



SHOOTING MISTAKES IN BIATHLON AS A RESULT OF INCORRECT PRONE SHOOTING POSITION

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ABSTRACT

The present research studies the mistakes committed as a result of taking an incorrect prone shooting position in biathlon. **The aim** of the research is to specify the errors when taking the prone shooting position in biathlon and to analyze their possible consequences. The following **methods** are used to resolve the tasks of the research: analysis of the specialized literature on the topic of the research; content analysis of the shooting protocols; system and structure analysis; pedagogical observation; discussion with biathlon coaches. The research involves seventeen biathletes in the categories - women, junior women and junior men. In the course of five years a purposeful pedagogical observation was conducted on the shooting preparation of eleven elite athletes from the Bulgarian National Team of Biathlon and of six students specializing in biathlon at the National Sports Academy “V. Levski”. **Results:** After a detailed analysis and summary of the collected data, the acquired results describing the various types of shooting errors made by biathletes as a result of their incorrect prone position and the ways to overcome these mistakes were presented in the form of a table (Table 1.). **Conclusions:** The presented table could be used in the training process by coached and athletes in order to overcome the mistakes when taking the prone shooting position in biathlon.

Key words: biathlon, shooting, prone position, mistakes

INTRODUCTION

Taking a shooting position means that the parts of the body should be placed so as to obtain the best stability of the weapon on target. When taking a prone shooting position, it is necessary for the biathlete to ensure a stable grip of the weapon, at the expense of least tension of the muscles involved in holding the weapon, and a natural position of the head, creating an optimal position of the visual analyzer when aiming at the target.

A specialist in sports shooting (1) points that the prone shooting position must provide: the necessary degree of stability of the “shooter - weapon” system at the least tension of the muscle apparatus of the shooter; the most favourable

conditions for the functioning of the senses, primarily vision and balance (vestibular apparatus); conditions for normal functioning of the internal organs and proper blood circulation.

Another specialist in the field (2) believes that just as the anthropometric data of different people are different, the shooting position of each athlete must be selected individually in the process of training. The mentioned author and other specialists in the area (3-5) state that the body position in relation to the firing line of sight must be around $15^{\circ} - 25^{\circ}$ (**Figure 1**). This position provides favourable conditions for adjusting the stock and aiming. Specialists in sport shooting (6, 7) recommend that the angle of the body position should be $3^{\circ} - 15^{\circ}$. According to another one (8), it should be $10^{\circ} - 15^{\circ}$; still other specialists (1, 9, 10) state it should be $12^{\circ} - 20^{\circ}$. The following author (11) believes that in the prone shooting position the rotation of the torso must be $20^{\circ} - 30^{\circ}$

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in relation to the firing line of sight. In general, all specialists in the field share the opinion that the body position related to the firing line of sight must be in the range of $15^{\circ} - 25^{\circ}$.

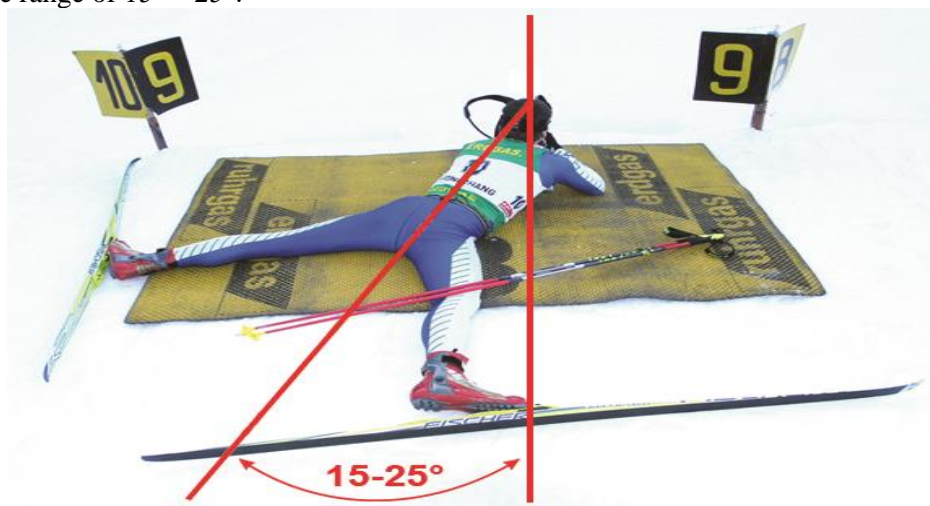


Figure 1. Body position related to the firing line of sight (according to Palakarski, 2016)

In the prone firing position, the left arm is a basic unit in the system “shooter-weapon”, and the support point of the left elbow is at the center of the whole system “body-shooter-weapon” (12). According to the same author, the shoulder should be placed under the rifle stock 2 – 4 cm vertically. The same opinion is shared by another specialist (13). A German author (10) also recommends a vertical position ranging up to 4 cm, and still another specialist (6) considers that it is advisable to place the elbow a little to the left for greater comfort and to avoid painful sensations. In his opinion, the position of the elbow does not provide any advantages. The left arm, bearing the full weight of the weapon must be bent at the elbow and brought forward as far as possible, with the fingers slightly holding the buttstock.

The gunstock of the weapon is placed in the palm of the hand, close to the thumb finger. It is pointed in many literary sources that the left hand and the wrist must be straight (7, 3, 10, 14). When the wrist position is twisted, the “take-off” angle of the bullet will constantly change (14). If the fingers of the left hand hold the barrel, the type of vibrations of the barrel when shooting changes (15).

Particular attention should be paid to the tension of the stock belt, which ensures the stable position of the weapon and helps to reduce the tremor that

imparts the specific vibrations to the weapon. The stock belt and the arm support belt form a stable triangle: “belt – shoulder – arm”, acting as an artificial support. The biceps muscle should be relaxed, not strained to support the weapon, the belt should act as a support. A shooting specialist (1) observes that if the belt of the left arm is loosely attached, the “arm-rifle” system is not stable enough, in other words, it is unbalanced. If the belt is too tight, blood circulation in the muscle is disturbed causing rhythmic oscillation of the weapon – “tremor” and painful sensations in the arm. Still another author (13) points to the fact that if the belt is too loose, the athlete has the impression that the weapon points below the center of the target and tries to maintain the shooting position applying muscle pressure with the left hand, which does not allow him/her to work the trigger correctly.

Depending on the position of the left arm and the angle between the shoulder and forearm, there are medium, low and high shooting position. In the medium shooting position, the shoulder and forearm form an angle of 100° , providing stability to the “shooter-weapon” system. The medium shooting position is used by most biathletes (12). In the low position, the angle between the shoulder and the forearm is a little over 100° , its advantage is the greater stability, but at the same time it makes breathing more difficult, due to the

bigger load in the chest area of the body, as the heart contractions increase the oscillation of the weapon. In the high shooting position, the angle is smaller than 100°, and the upper part of the body is raised above the support area offering good conditions for breathing, but it provides less stability due to the high center of gravity of the body.

The stock should rest freely in the shoulder area between the pectoral and deltoid muscles (in the shoulder socket). In the specialized literature, recommendations can be found of the need for a greater effort when placing the stock on the back of the shoulder (16). According to the Ukrainian specialist (12), in biathlon the stock is placed freely in the shoulder area.

The main function of the right hand is to reload the weapon and to work the trigger. The elbow of the right hand should not come close to the body or be brought to the side of it with tension. After gripping the stock handle, the elbow should be placed freely on the shooting mat, with a natural movement. Besides there should be no additional tension in the right hand and in the index finger when handling the trigger. The authors (1-12) recommend that the right elbow should be placed at 20 – 25 cm from the projection of the aiming line.

One of the most important and basic moments when taking the shooting position, as noted by a number of specialists in sports shooting (13, 14, 17), is the position of the head, which must be placed in a natural way on the stock comb. The head must be upright, pressing the stock comb lightly, with the help of the cheekbone, without much tension, providing the most suitable conditions for work of the visual analyzer (the eye) when aiming, and a quick approach to the next shot. These authors (13, 18) do not recommend tilting the head to the right and changing the head position on the stock comb from shot to shot, which is often done by beginner biathletes, and is a prerequisite for increasing the dispersion of hits.

The legs must be placed apart at a slight angle, without tension in the muscles. The specialists from the Russian school (8, 9) recommend that the legs are placed so that the right leg is almost parallel to the aiming line. And the German

specialists suggest the left heel as the main orienteer, which should be located approximately on the front line from the top of the left shoulder through the crest of the iliac bone. According to another specialist (10), the position of the inside edges of the skis helps to release the muscle tension on the lower limbs.

In the “Scandinavian” variant of taking a shooting position, the body weight is transferred on the left hip, while the right leg is bent in the knee and drawn to the stomach.

The problems of taking a shooting position, of correcting errors in the prone shooting position made by the competitors by using the means of special shooting training, and the development of a methodology for error correction, are very important current issues.

The preliminary study of the specialized literature and sport practice in biathlon gave reasons for the formulation of the *thesis* that shooting preparation in biathlon, purposefully directed towards the detection of errors resulting from incorrect prone shooting position would be much more effective, if it is realized on the basis of a properly defined effective program for correction of the shooting position, which presents a clear idea of the correct execution of this element of the shooting technique and of the way to master it.

The aim of the present research is to specify the mistakes in taking the prone shooting position and to analyze their possible consequences, and the ways to eliminate them.

In accordance with the aim of the research, the following *tasks* are defined:

1. To study the theoretical and methodological literature on the research problem.
2. To conduct a purposeful (pedagogical) observation.
3. To check coaches' opinions regarding the errors made when taking incorrect prone shooting position in biathlon.

MATERIAL AND METHODS

The subject of the present research is the technique in the prone shooting position in biathlon and the *object* of the study are the committed mistakes, their consequences and the ways to eliminate them.

In the course of five years a purposeful (pedagogical) observation was made during the shooting preparation of eleven elite biathletes (three junior men, three women and five junior women) from the National Biathlon Team of Bulgaria, and of six students specializing in biathlon at the National Sports Academy “V. Levski” (three junior women and three junior men).

Specialized and methodological literature on the problem was studied in the course of the research, content analysis of the shooting training protocols was performed and the acquired results were analyzed. The research was conducted during the training camps in the program of the National Biathlon Team for women and junior women in the periods 2018 – 2019 and 2020 – 2022 and during the training sessions in biathlon with the students from the National Sports Academy,

specializing in biathlon. The shooting protocols from the technical shooting training sessions in this period were processed and analyzed (taking note of all missed targets), photo and video materials were also analyzed.

The following scientific research *methods* were applied to solve the tasks of the study: purposeful (pedagogical) observation, discussion with biathlon coaches, analysis of specialized literature on the problem of the research, analysis of the photo and video materials, and system-structural analysis.

RESULTS

After an in-depth analysis, the summary of the collected material was organized in the form of a table (**Table 1**). Various shooting errors made by the biathletes as a result of incorrectly taken prone shooting position and the ways for their elimination are presented in (**Table 1**).

Table 1. Mistakes, consequences and possible corrections in shooting as a result of taking unsuitable prone shooting position in biathlon

Mistakes	Consequences	Possible corrections
1. Insufficient or excessive twisting of the body and legs towards the target.	Distortion of the spine, tension in the muscles; difficulty in achieving not only fine, but also rough aiming.	Repeatedly taking the prone shooting position.
2. Legs too close together.	Reducing the support area and instability of the system “shooter-weapon”.	Repeatedly taking the prone shooting position. Marking the support points of both legs.
3. Legs too wide apart.	Great muscle tension, affecting the system “shooter- weapon”	Marking the support points of both legs.
4. Pronounced asymmetry in the shoulder girdle in the vertical plane.	The difference in the shoulder levels leads to a lateral tilt of the weapon or to discomfort in the back muscles.	Readjusting the shooting position by regulating the stock belt.
5. The angle between the left forearm and upper arm is too small.	Tension in the back muscles, the shoulder girdle and the neck; great deviation of the shots horizontally.	The stock belt is too tight – adjustment is needed; the angle between the upper arm and forearm must be around 100°.
6. The angle between the left forearm and upper arm is too big.	Great tension of the forearm muscle; negative impact on the chest breathing movements; uncomfortable position of the head, causing difficulties for the visual analyzer (the eye) when aiming.	The stock belt is too loose – adjustment is needed; the angle between the upper arm and forearm must be around 100°.

7.The support belt of the left arm is loose.	Difficulties in holding the weapon. Leads to a downwards movement of the rifle at the moment of shooting, which causes difficulties in proper working the trigger.	The belt should be tightened to normal position of 100°.
8.The support belt is too tight.	Restricted blood circulation in the muscle of the support arm; increased tremor, which is transmitted to the weapon;	The stock belt should be released to normal position of 100°.
9.The fulcrum of the supporting left arm is too far to the right of the norm. For left-handed athletes, the support arm will be the right one – accordingly, it will be too far to the left.	The vertical axis of the weapon is moved to the left – for lefties to the right.	Marking the support points of both elbows; retaking shooting position.
10.The fulcrum of the support arm is located too far to the left of the norm – it will be the opposite for left-handed athletes.	The right arm is quite tense in order to keep balance, causing instability of the shooting position.	Marking the support points of both elbows; retaking shooting position.
11.The left hand holds the front of the stock with too much finger tension.	Disruption of the stability of the position – too many muscle groups involved in holding the weapon.	Training in wrist relaxation.
12.The right hand elbow slides on the outside during serial shooting – with left-hand athletes, it will be the opposite direction.	Shifting of the body axis in relation to the target. Pressure is exerted on the weapon to the target; missed shots – up to the left of the target (at 10 – 11 o'clock).	When taking a shooting position, attention should be paid to the elbow position.
13.The butt of the stock is placed incorrectly in the shoulder socket.	The butt of the stock does not sit in the socket, but rests on the shoulder bone. In this position, the weapon is often unstable.	Training for correct placement of the butt in the shoulder socket; the position should be such, that with rough aiming there is no pressure on the weapon.
14.The butt is placed higher than necessary in the shoulder socket.	The weapon points down below the target, when aiming, it is necessary to lift it up; missed shots are below the target.	When taking a shooting position, the image of the target should be stable without applying pressure on the weapon.
15.The butt is placed too low in the shoulder socket.	When taking a shooting position, the weapon points above the targets; when aiming, the weapon is pushed downwards; missed shots – above the center of the target.	When taking a shooting position, the image of the target should be stable without applying pressure on the weapon.
16.The stock handle of the rifle is unevenly and loosely held.	It leads to vertical dispersing of the shots.	Attention should be paid to the grip – it should be firm but without putting too much effort.
17.Too much pressure of the shooter's head on the stock comb.	The average hit point is moved upwards (hits at 12 o'clock).	Attention to observance of the concentricity of the aiming devices when aiming.

DISCUSSION

From the shooting mistakes in biathlon presented above (**Table 1**), as a result of incorrectly taken prone shooting positions and their consequences, we have to note that creating special technical rules must always include the ways in which corrections will be made for the elimination of the errors. Practically, all mistakes connected with taking incorrect prone shooting position when firing, are corrected by the placement of different special markers on the shooting mat, and also by using special technical exercises for taking correct shooting position. In the process of eliminating mistakes in taking the prone shooting position, the well-known didactical principles should be followed, presupposing expert knowledge of the subject, and of the concrete element to be trained, professional experience and active participation in creative work on the part of the biathletes.

According to a specialist (5), there are a lot of variants in taking a shooting position with biathletes leading to the achievement of speed of motor actions, the prevention of useless or inaccurate movements, and perfecting the set of actions to the point of automatic performance.

Another researcher shares the opinion that, according to contemporary requirements for fast and accurate shooting, it is essential for a biathlete to master an impeccable shooting technique, including quick aiming at the target (19).

All these details on the optimization of the shooting position in biathlon would lead to improvement of its quality, faster shooting and higher success rate.

CONCLUSION

In the process of the research it was found, that biathletes tend to make individual mistakes, specific for each one of them, when taking the prone shooting position, and that its technical performance is insufficiently mastered.

In case of a big number of errors, their elimination must start from the most frequently occurring main error and then proceed with the elimination of minor ones. In the course of work on eliminating the errors as a result of taking incorrect prone shooting position, it is necessary to widely apply the methods of objective

presentation and evaluation of photo and video materials. They allow the trainer to detect the hidden actions for holding the weapon on target in the appropriate shooting position. In addition, using these methods in data analysis allows for detailed fixing of the temporal structure of the performed actions. The present (Table 1), can be used in the training process, to help coaches and competitors to eliminate mistakes when taking the prone shooting position in biathlon.

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