.

4. It was found that the monitoring of the shooters' physical conditioning will allow the trainers to make timely corrections to the training process.

Competing interests The authors declare that they have no competing interests.

References

- Briskin Yu. A., Pityn M. P., Zanevskyy I.P., Hrybovska I. B., Hrybovskii V. V., Hrybovskii R. V. (2006) A comprehensive training for sports athletes at the Skeet: Pat. 112060 Ukraine, CPK A01M 31/02 (2006.01) / - No. u201610270; zayavl 10.10.2016; opubl November 25, 2016; Byul No. 22
- Hrybovskyy R. (2015) Problema vdoskonalehha tehnicnoi pidhotovky sportsmeniv u stendovij strilbi z vykorystannjam imitatsijnyh vprav [The Problem of Improving of Technical Training of Athletes in Shotgun Shooting Using Simulation Exercises] *Moloda Sportyvna Nauka Ukrainy*. Lviv. Vol. 19, T. 1. P. 60-64.
- Hrybovskyy R. (2016) Metodika udoskonalennya tekhnichnoyi pidhotovky sportmeniv u stendovij stril'bi [Method of Technical Training Improvement of Athletes in Skeet Shooting]. *Naukovyy chasopys Nats. ped. and-you imeni M.P. Drahomanov. Seriya 15*. Kiev, Vyp. 4 (74) 16. 14-18.
- Hrybovskyy R., Zanevskyy I., Hrybovskyy V. (2015) Modeling of the Skeet Shooting Technique with the Use of Simulation Exercises. *Journal of Physical Education and Sport*. Vol. 15 (3), 603-609.
- Korostylova Y., Mykhaylov V., Mykhaylov V. (2012) Udokonalennya model skladannya reytynhiv sportmeniv u kul'oviy stril'bi za rezul'tatamy zmahal'noyi vpravy [Improvement of the Rating Model of Athletes in Shooting Based on the Results of the Competitive Exercise]. *Fizychna aktivnist', zdorov'ya sport*. № 1 (7), 3-10.
- Korostylova Y., Zanevskyy I. (2009) The Accuracy of Shooting Results Imitation with an Optoelectronic Training System. *Book of Abstracts of the 14th Annual Congress of the European College of Sport Science*. Oslo, 603.
- Maglovanyy A., Pazichuk O. (2012) Osoblyvosti harchuvannya i specialna pidhotovlennist kvalifikovanyh sportsmeniv-strilciv z luka [Peculiarities of Nutrition and Special Training of Qualified Athletes – Archers] [Electronic resource]. *Sport Science of Ukraine*. No.7 (51). pp. 8-12. - Access mode: <http://www.sportscience.org.ua/index.php/Arhiv.html>.
- Mononen K., Kontinen N., Viitasalo J., Era P. (2007). Relationships between posture balance, rifle stability and shooting accuracy among novice rifle shooters. *Scandinavian Journal of Medicine & Science in Sports*, 17 (2), 180-185.
- Pejha Z., Gut V. (2014) Obshchefyzicheskaya podhotovka strelkov [General Training of Shooters]. Moscow Strelkovyy soyuz Rossyy, 59 s.
- Pejha Z., Michaelides M., Collins D. (2018) The relative importance of selected physical conditioning parameters in the Olympic clay target shooting. *Journal of Human Sport and Exercise*. Vol. 13 (3), 541-552.
- Polyakov M. (1982) Metody otbora v stendovoj strelbe [Method of Selection in Shotgun Shooting] / M. Polyakov // *Multicolored targets: Sb. statyey i ocherkov po pulevoj stendovoj i strelbe z luka*. - Moscow: Physical Culture and Sport, P. 24-29.
- Polyakov M. (1984) Trenirovochnyje uprazhnenija v stendovoj strelbe [Training Exercises in Shotgun Shooting]. *Multicolored targets: Sb. statyey i ocherkov po pulevoj stendovoj i strelbe z luka*. - M.: Fys, 1984. - P. 26-35.
- Sergienko L. P. (2001) Testuvannja ruhovyh zdbnostonij shkoljariv [Testing of Schoolchildren's Motor Abilities]: teaching. manual. - Kyiv: Olympic literature. 439 p.
- Hrybovskyy R., Zanevskyy I., Briskin Y., Pityn M., Hrybovska I., Matviyas O. (2017) Simulation exercises efficiency in skeet shooters' technical training. *Journal of Physical Education and Sport*. Vol. 17 (4), p. 2576 -2585.
- Sobko I. P. (2012) Vdoskonalennja protsesu fizychnoi pidhotovky striltsiv-sportsmeniv [Improvement of the Shooters-Athletes' Physical Training Process]. *The theory and methods of physical education*. - 2012. - No. 7. - P. 3-7.
- Vahner P. P. (2012) Tekhnicheskaya podhotovka strelkov-yuniorov k fynal'noj seryy vustrellov na transheynom stende [Technical training for shooters-juniors for the final series of shots on the trench stand]: avtoief. dys ... heel ped. Nauk: 13.00.04. Moscow, 2012. 24 s.