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CONTRIBUTIONS REGARDING THE OPTIMIZATION OF SHOOTING SEQUENCE SPORTS TRAINING IN BIATHLON AT THE LEVEL OF JUNIOR BIATHLETES

SUMMARY

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INTRODUCTION

In recent years, the biathlon sports discipline has made a considerable leap both from the point of view of running on skis and from that of shooting, in terms of the times obtained when running as well as in terms of the efficiency of shooting. The authors Cholewa, Gerasimuk, Szepelawy & Zajac, (2005, pp.37-38) note that the modern industry involved in the manufacture of competition materials (skis, sticks, boots, weapons, cartridges), the optimal arrangement of the routes, but primarily the continuous improvement of the training method have contributed remarkably to these results. The objectives and tasks of the performance and high performance biathlon in our country, in the next period, can be achieved only if the training method will be correctly directed and scientifically grounded. According to the authors Hoydal & Nord, (2017, pp.359-360), achieving this qualitative leap is not possible without not paying attention to the following in the training process:

- ✓ Continuous modernization of the training process, knowledge and application of the latest conquests of theory and practice;
- ✓ Compliance with the workload at the global parameters comprising 1300-1400 hours of training, 8000-10000 km, 9000-11000 cartridges per year for high-performance athlete;
- ✓ Increase in the value of physical qualities indices and specific physical training;
- ✓ Work for the acquisition and improvement of the technique (both skiing and shooting) that must be an important and constant concern at all levels and especially at the level of children and juniors;
- ✓ Development and improvement of psychic qualities – willpower, diligence, combativeness;
- ✓ Directing the preparation processes with the help of as much objective data as possible.

Motivation for choosing the theme

I chose this theme because for 10 years I practiced biathlon skiing at performance level and I worked between 2017-2020 as a teacher/coach at the biathlon ski department within the Dinamo Râșnov School Sports Club.

I believe that no more attention has been paid to the shooting sequence within the biathlon, and this is felt by the lack of results worldwide, especially at the junior level. There is still a significant difference in terms of running on skis, but lately we have moved away from the world elite in terms of the shooting side.

Our country has potential in this winter sport and I believe that if we approach the attention required for sports training for the biathlon skiing shooting sequence at the junior level along with a controlled development of the motor quality resistance, the results will begin to appear worldwide gradually, both at the junior level and at the senior level further on.

CHAPTER 1 THEORETICAL AND METHODOLOGICAL FUNDAMENTALS IN THE SPECIALTY LITERATURE REGARDING THE BIATHLON DISCIPLINES

1.2 The basic components of biathlon sports training

The content of sports training, regarded as a complex and unitary process, is carried out in different aspects.
According to the authors Pelin, Gaspar & Lungociu, (2007, pp.33-38), the main components of this complex process are:

1.2.1. Physical training of biathletes

Physical training is the main component of the training of the cross-country and biathletes. Sports performances depend to the greatest extent on her level. In cross-country skiing and biathlon physical training is a limiting factor of sports performance.

During the entire training process, the weight of physical training is different, in relation to the other components of training, according to the authors Esteve-Lanaom, Foster, Seiler & Lucia, (2007).

The physical training of biathletes includes two aspects:

- general physical training adapted to the biathlon sports discipline;
- physical training specific to the biathlon sports discipline.

We agree with the statement of the author Bompa (2002, pp.11-12) who states that "general physical training is carried out with general means and methods derived from disciplines other than those of biathlon". From the diversity of exercises are chosen those that help the specific training of skiers, in other words the general physical training "specializes" without becoming special.

Regarding the place of general physical training in training macrocycles, the authors Berger & Mihov, (1994, p.43) mention that "it has a very important role at the beginning of the preparatory period, with the aim of ensuring the development of basic motor qualities and increasing the functional possibilities of the organism in general". As it progresses in the preparation, its share decreases leaving for specific training.

The author Vonheim, (2012, p.69) states that "specific physical training has a content oriented mainly towards the development of specific effort capacity, as well as the combined motor qualities prioritized and differentiated involved, ultimately determining the specific yield". "Specific physical training is carried out with strictly specialized means that develop the combinations of qualities priority determined by the peculiarities of cross-country and biathlon skiing, by the muscle groups engaged in effort, by the type of stress, etc." (Vonheim, 2012, p.70)

1.5 Elementary notions regarding the shooting training at the biathlon sports discipline - junior category

1.5.1 Training for junior on shooting range technique

Even with a very low lack of experience in shooting technique or a small change in a learned skill, they have a negative effect on performance (Wormwood, F., et al., 2008, p.68).

Training in the technique of shooting is divided into two parts:
1.Training with the weapon without ammunition.
2.Training for the technique in conditions of effort.
Note: Basic learning, perfecting and maintaining the shooting technique is achieved by simulated firing (to the tube) throughout the year.
Neglecting to pull "to the tube" reduces the control of the following factors:
- weapon -body complex;
- eye reflex - finger;
- the aiming- triggering link;
Note:
- After the specific training (competitive, etc.) the biathletes resume the training "on the tube" extensively;
- Each training or competition must be analyzed in its good and bad aspects, the new experience must be combined with the old one.
The measurement mechanisms (shooting technique) change and can decrease in accuracy and efficiency for this they must be carefully monitored in the competitive season.
An insufficiently stable movement mechanism due to improper training cannot be effective in conditions of intense stress during the competition. (Zubrilov & Astafyev, 2016, p.103)
Paths for training the technique of shooting (shooting) according to the authors Pelin, F., Wormwood, Gh. & Lungociu, (2007, pp.33-36):

- Firing position
- The habit of triggering fire;
- Arms control;
- Triggering technique;
- Handling the weapon;
- Breathing technique;
- Organization of the drawing time;
- Shooting pace;
- Pulling "to the tube";
- The result of the drawdown.

Technical-methodical indications about the training of sighting and fire-triggering technique (Pelin, F. et al., 2008)

- o The image of the target will be constant under all conditions; it may be affected by:
  - o - correct use of vision;
  - o - choosing the best eye for vision;
  - o - the correct position of the head;
  - o - light;
  - o - the physical request.Imaginea țintei este cea mai clară timp de 2 – 6 sec. (în serie de 5 focuri);
- o Prolonged aiming changes the image of the target but the biathlete does not notice this;
- o The distance between the diopter and the eyes is 5 to 15 cm, depending on the shooting position and the individual peculiarities (including age);
- o The eyes will be directed to the same line.

It is recommended to focus the central vision which determines the direction of the blow.

It is the pipe that oscillates and not the target or the diopter;

- o Both eyes remain open, the left one can be covered
- o Too small diopter orifice causes the light to diffuse the image of the target and thus cause distortion of the image
- o Biathletes often try to bring the eye too close to the diopter hole, which is wrong
- o Too low a central view causes pressure in the central point (yellow spot);
- o The central vision shall be of sufficient size to be able to clearly distinguish the movements of the weapon;

The correct pull on the trigger is influenced by the correct catching (grasping) of the neck, weapon and the correct pressing on the trigger;

The joint will be stiff when pulling on the trigger;

- o Arma grabs firmly but not too crisp;
- o The index finger sits correctly on the trigger;
- o The finger is bent at the level of the second joint, and the triggering is made with the first phalanx close to the first joint;
- o Pulling the trigger is not done with all the finger;
- o Pressing on the neck of the weapon is constant;
- o The trigger is pressed directly to the back;
- o Finger moves freely;
- o The finger should not react to movements;
- o The eye observes very vaguely the movement of the weapon when working under tension;
- o Physical exercise training is the most effective. (Pelin, F., et al., 2007, pp.41-43)

1.5.2 The technique of prone position in biathlon-methodical indications

The technique for shooting from the prone position is more stable compared to the technique for shooting from the standing position. This is due to a larger support base that the biathlete's body has in the prone position and the low position of the equilibrium center.

The preparation for firing consists in finding the position of the body to ensure the support of the weapon in the conditions of minimal muscular effort and placing the head in a normal position, in which to create optimal conditions for the eyes (Pelin, F. et al., 2007, p.19-21).

When preparing for shooting from the prone position it is necessary to comply with the following requirements:

- The position of the body in relation to the shooting line must be within the angle of 15 – 20 degrees to the left. Movement is necessary to ensure a comfortable and normal placement of the head on the rifle, an essential condition for a correct aiming. The support range consists of the following support points: the left elbow, the right elbow, the lower part of the chest, the abdomen and the lower limbs.
- The left elbow is an important point of support, its placement having a decisive role in the accuracy of shooting. On the left arm he presses the weight of the weapon and for this he is bent from the elbow joint and pushed forward within the limits of convenience and the requirements of the regulation. The vertical projection of the rifle must fall tangentially on the inner edge of the left elbow. By moving forward under the weapon, the left arm ensures the support of the rifle in the line of sight in advantageous conditions by jumping the support range.
- The right elbow is placed laterally to the right in support on the ground. Its location must ensure arm as an unforced position providing optimal conditions for the best possible contact of the right hand on the butt of the weapon and ultimately an optimal position of the finger on the trigger.
- The lower left part of the thorax comes into contact with the supporting surface starting from the sixth rib, continuing with the left costal rim, the left abdominal wall and reaching the pelvis which also keeps the overturning on the left. The pelvis rests on the iliac crest and the left antero-posterior iliac spine.

In this way the overturning of the trunk to the left, more or less accentuated, is performed according to the individual particularities. This reversal is physiologically justified because in this position respiratory function is ensured within normal limits as well as other functions. By maintaining direct contact of the entire abdomen and the lower part of the thorax with the supporting surface, the functions of the internal organs would be hampered due to the pressure exerted on them. Thus, the respiratory function risks being blocked by blocking the diaphragm and the lower part of the lungs, causing the sensation of suffocation. There is also an abnormal pressure on the liver, stomach, pancreas, spleen and intestines, thus hindering the functions of the circulatory and digestive system.

❖ The overturning to the left remedies these inconveniences by releasing the internal organs, the weight being supported by the ribs 6 -10, the left abdominal wall and the iliac crest.

❖ The legs together with the skis are spaced sideways, the skis rest on the inner edges. the body is as relaxed as possible with a slight flexion of the right knee. Slight flexion of the right knee helps to release the pelvis and chest.

❖ The contact of the biathlete with the side of the weapon through the right cheek must be as comfortable as possible and ensure the greatest possible relaxation of the neck muscles. This condition is absolutely necessary to allow a more natural position of the eyeball, necessary for sight in optimal conditions.

❖ The palms of the hands cover and tighten the rifle, without tension.

❖ The body is in a natural position so that the eye can perceive the target directly in the best aiming conditions.

❖ The weapon strap is passed over the biceps of the left arm and secures the rifle so that the strap, shoulder blade and shoulder form a stable triangle that provides support to the weapon and frees the muscles of the left hand from the weight of the weapon.

❖ The side of the weapon is supported in the shoulder region between the pectoral muscle and the deltoid.

❖ In relation to the angle of the elbow of the left hand we can meet three positions: high, medium, low.

❖ The right hand, which has a decisive role in triggering the fire, grabs the neck of the weapon, the elbow is relaxed, the last phalanx of the index finger touches the trigger of the weapon.

❖ The arrangement of the "shooter - rifle" system horizontally is correct when the rifle is aimed at the target (each deviation requires an additional reset).

❖ preparation for shooting is stable and regular when it takes into account individual qualities, thus being a multilateral process that requires systematic training.

❖ The pedagogical ability of the coach and the preparation of the competitor represent decisive factors for the creation and improvement of the shooting technique.

The disposition of the hands when preparing for shooting in the prone position can be: a) high; b) average; c) low

1.5.3 The technique of standing position in biathlon- methodical indications

According to the author Pelin, F., (2008, 53-57), the technique of pulling from a standing position is, in fact, the most difficult.

The weight comes mainly from the small support surface, the high arrangement of the center of gravity of the "shooter - rifle" system, as well as a greater tension of the muscular apparatus.

There are two options for shooting from the "feet" position:

- with the body weight evenly distributed on both legs or slightly more on the right leg;
- with the weight of the body distributed almost exclusively on the leg located on the firing line (generally on the left leg).

Both options can be equally effective in relation to the individual characteristics of the biathlete. Unfortunately, the adaptation of one or the other of the positions is made according to the school preferred by the coach and not according to the particularities of the athlete.

Performing a shooting technique in the standing position in biathlon is even more difficult, because it is performed in conditions of accumulation of fatigue and high pulse at 170 -180 beats per minute. To these can be added some weather conditions.

The factors on which the stability of the biathlete's pull to the standing position depends are:

- taking the most appropriate way of support;
- taking the most appropriate body position;
- placing the center of gravity of the "sniper - rifle" system above the support surface and bringing the center of gravity of the rifle as close as possible to the center of gravity of the shooter;
- release of tension of the muscular and articular apparatus;
- position of the left hand.

When preparing to pull from the standing position, the following requirements shall be ensured, in accordance with the sequence:

- in the basic position the body is arranged with the transverse axis in the direction of the target;
- the soles of the feet are arranged at shoulder width, and the left shoulder is oriented towards the target;
- the line of sight intersects the middle of the sole of the left foot;
- the center of gravity of the "shooter - rifle" system falls between the two legs by moving;
- moving the torso backwards and the pelvis forwards causes the vertical of the center of gravity of the whole system to project towards the middle of the support range or a little more towards the right leg. Due to this fact, the fixation of the trunk and the hip region is done not so much by muscular effort but especially by the stress of the ligaments that fix the pelvis and the lower limbs. In this way the balancing of the system is done mainly by the skeletal and ligamentous apparatus allowing the majority of the muscular mass to be maintained in conditions of relative relaxation;
- the left hand is bent at the elbow joint, at a sharp angle; the forearm is supine and raised almost vertically, the elbow resting on the iliac crest or chest; the angle of the elbow being about 25 -30 °, inversely proportional to the biacromial diameter and the length of the segments.

Standing position:

a. in a more accentuated straightening of the body;
b. by deviating to one part of the body and turning the back backwards.

- moment of determination of the center of gravity of the rifle;

1.– the center of gravity of the "shooter - rifle" system;
2.– elbow support;
3.– the line of the center of gravity of the system;
4.– line of gravity of the rifle.

- the biathlete shoulders the rifle bed in such a way that the lower part rests on the wrist, in the subclavian cavity and on the deltoid muscle of the right shoulder;
- the palm is open, the fingers (index, middle and ring) are glued to the bottom of the rifle groove and the thumb supports the weapon at the trigger guard;

- the right hand performs the same functions as in the supine position, but maintains the rifle slightly more accentuated and comprises the neck of the rifle bed with the elbow raised laterally approximately at shoulder height;
- regarding the right hand, it is also necessary to make the following clarifications:
  - the shelves will be placed freely in the hollow of the stick without pressing the mount;
  - the index finger will be placed on the trigger at a 90 ° lateral angle and will make contact with the front face of the trigger through the pulp of the first phalanx, as close as possible to its joint with the second phalanx. In this way the triggering is ensured by acting in the direction of the pipe axis;
  - care will be taken to keep the hand in the continuation of the forearm, avoiding flexions and extensions as much as possible. The other three fingers will include the butt of the weapon with moderate pressure;
  - the contact of the head with the rifle is made by means of the cheek, raising the bed of the rifle to the height of the straight cheek to maintain the normal position of the head. Strictly avoid additional tightening of the neck muscles;
  - the placement of the cheek on the weapon will be quite light and will follow the constant maintenance of the line of sight, avoiding the overload of the oculomotor muscles;
  - preparation for shooting in the standing position is, without a doubt, the most complicated link in the whole system of biathlon shooting technique. Its training and improvement requires diversified means and methods.

The second variant of the standing position starts from the fact that the support of the left elbow is mandatory on the iliac crest, regardless of the length of the arm. This has the advantage that the support is firmer and more constant, and the scapulo-humeral joint is less stressed. In this position the weight of the body falls almost entirely on the left leg (front), the joint of the left knee being extended and the right knee slightly flexed.

The distance between the soles of the feet is about 15 cm.

The torso is in a left lordoscoliotic position (due to the leading of the left hip forward). In this case, too, it is mandatory for the epaulette to be done by bringing the rifle to the head and not by tilting the head forward and to the right.

The rifle tends to be brought over the chest without touching it. This is very important because by bringing the weapon as close to the body as possible we will have a more comfortable aim, the center of gravity of the rifle will fall closer to the center of gravity of the body.

1.5.4 Overall coordination of the technical elements of shooting in biathlon

"The success of shooting in biathlon depends on the extent to which it is possible to combine the technical elements executed to perfection in an overall development at a high quality level" (Nordvall, 2017, p.31).

In principle, we must start from the idea that only in conditions of a high degree of improvement of all technical elements and their efficient combination are possible results without shooting errors.

The overall coordination is characterized as follows: after the onset and expiration of the rest of the air, a breathing cycle ends, which during the expiration was interrupted by the onset of apnea. Apnea (shortness of breath) begins when about two-thirds of the air has been exhaled. This breathing cycle overlaps with the loading and the start of the triggering activity. The increase of the pressure on the relaxation cock should start with the expiration, so that at the beginning of the apnea the necessary level of the plateau of approx. 80%. (Maier, Meister, Troesch & Wehrlin, 2018, pp.3-5)

Through this triggering activity, depending on the time, the athlete has the opportunity to focus entirely on obtaining a stable central position. The reached level of the trigger plate allows it to move immediately to the second pull of the trigger at the first stable central position without the need for a great effort of force until the fire is triggered.

After firing, the weapon must be held for another fraction of a second in the direction of the target.

It is necessary for the athlete to remain in apnea during this time and for the flexed finger to also remain on the trigger for a fraction of a second.

There is a direct dependence between the result on the target panel and the degree of immobility of the weapon when aiming and pressing.

A trigger in motion must be rejected because it does not guarantee high and stable results.

If the athlete fails to fire at the time set in training, then, as a rule, it is necessary to put down the gun and resume training the fire. Too long a look has the effect of increasing the amplitude of the weapon again after a phase of reducing the oscillations of the weapon. There is no point in prolonging apnea too much because due to intense prior physical demands there will undoubtedly be pressure breathing.

1.5.6 Methodical particularities in the impromvement of the shooting technique for modern biathlon in the junior category

Basic methodological guidelines for an effective technical training in biathlon shooting according to the authors Chapman, Stickford & Levine (2010, pp.103-108)

An effective shooting training requires a correct, stable technique, the acquisition of which guarantees high performance even when some external conditions are variable.

The demands in training to improve the technique are, in principle, long-lasting.

The training of the firing technique at the level of world performances means the improvement of the coordination capacities and of the technical skills. It is made at such a level that in the future, in the conditions of a great physical and mental effort, it will be possible to obtain a high precision of the blows and a faster execution of the firing.

The main premises and conditions for a successful biathlon shooting training are:

Concentration and shooting training

A high ability to concentrate is absolutely necessary to achieve success in learning the technique of shooting with a gun. In this respect, the following should be noted:

- the athlete's state of fatigue at the beginning of the technical training as an effect of the previous training sessions;
- framing the technical training in the day regime;
- volume, duration and intensity of technical training.

Shooting training must be included in the general training process so that the accumulation of fatigue, due to running training has not had a negative effect on the ability to concentrate, it is necessary to introduce a recovery time between running training and technique . Intense phase training ensures a judicious combination of shooting and running training and thus a more pronounced cumulative effect on the content of the different workouts.

1.5.9 The main mistakes in breathing and tiggering in the shooting process of the biathlon weapon

Mistake

Apnea occurs after total expiration.

Consequence

Negative influence on firing stability.

Possibilities for correction

The volume of basic firing and effort firing is increased. Breathing is followed by chest movements.

Mistake

Apnea at maximum inspiration.

result

Chest under pressure prevents relaxation and fixation of the center of sight.

The scattering of the blows will be noticed.

Mistake

Apnea is stopped before the fire starts.

Triggering without apnea.

Consequence

Breathing causes the weapon to be unstable in the fine sight phase, which results in a greater spread of fire.

Mistakes

He jerked when the fire started.

The first phase is too small before the fire starts.

result

The weapon moves from position to position when the fire is started.

The movement of the weapon due to the still relatively high resistance to firing at the time of firing.

Possibilities for correction

Repeated exercises to "break" the first obstacle and start the fire.

Attach a wide paper to the back for optical control.

High volume of tube firing with target - trigger.

Check and, if necessary, correct the resistance and stroke of the trigger system.

Mistake

Preliminary phases of firing too long, prolonged application time, low in intensity.

result

Prolonged sighting increases the instability of the weapon and thus, to a greater degree of scattering.

Prolongs the firing rate and the parking time accordingly.

Mistake

Gradually increase the pressure until the fire starts.

Consequence

It negatively influences the achievement of a stable central position.

Mistake

Instability at the peak of the trigger moment

Consequence

Frequent changes in trigger pressure have a negative influence on establishing the central position; as a result, large scattering and missed fires.

A differentiated assessment of the degree of improvement of the technical elements and of the development of the whole action is necessary in order to be able to assess the degree of readiness. Based on pre-established technical characteristics and time structures (which depend on the training stage and age group) the coach has the opportunity to include some essential points of the shooting technique for biathlon. Video recordings facilitate the differentiated evaluation of the development of the action and of some technical characteristics (Pelin, F. et al., 2008, p.44).

1.7 Conclusions and final theoretical considerations

The training of junior biathletes includes a content of modern sports training, which has become more complex, more comprehensive, more dynamic, in which the consolidation and improvement of the shooting sequence is based on theoretical and methodological research in the field of biathlon and sport shooting, and the part of the ski trip is based on the detailed analysis in the field of cross-country skiing from a physiological and biomechanical point of view.

The importance of the approach of the present research is signaled by the study of a literature, publications and research of some in the interdisciplinary study of a morpho-functional request, especially at the age of juniors.

According to the studied bibliographic sources, the optimal age for the consolidation and improvement of the shooting sequence is from 16 to 19 years, but the practice shows that it can be improved even after this age category. the branch of training of junior biathletes, using the method of repetition, with diversified and differentiated means of training.

The strategy to create top biathletes must be based on: the study and analysis of competitive activity, the operational programming of sports training, the cross-sectional and longitudinal verification of training effects, with the correction of possible mistakes, especially during shooting range.

Through its content, our theme aims to address on a scientific basis, the optimization of the shooting sequence in biathlon skiing, in accordance with the current and perspective needs of this discipline. That is why the priority must be the long-term individual development of biathlon players, especially during the junior period, where it is not the priority to obtain results, but the obtaining of physical, technical parameters and high precision in the shooting range.

CHAPTER 2 PRELIMINARY OPERATIONAL RESEARCH ON BIATHLON TESTING, SHOOTING SEQUENCE - JUNIOR CATEGORY

2.1 Premises of some studies on the researched topic

Over the years, the sport of biathlon has become more and more dynamic through a permanent increase in the level of shooting accuracy and the level of motor qualities. Thus, the specialists in the field of biathlon are constantly confronted with the need for a rigorous and continuous selection, especially at the level of performance groups, but also with the complexity of training junior biathletes from a physical and technical point of view.
Participants in the competitions reserved for the junior age level in biathlon skiing, bring to the fore lower levels of achievement than expected on the fulfillment of certain instructive objectives foreseen in the training programs of the specialized forums, which refer both to the acquisition of specific content and skills. biathlon, but also at the level of development of motor ability. Thus, explanations can be found both in the contents that the coaches propose for training and in the methodologies used, which prove to be sometimes inappropriate for the context of the peculiarities of shooting with a firearm in the range of all athletes involved in the process.
The theoretical and methodological part approached in the first part has the merit of establishing the level of knowledge and research of the approached topic and at the same time allows us to retain the ideas underprone the study as well as the premises mentioned in papers with similarities of the topic. the hypotheses of the research presented in the paper are based.

The technical training of the shooting sequence is the most important component in the sports training of junior biathletes in terms of shooting and is based on a scientific, interdisciplinary content, specific to sports shooting with adaptation to physical effort specific to biathlon.

2.2 Purpose of the preliminary research

The first purpose of the preliminary study is to identify the opinions of specialists in the field on optimizing the shooting sequence in biathlon skiing at the junior level. The second goal proposed by us is to establish a battery of investigations through specific tests, to evaluate the specific preparation for shooting in the range in order to increase sports performance based on optimizing specific psychomotor parameters in the range activity in the biathlon test.

2.3 Preliminary research hypoteses

Hypothesis 1
"The opinions of biathlon specialists regarding the optimization of the shooting sequence at the level of junior biathletes can lead to the development of a program to improve the training process in terms of shooting in the range."

Hypothesis 2

"The elaboration and implementation of an appropriate program specific to the environment of the landfill site with land training will contribute to the improvement of physical and technical-tactical parameters through the methodology of individual training of biathlon juniors."

2.4 Preliminary research objectives

The preliminary research aims as concrete objectives two important directions specific to the training of biathlon juniors, materialized in:

a. The use in the training of biathlon juniors of a system of biathlon-specific means, carefully selected, through which the aim is to optimize the shooting sequence for this age category.

b. Knowing the opinion of specialists on the importance of preparing the shooting sequence for junior biathletes and the need to implement modern technology for analysis of shooting in the training process for this age category.

2.5 Preliminary research tasks

The tasks proposed in the preliminary research derive from the establishment of the topic and from the need for the theoretical-methodical argumentation of our research. These are:

- ✓ Identifying the group of junior biathletes who will be subjected to testing;
- ✓ Organizing the necessary framework to support the tests;
- ✓ Selection of control samples proposed in the preliminary research;
- ✓ Application of selected samples under standard conditions;
- ✓ Completion of a questionnaire regarding the opinion of the coaches who work at the level of junior biathletes;
- ✓ Application of the questionnaire and interpretation of the answers obtained;
- ✓ Validation of the questionnaire applied by calculating the Alpha Cronbach coefficient;
- ✓ Identifying the specific parameters necessary for the analysis and interpretation of the results;
- ✓ Establishing the preliminary conclusions and proposals that are required following the preliminary testing.

2.7 Subjects, place and date of the preliminary research

The subjects of the study are 4 male athletes aged 17-19, junior biathletes from the Dinamo Râșnov School Sports Club. The experiment consisted in evaluating the shooting sequence at the beginning of the summer preparation period and then at the end of this period. The training period took place at the sports base at the Dinamo Râșnov School Sports Club located on Valea Cărbunării-Râșnov as well as at the sports base at Fundata-Cheile Grădiștei and lasted 8 weeks between July 6 and August 30, 2020.
The subjects were subjected to two evaluations: an initial evaluation that took place between 6-7.07.2020 and a final evaluation that took place between 29-30.08.2020.
All 4 subjects were accepted to participate in the research (Annex 2), also the sports club to which they are entitled expressed its agreement for their participation in the proposed preliminary experimental program. (Annex 3)

2.8 Presentation of the intervention program for the optimization of shooting sequence for junior biathletes- preliminary research

In the preliminary research, during the period between the two tests (initial test and final test) the following program was applied to optimize the shooting sequence for junior bialonists, with the consent of the coaches and athletes from the Dinamo Râșnov School Sports Club. (Annexes 2 and 3)
In table no. 17 are staggered the main themes of the training lessons planned in order to optimize the shooting sequence for junior biathletes within the sports club mentioned above. (A1-A6) was designed with a working time of 20 min.

Table nr. 17 – Preliminary research shooting sequence optimization program

Săpt.	Luni	Marți	Miercuri	Joi	Vineri	Sâmbătă	Duminică
S1	Forță rapidă în regim de rezistență	Încălzire 15 min ,studiu tir 80 focuri	Forța membrelor inferioare + **A2**	Conținut complementar+**A1**	Rezistență R 2	Odihnă	Odihnă
S2	SR R3 20km,tir 80 focuri,10 min gimn+mobil	Hipertrofie musculară + **A4**	Odihnă	Conținut complementar + **A5**	SR R4 6x2km ,pauză 5-6 min,tir 80 focuri	Complementar forță și mobilitate+**A3**	Odihnă
S3	Rezistență R4+**A1**,**A5**	Odihnă	Forță rapidă în regim de rezistență și coordonare+**A4**	SR R3 20km,tir 80 focuri,10 min gimn+mobil	Odihnă	Intensiv pentruFR (alactacid) + **A2**	Odihnă
S4	FRa, FR și contrast+ **A5**	Rezistență R 3	SR R2 împingeri simultane in pantă 3x5km Pauză 7-8 min 10 min gimn+mobil	Odihnă	Hipertrofie musculară +**A1**,**A3**	Viteză și coordonare + **A2**	Odihnă
S5	Forță rapidă în regim de rezistență+**A6**	Rezistență R5 + **A4**	Odihnă	Intensiv pentru FR (alactacid) +**A5**	Odihnă	Rezistență R5 +**A3**	Odihnă
S6	Forță rapidă în regim de rezistență și coordonare+ **A1**	Încălzire 15 min ,studiu tir 80 focuri +**A2** 20	Odihnă	Complementar forță și mobilitate+**A4**	FRa, FR și contrast + +**A6**	Rezistență R3 + **A5**	Odihnă
S7	Viteză șicoordonare + **A4**	SR R3 25 km 50% fără bețe R2	Încălzire 15 min ,studiu tir 80 focuri+ **A3**	Intensiv pentru FR (alactacid) +**A5**	SR R1 20 km 50% fără bețe+**A1**	SR R2 împingeri simultane în pantă 3x5km Pauză 7-8 min 10 min gimn+mobil	Odihnă
S8	Intensiv pentru FR (alactacid) +**A5**	Sr R2 împingeri simultane in pantă 3x5km Pauză 7-8 min 10 min gimn+mobil	SR R1 20 km 50% fără bețe+ **A6**	Încălzire 15 min ,studiu tir 80 focuri+ **A3**	Viteză și coordonare + **A2**	SR R4 15 km 50% fără bețe R2 + **A1**	Odihnă

2.9 Processing, analysis and interpretation of data obtained from the application of the opinion questionnaire

Studying the opinions of specialists in the field of biathlon in Romania, is a way to obtain information that reflects the importance of preparing the shooting sequence at the level of junior biathletes.

The answers received following the application of the opinion questionnaire were investigated quantitatively and in percentage, and will then be represented graphically according to their weight. From the analysis of the respondents' opinions, we established the need for the proposed approach, the importance of the specialized topic, but also the importance of preparing the shooting sequence specific to biathlon skiing.

Data were statistically processed with IBM SPSS software 25. Statistical analysis included the calculation of descriptive statistical indicators of central tendency and frequency of responses: relative and absolute frequency, as well as weight, responses to each item, arithmetic mean and standard deviation (SD). The Alpha Cronbach statistical index was calculated to assess the internal consistency of the questionnaire. Also, to check the relevance of the answers, we calculated the student t test. The value of statistical significance was set at $p < 0.05$.

The Alpha Cronbach's coefficient for the 31 items in section 2 was 0.729, which suggests the high internal consistency of the questionnaire and allows us to confidently analyze the responses collected in the survey.

2.10 Processing, analysis and interpretation of data obtained from preliminary research control tests

For the analysis of the investigated variables regarding the statistical-mathematical interpretation of the performances on the firing line of the junior biathletes, we used model 25 of the IBM SPSS Statistics software. The data collected from the 4 athletes were included in an SPSS database and were processed using the following indicators and statistical tests: mean and standard deviation of the mean to identify indicators of the central tendency of the results in control samples, amplitude, median, maximum and minimum value, Wilcoxon test for two pair-samples used to highlight differences between repeated measurements on the same sample of subjects, d Cohen effect size calculated using GPower software to verify the strength of differences identified in the tested population. All statistical processing was performed after checking the conditions of application of the Z test (Wilcoxon). Preliminary data analysis indicated symmetrical distributions on all variables included in the analysis, without missing data. To interpret the effect size values we took into account the following limits: a value below 0.20 is a small to very small value of the effect size, a value between 0.20 and 0.50 is an average value, a value between 0.50 and 0.80 is a high value, and a value above 0.80 is a very high value. It should be noted that the small sample size can influence the Cohen d value.

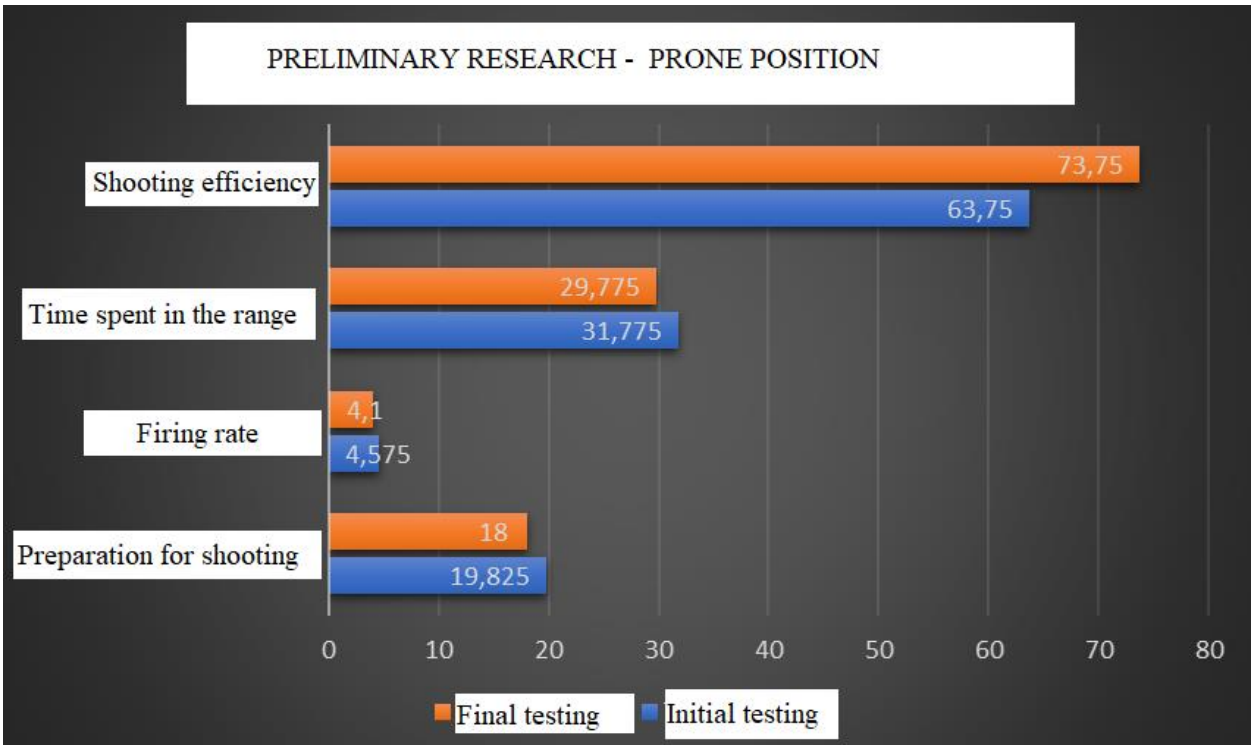

Figure nr.33 Comparative graph results of prone position control tests preliminary research

After the application of the intervention program specific to the shooting sequence for junior biathletes, the values of the initial tests at the control tests in the prone position in the preliminary research underwent positive changes, so in terms of the control test the preparation for shooting we have made a progress of 9, 2%, for the firing rate in the range we can say a progress of 10.38%, for the test time spent in the range we have an increase of 6.29% and the efficiency of shooting from the prone position increased by 10% compared to the initial testing.

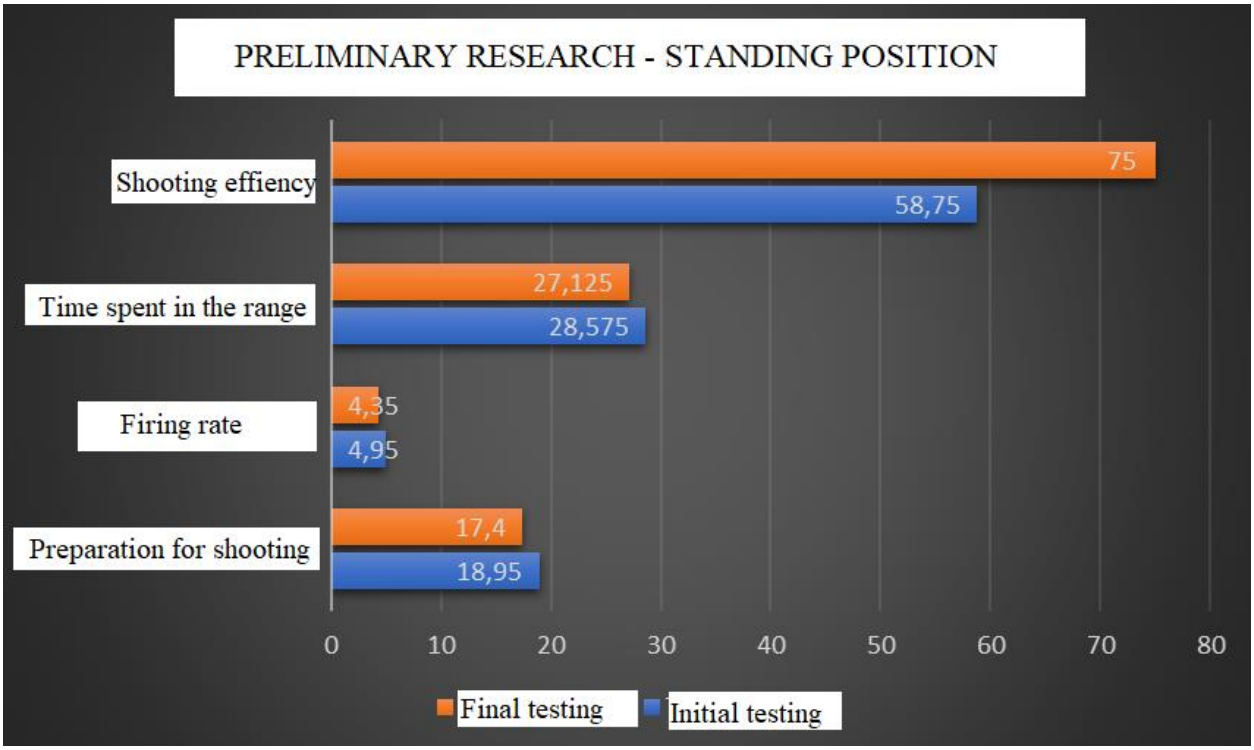

Figura nr.34 Grafic comparativ rezultate probe de control poziția picioare-cercetare preliminară

After the application of the intervention program specific to the shooting sequence for junior biathletes, the values of the initial tests at the control tests in the foot position underwent positive changes, so in terms of the control test the preparation for shooting we have a progress of 8, 17%, for the firing rate in the range we can say a progress of 12.12%, for the test time spent in the range we have an increase of 5.07% and the efficiency of shooting from the prone position increased by 16.25 compared to the initial testing.

To verify that there are significant differences between the initial test and the final test (after the intervention through the specific training program), in terms of speed of handling the weapon, time until the first fire, maintaining an optimal firing rate, and under the ratio precision (in both positions specific to prone and standing biathlon skiing), we used the Wilcoxon test for the two pairs samples and calculated the effect size to see how big the impact of the intervention is on the athletes' success. (Tables 31 and 32)

Table nr. 31 Statistical analysis-preliminary research - prone position

Control tests - prone position	Wilcoxon		
	Z	p	Effect size "d"
Test 1 - preparation for shooting from the prone position	1,826	0,068*	0,33
Test 2- Rhythm of shooting in the prone position	1,890	0,059*	0,34
Sample 3 - Time spent in the range prone position	1,841	0,066*	0,34
Test 4 - Efficiency of shooting from prone position	1,841	0,066*	0,34

Note: * p >0.05

Regarding the value of the Wilcoxon test in the case of control test-preparation for shooting from the prone position, the value of Z is 1,826 calculated at the median of the ranks used. Since p = 0.068, we can notice that at the end of the experimental intervention the junior biathletes obtained a better time in terms of preparation for shooting from the prone position, but statistically significant marginally due to the small number of subjects. Also, the firing rate and the time spent in the range had p> 0.05 and at the end of the experiment the values were improved, these being marginally significant from a statistical point of view with the initial time of the study. The effect size index shows a medium to low effect between the two tests in all 4 control samples, the differences being marginally statistically significant and practical.

Table nr.32 Preliminary research statistical analysis - standing position

Control tests - standing position	Wilcoxon		
	Z	p	Effect size "d"
Test 5 - preparation for shooting from the standing position	1,826	0,068*	0,33
Test 6- Pulling rhythm in the standing position	1,841	0,066*	0,34

Test 7 - Time spent in the range standing position	1,841	0,066*	0,34
Test 8 - Efficiency of pulling from the standing position	1,841	0,066*	0,34

Note: * p > 0.05

Regarding the value of the Wilcoxon test in the case of test control-preparation for shooting from the standing position, this is 1,826 calculated at the median of the ranks used. Since p = 0.068, we can notice that at the end of the experimental intervention the junior biathletes obtained a better time in terms of preparing to shoot from the standing position. The values of the experiment were improved, these being marginally significant from a statistical point of view. We can note that the junior biathletes obtained a significantly higher success rate compared to the initial time of the study. The effect size index shows a mean to low difference between the two tests in all 4 control samples, the differences being marginally statistically significant, as well as practical, due to the small number of subjects.

2.11 Preliminary research conclusions

Based on the preliminary experimental research initially conducted with questionnaire survey to find out what is the orientation in the training methodology of expert coaches in the training of junior athletes with a view to raising their level of performance in the biathlon test, a unity of views was found in some points indicated by analyzing the results of the questionnaire.

From the analysis of the answers received to the questions of the questionnaire, some conclusions are required which in turn confirm hypothesis 1 of the preliminary research:

The use in the preparation of the specific means destined to the optimization of the shooting sequence influences the level of the accuracy of the shooting in the range at the level of the junior biathletes;

The coaches who work at the age level of the biathlon juniors, consider that one of the priorities of the biathlon ski training process is represented by the optimization of the shooting sequence;

The vast majority of surveyed specialists agree that the use of modern technology for the analysis of shooting range is a necessity and a priority in the process of training junior biathletes.

Following the analysis of the results of the preliminary experimental research for this category of juniors at international and national level, we sought to adapt the specific range samples to the parameters with individualized psychomotor aspect, resulting from the application of the training program for a period of 8 weeks. noting that there is progress on each topic which is a limitation of performers' research.

In order to orient ourselves towards a basic research according to the results obtained in the preliminary research, we sought to generalize through statistical-mathematical processing of the whole group to find new innovative ways and methods with the application of a modern technology in preparing future performers. .

After analyzing the data from the control tests we can conclude that the results have an important effect in the case of this small sample (4 subjects), which is why we want to verify the effectiveness of the intervention on a larger group of athletes.

The experimental training model proposed in the preliminary research led to the optimization of the shooting sequence specific to junior biathletes.

CHAPTER 3 CONTRIBUTION TO THE EFFICIENCY OF THE TECHNIQUE AND INDIVIDUAL TRAINING WITH THE PROPOSAL OF DEVELOPING A METHOD LINE FOR APPROACHING THE SHOOTING SEQUENCE TO THE JUNIOR CATEGORY

3.1 Premises of the final experimental research

In our research we start from the premise that the sports training process for the polygon sequence can be corrected and optimized to achieve superior performance in the competition season.
The timely and correct application of specific techniques directly in the preparation process (summer season) through immediate corrections of specific elements of shooting in the range contributes to improving training performance and, implicitly, raises the chances of obtaining future value performance according to studies by Sattlecker et al (2014).
Another premise in our research is generated by the assertion that the preparation of the shooting sequence in biathlon skiing cannot be dissociated and planned independently from ski running training (rollers, cross running, skiing), but today the concept of "total training" supported by countless experts in the field say that the preparation of the off-season polygon sequence has a profound echo in supporting the performance of the season. (Sattlecker, G., Buchecker, M., Muller, E., Biathlon shooting: Previous analyzes and innovative concepts, Science and Nordic Skiing, 2016).
During the training process for biathlon juniors, an attempt was made to combine the classic training methodology represented by the proposed experimental program with modern computer technology, these being represented by the use of SCATT WX-2 sensor and Simway / SkiErg simulator.

3.2 Purpose of the final experimental research

The proposed goal is to find effective methods and means to optimize the polygon sequence in biathlon skiing at the junior level, the introduction of new tests for its evaluation and the elaboration of a methodical line for the preparation of this sequence from sports training to the above mentioned age category.

3.3 Final experimental research hypothesis

"Stimulating the training of the shooting sequence for junior biathletes through the intervention program proposed with the help of modern technology will improve the shooting performance from both prone and standing position, as well as the results obtained nationally and internationally."

3.4 Final experimental research objectives

The main objective is to improve the training of junior biathletes by implementing a training program for the specific shooting sequence and evaluating it through a series of specific tests.
Establishing the training program for the shooting sequence through which to improve sports performance.
Highlighting the main methods and means of training that can provide maximum performance in performance biathlon skiing.
Choosing the most effective methodical strategies that could optimize in time the intervention from the training and, last but not least from the competition.

3.5 Final experimental research tasks

- ✓ Information and bibliographic documentation for determining the theoretical and methodical bases that are related to the topic and objectives of the research;
- ✓ Theoretical and methodical treatment of the issue of shooting preparation based on a scientific substantiation and own experience;
- ✓ Selection of tests and design of specific control tests;
- ✓ Carrying out the initial testing;
- ✓ Elaboration of a training program to which the training of each athlete can be related, and which will ensure a high level of performance capacity;
- ✓ Carrying out the final test;
- ✓ Data processing and interpretation;
- ✓ Establishing conclusions and recommendations.

3.7 Subjects, place and date of the final experimental research

The experiment (initial and final testing, as well as the experimental intervention) took place in the training locations of junior biathletes included in the National Olympic Center for Junior Training, at the Cheile Grădiștei-Fundata sports base, respectively Valea Râșnoavei Predeal sports base .
The preliminary and final testing were carried out with the consent of the athletes and coaches (Annexes 4 and 5), within the agreed time interval.
The subjects who took part in this experimental research were 8 male biathlon athletes, all 8 athletes being juniors aged between 17 and 20 years.

The biathletes participating in the research are legitimate athletes at CSS Dinamo Râșnov, CSS Miercurea Ciuc, CS Dinamo Bucharest and CS Steaua Bucharest, being members of the C.N.O.P.J. biathlon, coached by prof. Tudor Gârbacea and Mazilu Daniel.

The pedagogical experiment took place between 03.05.2021-19.11.2021. During this period the initial testing was performed (3-7.05.2021), the specific training program was implemented, and at the end of the period the final testing was performed (15-19.11.2019) . Both the two tests and the trainings took place inside the sports base at Cheile Grădiștei-Fundata, as well as the training base in Predeal.

Before performing the initial testing, all the 8 athletes involved in the final research were evaluated from a medical-sports point of view at INMS Bucharest, on 29.04.2021, where they were declared fit for sports effort for 6 calendar months. (Annex 6)

3.9 Proposed intervention program for optimizing the shooting sequence for junior biathletes - final experimental research

In the basic research, during the period between the two tests (initial test and final test), the following program was applied to optimize the shooting sequence in junior biathletes, with the agreement of the coaches and athletes from the National Olympic Center for Junior Training.

During the period between the two tests, 3 monitoring of the measured parameters specific to the shooting sequence were carried out (Annex no. 10), where it was found that subjects 4, 7 and 8 needed changes in the intervention plan, this plan being individualized and described in detailed in Appendix no. 11, and entered into force starting from the 2nd day after the monitoring in August 2021.

Also, together with the team coaches, the intermediate objectives for the 2021-2022 season were developed (Annex no. 14), after which the weekly training cycles were also developed. (Annex no. 15)

Table nr.37 **Planning the optimization program of the shooting sequence the final experimental research**

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
S1	Fast strength in endurance mode + Scatt static 30 min	Rest	Forță + Scatt efort 20 min	Conținut complementar+OSP1 30min	Rezistență R 2 + Scatt static 30 min	Antrenament CEE-IBU 60 min static	Rest
S2	Speed and coordination + Simway/ SkiErg	Muscle hypertrophy + OSP2 30min	CEE-IBU Training 60 min static	Content complementary + Simway/ SkiErg	PEM/ Form of jumps	Complementary strength and mobility	Rest
S3	Endurance + Scatt static 30 min	Rest	Fast strength in endurance and coordination	Endurance R3 + Simway/ SkiErg	Antrenament CEE-IBU 60 min static	Intensiv for FR (alactacid) + OSP3 30min	Rest
S4	FRa, FR and contrast+ OSP4 30min	Endurance R 4 + Scatt efort 30 min	PEM/ Forms of jumps	Rest	Muscle hypertrophy + Simway/ Skierg	Speed and coordination + SCATT static 30 min	CEE-IBU Training 60 min static
S5	Fast force in regime of resistance	Endurance R3 + Scatt static 30 min	Rest	Intensiv for FR (alactacid) +OSP5 30min	CEE-IBU Training 60 min static	Endurance R4 + Scatt efort 30 min	Rest
S6	Fast strength in endurance and coordination + Simway/ SkiErg	PEM/ Forms of jumps + Scatt static 30 min	Rest	Complementary strength and mobility + Scatt static 20 min	FRa, FR and contrast + Simway/ SkiErg +OSP6 30min	Endurance R3 + Scatt efort 30 min	CEE-IBU Training U 60 min static

The stability of the gun can be described as the movement of the sight point in the target. On the one hand, the entire path (yellow trajectory) can be used as a performance parameter. On the other hand, rifle movement can be considered separately in the horizontal (x) or vertical (y) direction to analyze weak points.

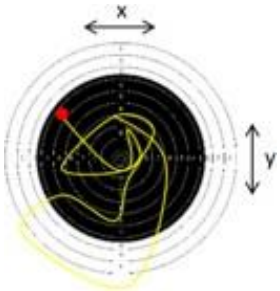

Figure nr.54 Trajectory and directions of shooting analysis

It is not possible to hold the weapon in a 100% stable position neither in the prone position or in the standing position. But the steadier the weapon can be held, the less vulnerable shooting at the range becomes and the more controlled accuracy can be. It is understandable that the movement of the weapon increases under load. But this also means that the more stable the weapon can be held at rest, the less the effects of the load.

In addition, the weapon and the body form a unit in the firing position. Accordingly, balance skills play a significant role in weapon stability. The whole body must react if there are instabilities caused to the weapon. For this reason, we tried to include sling pull and shoulder pressure in the exercises and parameters. In addition, you will find variations for the trigger and the arm rest, which is the direct connection between the body and the rifle. They offer specific training options for individual weaknesses. All this can be achieved by using the sensor for biathlon shooting training called SCATT, purchased by the Transilvania University of Brașov within the Research-Development Institute, Quality of Life and Human Performance.

Scatt is an advanced optical sensor attached to the gun and combined with software that allows the shooter to see immediate and detailed visual feedback on the entire aiming process. This intuitive data allows the biathlete and coach to see and eliminate both simple aiming errors, as well as deeply rooted. Progress is made much faster than regular shooting training. There is no limit to SCATT training sessions, it can be used both indoors and outdoors, with simulated fire or real fire, at a real distance or distance reduced.

The SCATT optical sensor was useful for us to improve biathlon shooting without prior physical demand and was included in the training lessons proposed for the athletes of the final experimental research. (Annex no. 1)

Also the analysis of shooting, the rapidity of movement between shots and the correction of mistakes in the aiming process, both during effort and static, were carried out with the help of modern SCATT technology. (Annex no. 18)

Figure nr.55 Scatt sensor attached wo the biathlon weapon

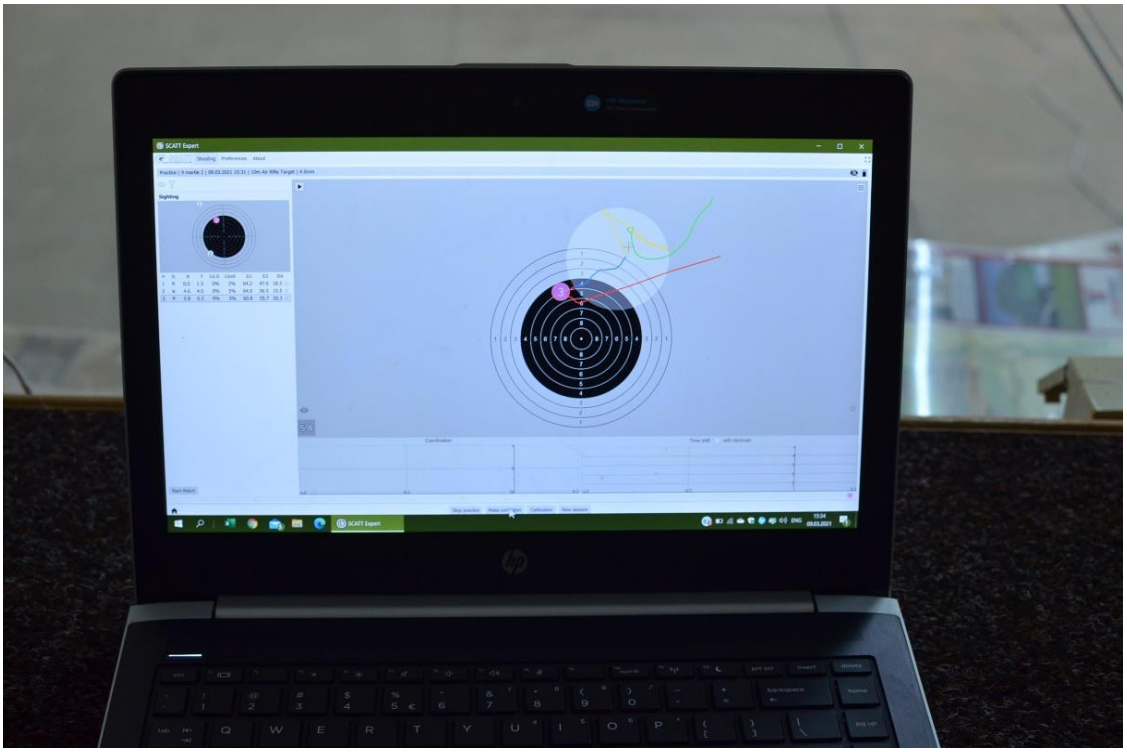

Figure nr.56 Software SCATT aiming process

Green line - interval from target entry to -1 second before firing

Yellow line- the interval between -1 and 0.2 seconds before the trigger

Blue line - the interval from -0.2 seconds to the time of firing

Red line - the interval after the start of the fire

Simway/SkiErg training

Simway XC is a software that allows the simulation of biathlon races. The simulator is compatible with the SkiErg and ToraxTrainer training systems. The biathlon tracks used by the software are those of Vasalopet, Ostersunds Stadion and Castle Sprint in Stockholm. The length of the races can vary from 200m to 10km. The software allows training in single or double mode. It allows training in the range, as well as the analysis of shooting (weapon movement). Working on this simulator allowed the subjects of the final research to strengthen the technical elements of shooting the weapon and develop their competitive spirit thanks to the training lessons conducted in the "competition" module.

Figure nr.57 Simway/SkiErg simulator

Figure nr.58 Software shooting Simway+SkiErg

3.10 Analysis and interpretation of data recorded in the final experiment

For the analysis of the variables investigated in terms of the statistical-mathematical interpretation of the performances of the junior biathletes, we used version 25 of the IBM SPSS Statistics software. The data collected from the athletes were entered into an SPSS database and processed using the following indicators and statistical tests: minimum and maximum value, amplitude, median, mean and standard deviation of the mean to identify indicators of central tendency of the results of the evaluation samples, the Z test (Wilcoxon) for independent samples to compare the differences in means between the initial and the final testing, the Cohen's d effect size calculated by means of GPower software to check the strength of the differences identified within the tested population. All statistical processing was carried out after checking the conditions of application of the Z-test. The normality of the distribution of scores was checked with the help of skewness and kurtosis indicators also calculated in the SPSS program. Preliminary data analysis indicated symmetrical distributions on all variables included in the analysis, without missing data. To interpret the effect size values we took into account the following limits: a value below 0.20 is a small to very small value of the effect size, a value between 0.20 and 0.50 is an average value, a value between 0.50 and 0.80 is a high value, and a value above 0.80 is a very high value. Depending on these values, we can expand the interpretation of the obtained results so that we can specify how intense the differences recorded in the current research would be if the intervention were carried out at the level of the entire population from which the two samples were drawn. It should be noted that the small size of the samples can influence the value of Cohen's d. The progress rate was also calculated for each individual subject, both for the specific control samples and for the non-specific tests. (Annex no. 16)

Tabel nr. 49 Statistică descriptivă(2) – probe de control – testare inițială și finală-poziția culcat-cercetarea finală

Control tests - prone position	Wilcoxon						
	Z	p	Average		Average difference	Effect size "d"	Progress rate
			TI	TF			
Test 1 - preparation for shooting from the prone position	2,527	0,012*	18,58	17,01	1,57	0,74	8,44%
Test 2- Rhythm of shooting in the prone position	2,539	0,011*	3,85	3,08	0,77	0,83	20%
Test 3 - Time spent in the range prone position	2,524	0,012*	29,55	27,1	2,45	0,53	8,29%
Test 4 - Efficiency of shooting from prone position	2,539	0,011*	65,62	83,12	17,5	1,34	26,66%

Note: * $p < 0.05$

Regarding the value of the Wilcoxon test in the case of sample 1 control-preparation for shooting from the prone position, the value of Z is 2.527 calculated at the median of the ranks used. Since p= 0.012, we can note that at the end of the experimental intervention the junior biathletes achieved a better time in terms of preparing the shot from the prone position. Also the shooting rhythm and the time spent in the range had p< 0.05 and at the end during the experiment the values were improved. We can note that the junior biathletes obtained a significantly higher percentage of success compared to the initial moment of the study. The effect size index shows a strong difference between the two tests in all 4 control samples, the differences being statistically significant as well as practical.

Table nr. 50 Descriptive statistics(2) – control samples – initial and final testing – standing position – final research

Control tests - standing position	Wilcoxon						
	Z	p	Average		Average difference	Effect size "d"	Progress rate
			TI	TF			
Test 5 – preparation for shooting from the standing position (sec)	2,521	0,012*	16,87	14,96	1,91	0,94	11,32%
Test 6- Rhythm of shooting in the standing position (sec)	2,536	0,011*	3,91	3,22	0,69	1,43	17,64%
Test 7 - Time spent in the range standing position (sec)	2,524	0,012*	24,78	22,11	2,67	1,24	10,77%
Test 8 - Efficiency of shooting from the standing position (%)	2,539	0,011*	61,25	80	18,75	1,43	30,61%

Note: * $p < 0.05$

Regarding the value of the Wilcoxon test in the case of sample 5 of the control-training for shooting from the standing position, it is 2.521 calculated at the median of the ranks used. Since p= 0.012, we can note that at the end of the experimental intervention the junior biathletes obtained a better time from the point of view of preparing the shot from the standing position. Also the shooting rhythm and the time spent in the range had p< 0.05 and at the end during the experiment the values were improved. We can note that the junior biathletes obtained a significantly higher percentage of success compared to the initial moment of the study. The effect size index shows a very strong difference between the two tests in all 4 control samples, the differences being statistically as well as practically significant.

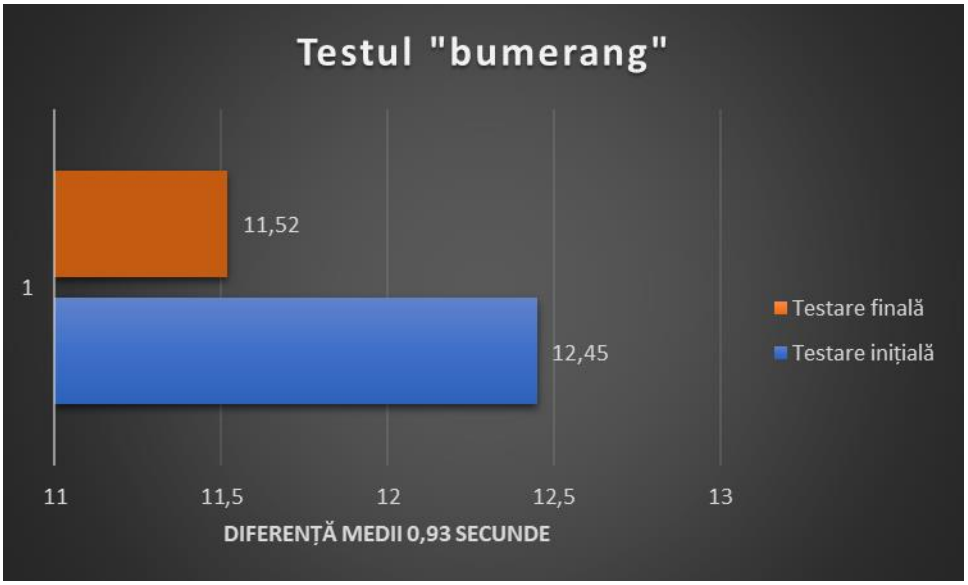

Figure nr.63 Arithmetic mean values calculated for the "boomerang" test

Table 53. Results of the Wilcoxon "boomerang" test.

WILCOXON TEST	
Z	2,521
P	0,012
Effect size	0,86

Significance threshold p = 0.012 < 0.05 for z = 2.521, the progress made being statistically significant. The effect size index (0.86) shows a large to very large difference between the two tests. The evolution of F.C. during the final testing of the "boomerang" test can be found in figure no. 64, 65, 66 and 67.

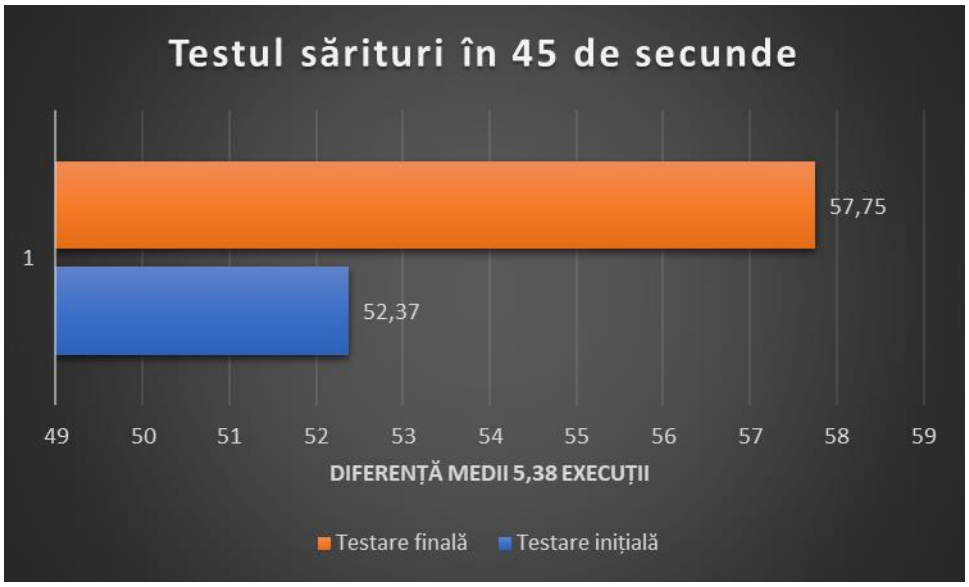

Figure nr.68 Arithmetic mean values for the "jumps in 45 seconds" test

Table nr.56 Wilcoxon test results, jumps in 45 seconds

WILCOXON TEST	
Z	2,527
P	0,012
EFFECT SIZE	0,77

Significance threshold p = 0.012 < 0.05 for z = 2.527., the progress made being statistically significant. The effect size index (0.77) shows a large to very large difference between the two tests.

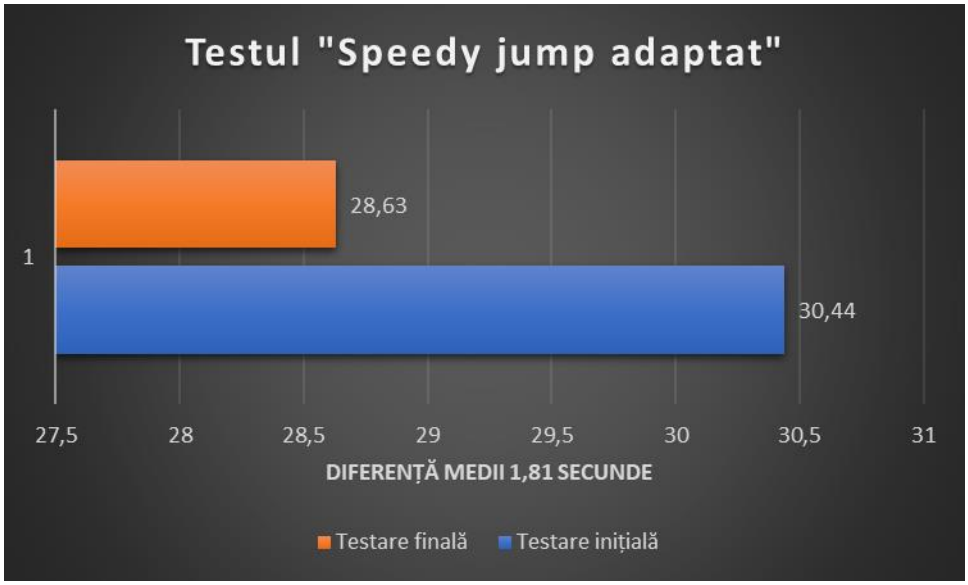

Figure nr.73 Arithmetic mean values for the "Speedy Jumps" test

Table nr.59 Wilcoxon speedy jump test for checking jump coordination

WILCOXON TEST	
Z	2,524
P	0,012
EFFECT SIZE	0,54

Significance threshold p = 0.012 < 0.05 for z = 2.524, the progress made being statistically significant. The effect size index (0.54) shows a medium to large difference between the two tests.

The training program specific to the shooting sequence in the biathlon discipline, junior category, proposed, proved viable and effective, considering its acceptance by the athletes and their progress supported by the data of the tests performed.

Regarding the test results from the control samples we can conclude the following:

The means of all test scores improved at the final test compared to the initial test. In the case of all the control samples a positive progress was shown, in the case of preparation for shooting from the prone position the mean from the final testing decreased by 1.57 seconds compared to the initial testing, and for the standing position the mean decreased by 1.91 seconds compared with the average obtained at the beginning of the check.

When testing the rate of fire between shots from prone and standing, the average from the final test dropped by 0.77 seconds (prone) and 0.69 seconds (standing).

In the case of the test total time spent on the shooting line - the average duration decreased by 2.45 sec at the final test for the prone position and by 2.67 sec for the standing position.

In the shooting efficiency control sample, the percentage from the initial testing was improved by 17.5 percent, reaching 83.12 percent in the final testing for the prone position and an improvement of 18.75 percent for the second specific position biathlon skiing, the standing position.

Compared to the preliminary research, the results have improved considerably, with all control samples having significant increases:

- ✓ For the shooting training sample, the average time for the final testing from the basic research decreasing by 0.99 seconds in the prone position, respectively 2.44 seconds in the standing position;
- ✓ The average test time spent in the range decreased at the final test by 2.67 seconds for the prone position, respectively 5.01 seconds for the standing position.
- ✓ For the test, the average shooting rhythm of the results decreased by 1.02 seconds, a progress of 24.87% was achieved in the shooting from the prone position, respectively 25.97% for the shooting from the standing position;
- ✓ In the shooting efficiency test, we notice that the shooting percentage was improved by 9.37% in the prone position and by 5% in the standing position.

As a result of the differences recorded between the initial and final testing and the progress achieved at the final testing in all eight control samples, after applying the Wilcoxon test it emerged that these differences are statistically significant, as well as practically due to the values following the application of the calculation formula for the "Size of effect" indicator.

Following the analysis of all these data, we can state that the hypothesis according to which "Stimulating training specific to the polygon sequence in junior biathletes through the proposed intervention program with the help of modern technology will determine the improvement of shooting performances both from the lying position and from the standing position, as well as the results obtained at the national and international level", it is confirmed.

In the control tests, in all three applied tests, improvements in the averages are found after the final tests.

In the "boomerang" run test over obstacles, the average results in the final test improved by 0.93 seconds, resulting in an improvement of 7.46%.

According to the data in table 34 (Normal values boomerang running over obstacles) of normal values and the results obtained in the tests, it appears that the subjects under research are in the satisfactory-good range, only subject 1 having values that fall into the very good category.

In the 45-second endurance strength test, the average score improved by 5.38 points, a 9.31% improvement over the initial testing.

Referring to the normal values in table 35 and the test results, we can say that all the athletes are in the area of the indicator very well.

In the third test, namely the speedy jumps test to check the coordination of jumps, the average time decreased in the final test by 1.81 seconds, the progress achieved was 5.94%.

From the analysis of the normal values in table 36 and the results obtained during the tests, we notice that the results of the athletes fall into the mediocre-satisfactory zone, the athlete S1 being the only one with a value at the level of very good.

As a result of the differences recorded between the initial and final testing and the progress achieved at the final testing on all three tests, after applying the Wilcoxon test, these differences were found to be statistically significant.

SUGGESTIONS

Following the experiment, it is necessary for the training of junior biathletes from C.N.O.P.J. to continue with training specific to the range sequence to develop a sporting performance with a high degree of accuracy in the shooting range.

We also recommend the development of a methodical training line for the shooting sequence for junior biathletes that includes the modern equipment used in the basic experiment and the increase in the number of hours allocated for shooting training within the training mesocycles (especially for the period of readjustment to the effort , the basic preparatory period and the pre-competitive period).

NEW FEATURES, LIMITATIONS OF RESEARCH AND DISSEMINATION OF RESULTS

From a theoretical point of view, through this work we tried to synthesize the information related to the shooting sequence within the performance biathlon at the junior level.

Studying the specialized literature, we identified the levers by which we can solve this practical need effectively, respecting the following methodical recommendations: the teacher/coach must have a complex system of theoretical knowledge regarding the methodology for optimizing the shooting sequence; sports clubs to provide coaches with the necessary means and materials for testing and especially optimizing the shooting process in the range; to take into account the individual characteristics of the athletes with whom they work.

From a practical point of view, the personal contribution stems from the fact that by applying an intervention program on the polygon sequence optimization process, the results obtained in the control tests specific to biathlon as well as the results obtained in the competitions improved.

However, in order to be certain about the adequacy of the intervention for the current Romanian context of the training of biathlon athletes, we investigated the opinion of specialists in the field, regarding the training of athletes from our country, the importance of the shooting sequence in sports training and the use of modern means designed to perfect shooting at the range. The opinions of specialists in our field confirm that the methodology must be adapted to the requirements of biathlon performances worldwide.

The theoretical contributions as well as the research results have clearly and concretely highlighted the role and importance of optimizing the range sequence and training programs in sports performance.

We believe that the approach to the topic and the way of organizing the scientific approach is original.

Also, the introduction of the three control tests for the assessment of physical training and their modification for the researched age samples, involves elements of originality and novelty.

RESEARCH LIMITS

Regarding the limits of the research, we believe that due to the small number of subjects participating in the research, we cannot generalize the conclusions obtained, but only recommend the application of the intervention program on the polygon sequence in the junior category developed by us.

Another limitation of the research was represented by the small number of specialists (14) who responded to our request to complete the opinion questionnaire on sports training and on the range sequence in junior biathletes. I also did not benefit from the physical training evaluation devices (Polar H10 heart rate belt, Suunto ambit heart rate monitoring belt) until the last part of the final testing checks, to track the time interval at which F.C. reaches its maximum value during the effort and to follow its consistency, the effort and intensity of the tests being very close to the values recorded by F.C. at the entrance to the polygon. During the initial testing, I had the Polar H9 heart rate

measuring device at my disposal, which unfortunately suffered malfunctions, the data measured on the first day of testing being lost and unable to be recovered. These evolution analyzes were performed in order not to neglect the effort part. The values recorded in the physical tests of F.C. they are similar to the values that a biathlete athlete registers when entering the range (Atasever, Kiyici, Bedir & Agduman, 2021). Also, thanks to the recommendations received by the subjects of the final research, who have indications for subsequent cardiological consultation in the content of the medical records from I.N.M.S., we made the decision to monitor the evolution of F.C., because quite high values are reached during the effort within non-specific physical tests. If any athlete reached a very high value in a very short time, he would have been stopped from completing the non-specific physical tests, which was not the case in our research.

ABSTRACT

The thesis complies with the methodological indications specific to the doctoral field, being structured on three chapters.

The first chapter of the research deals with its theoretical substantiation, based on the identified and studied bibliographic references, general aspects regarding the activity of the shooting range at junior biathletes as a process of adaptation to modern international standards.

In Chapter II of the thesis, the preliminary research is approached, being presented the premises of similarities studies regarding the topic, purpose, hypotheses, objectives and tasks of the preliminary research. In their continuation, the research methods used, the subjects and the location of the preliminary experiment are treated with the presentation of the content of the experimental research, the proposed intervention program, the presentation of the results of the questionnaire applied with Alpha-Cronbach validation value, the analysis and interpretation of the preliminary results obtained at the proposed and performed control tests and at the end of this chapter of the thesis the preliminary research conclusions are formulated.

Chapter III of the thesis contains the methodological approach of the basic experimental research, starting from the premises created by the results of the preliminary research with the specification of the purpose of the research, the hypothesis of the basic research, the objectives and tasks proposed to the specifics of the modern requirements at international level. There are presented the period and the staging, the place of the experiment, the subjects of the research, as well as the research methods used based on the application of a research with modern technology, approaching from a flexible perspective a research of modern training adapted to the age of juniors.

The theoretical contributions as well as the results of the research clearly and concretely highlighted the role and importance of optimizing the shooting sequence and the training programs in the sports performance of biathlon.

The training program specific to the shooting sequence in the biathlon discipline, junior category, proposed, proved to be viable and efficient, given its acceptance by the athletes and their progress supported by the data of the tests performed. Following the analysis of all these data, the hypothesis of the experimental research was confirmed.

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