THE LONG-TERM DEVELOPMENT OF SHOOTING SKILLS IN YOUNG BIATHLETES

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ABSTRACT

This study is a major part of the dissertation research. It is focused on the development of shooting skills in young biathletes in a three-year training period. Specifically, the long-term development of the percentage success rate of prone and standing shooting in both training and races is described in study. It mentions marginally shooting skills such as the postural stability, the stability of aiming and triggering. The first part of our research, completed in 2017, brought findings that the relationship between exercise intensity and the biathlete's postural stability exists, but following part of it, finalized in 2018, did not demonstrate the dependence of exercise intensity on the aiming stability and triggering. Initially, the study involved 23 young biathletes (13 girls, 10 boys). Whole research was completed by 19 biathletes (11 girls: age 17.8±0.64 years; 8 boys: age 17.4±0.72 years) after three years. The results of our current study are based on the records of shooting on metal targets that were created during each biathlon shooting training and all biathlon races of the participants in the three-year period. Only shooting with previous physical load was involved into results, shooting at rest was not included in the study. The results show the improvement of the percentage success rate in both prone and standing shooting in the three-year training period in both girl and boy groups and in both training and races (total percentage success rate = the average of the training and races percentage success rate – girls in prone: 2016/2017: 71.3%, 2017/2018: 75.5%, 2018/2019: 80.0%; girls in standing: 2016/2017: 61.8%, 2017/2018: 67.7%, 2018/2019: 73.4%; boys in prone: 2016/2017: 72.0%, 2017/2018: 72.9%, 2018/2019: 75.3%; boys in standing: 2016/2017: 57.6%, 2017/2018: 63.5%, 2018/2019: 67.7%). Girls are better shooters than boys in this research group. In general, the gradual improvement of percentage success rate in time is expected to occur in young biathletes that are in the intensive training process, but our study brings unique data of concretely values at this age of athletes that has not been known yet. The obtained data could be used by biathlon trainers to compare the current level of shooting skills at a given age of their young athletes. At the same time, a normative standard of biathlon shooting skills in a given age could be created in the case of gathering more data. That is one of the goals of the Czech Biathlon Union.

Keywords: Biathlon training; Shooting analysis; Physical load

Introduction

The biathlon is a very popular winter sport of recent years in the Czech Republic. The number of young athletes has expanded considerably thanks to numerous successes of Czech biathletes in world competitions such as the World Cups or the Olympic Games. Temporarily, it brought problems with the personal and material ensuring of clubs in several last years. Currently, the situation has stabilized. The increasing number of new talents and their maintaining in this sport is one of aims of the Czech biathlon union, an umbrella organization of this sport in Czechia. The way to achieve desired results leads through the long-term systematic training in all categories (from youth to seniors) that is created by experienced and educated trainers.

The learning of biathlon shooting skills is a complex long-term process. It is influenced by many factors. Many researchers dealt with factors such as aiming stability, postural balance, triggering, physical load, etc. The researchers considered all above-mentioned parameters as one of the most important factors in the resulting shooting success (Gallicchio et al., 2018; Haug, 2018; Ihalainen et al., 2018; Laaksonen et al., 2018; Sattlecker et al., 2013; Sattlecker et al., 2015; Sattlecker et al. 2017; Žák et al., 2018). Høydal and Nord (2017) presented the importance of the heart rate monitoring during training and races by junior biathletes. They meant that the heart rate control is one of main predictors of the successful shooting. Gallicchio et al. (2018) showed that physical exercise influences the destabilizing effect of cardiac contraction on shooting accuracy by augmenting it and making it occur earlier with the cardiac cycle. Other studies confirmed the dependence between the intensity of physical load and the athlete's postural balance in the standing shooting position, especially in anterior-posterior axis (Haug, 2018; Ihalainen et al., 2018; Sattlecker et al., 2015; Sattlecker et al., 2017; Vonheim, 2012; Žák et al., 2018). However, no study has confirmed the direct relationship between the intensity of physical load and the shooting success yet (Haug, 2018; Ihalainen et al., 2018; Laaksonen et al., 2018; Mononen et al., 2007; Sattlecker et al., 2015; Sattlecker et al. 2017; Vonheim, 2012; Žák et al., 2018).

This study is the final summary of the dissertation research that has been in progress since 2016. It has been divided into below mentioned parts. The first part of the dissertation research, completed in 2017, showed the influence of the exercise intensity on the biathlete's postural stability (Žák et al., 2018). The following part of the dissertation research was focused on triggering skills in different exercise intensities (Žák et al., 2018). The results of this study demonstrate the level of triggering skills of the participating youth and junior biathletes, but do not demonstrate the dependence of exercise intensity on the aiming stability and triggering.

The aim of this study is to evaluate the percentage shooting success in prone and standing position in the three-year training period of youth and junior biathletes in both training and races. The shooting skills, balance abilities and the development of strength-endurance abilities have been the main components of the training process of participants.

Methods

Experimental approach to the problem

This study is the major part of the extensive dissertation research. It is focused on the development of shooting skills in young biathletes in the three-year training period. Specifically, the long-term development of the percentage success rate of prone and standing shooting in both training and races is described in the study.

Participants

Initially, the study involved 23 young biathletes (13 girls, 10 boys). Whole research was completed by 19 biathletes (11 girls: age 17.8±0.64 years; 8 boys: age 17.4±0.72 years) after three years. All of these participants were included into the national junior biathlon team or into so called the selection of talented athletes in the Czech biathlon system during at least one of three years, so they

presented the high level of national biathlon standards of their categories. They were made aware the study protocol and all important terms at the beginning of whole research and during each partial study too. They confirmed their participation in the research by signing informed consent.

Measurements

The results of our current study are based on the records of shooting on metal targets that were created during each biathlon shooting training and all biathlon races of the participants in the three-year period. Only shooting with previous physical load was involved into results, shooting at rest was not included in the study.

Statistics

All shooting records were written by biathletes and coaches into the shooting diaries in shared Google sheets and were evaluated by the researchers using the statistical functions of this program.

Results

Only shooting with previous physical load was involved into results due to possible distortion of the results provided analysis of data of shooting at rest. The aim of the study is to analyze the shooting skills in situations that closely correspond to the shooting during racing load of biathletes. And in general, biathletes achieve better percentage success rate in shooting at rest. Therefore, shooting results were recorded only after the previous physical load.

The indicator of shooting performance is the percentage shooting success rate of shot down targets in five-shot series (5 shot down targets = 100% shooting success rate, none shot down target = 0% shooting success rate). The results show the improvement of the percentage shooting success rate in both prone and standing shooting in the three-year training period in both girl and boy groups and in both training and races.

The average percentage shooting success rate in prone in the group of girls (n=11) is: in training 2016/2017: 71.9%, 2017/2018: 76.7%, 2018/2019: 81.1%; in races 2016/2017: 68.9%, 2017/2018: 74.3%, 2018/2019: 79.0% (Figure 1.).

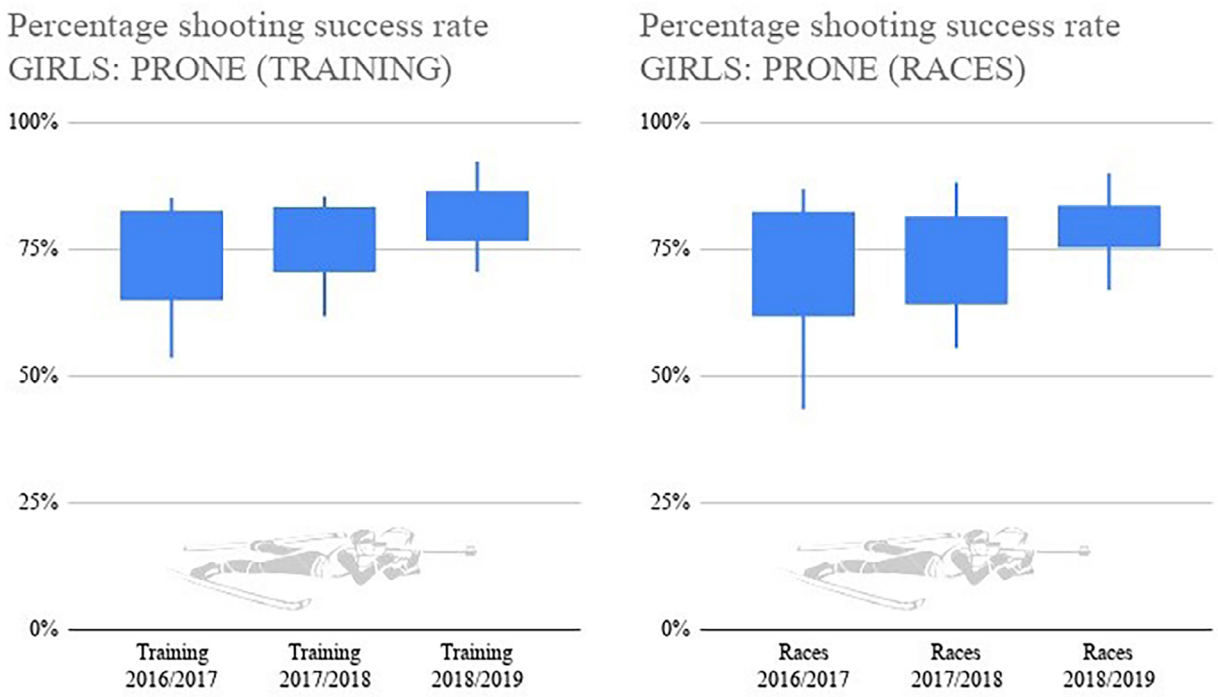

Figure 1 *The percentage shooting success rate in the group of girls (n=11) in both prone in training and races in the three-year period*

The average percentage shooting success rate in standing shooting position in the group of girls (n=11) is: in training 2016/2017: 63.9%, 2017/2018: 70.1%, 2018/2019: 77.3%; in races 2016/2017: 59.1%, 2017/2018: 65.4%, 2018/2019: 69.5% (Figure 2.).

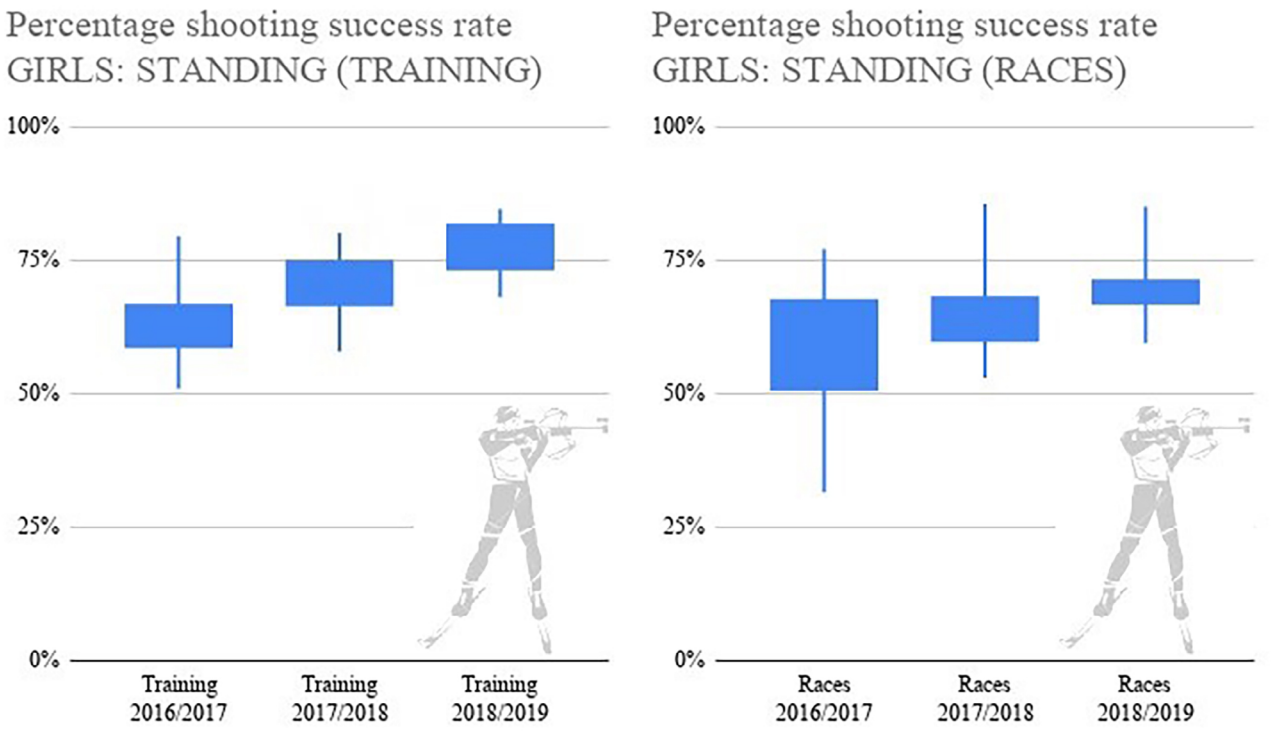

Figure 2 *The percentage shooting success rate in the group of girls (n=11) in standing in both training and races in the three-year period*

The total average percentage shooting success rate in the group of girls (n=11) is: total in prone 2016/2017: 71.3%, 2017/2018: 75.5%, 2018/2019: 80.0%; total in standing 2016/2017: 61.8%, 2017/2018: 67.7%, 2018/2019: 73.4% (Figure 3.).

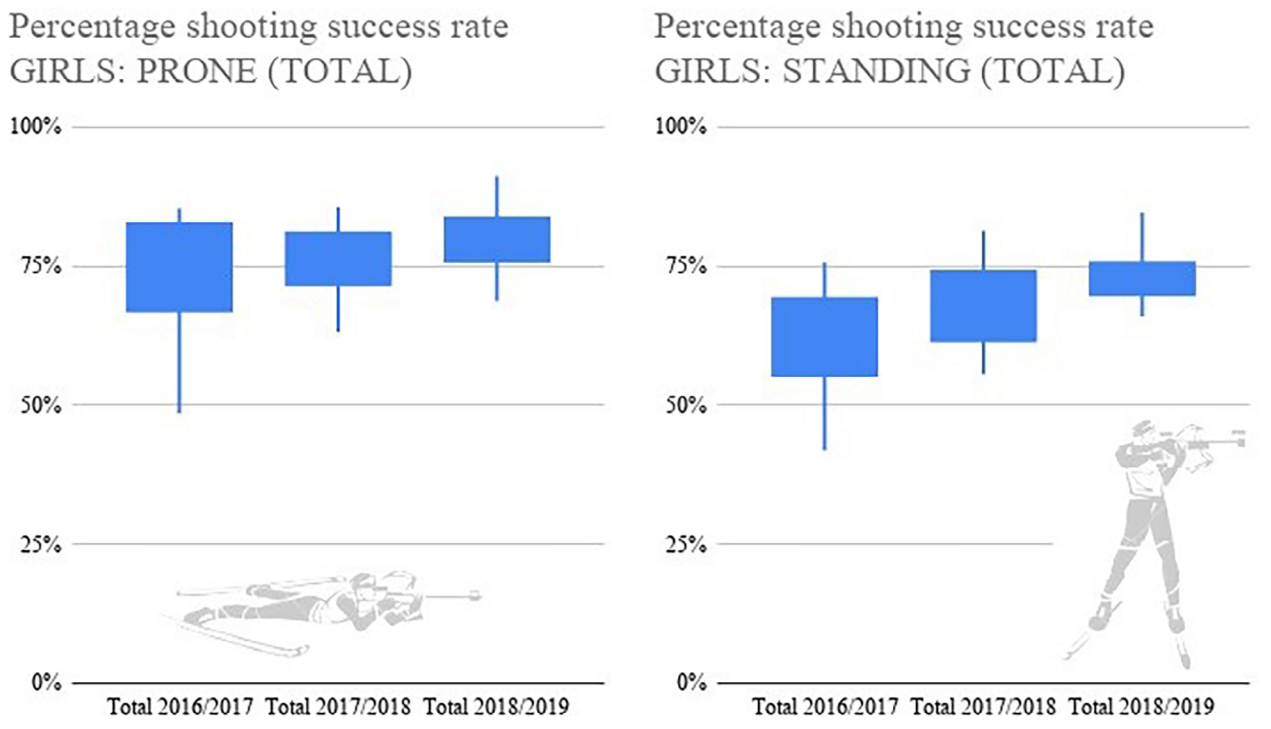

Figure 3 *The total percentage shooting success rate in the group of girls (n=11) in both prone and standing in both training and races in the three-year period*

The average percentage shooting success rate in prone in the group of boys (n=8) is: in training 2016/2017: 73.0%, 2017/2018: 75.1%, 2018/2019: 77.1%; in races 2016/2017: 71.2%, 2017/2018: 70.7%, 2018/2019: 73.6% (Figure 4.).

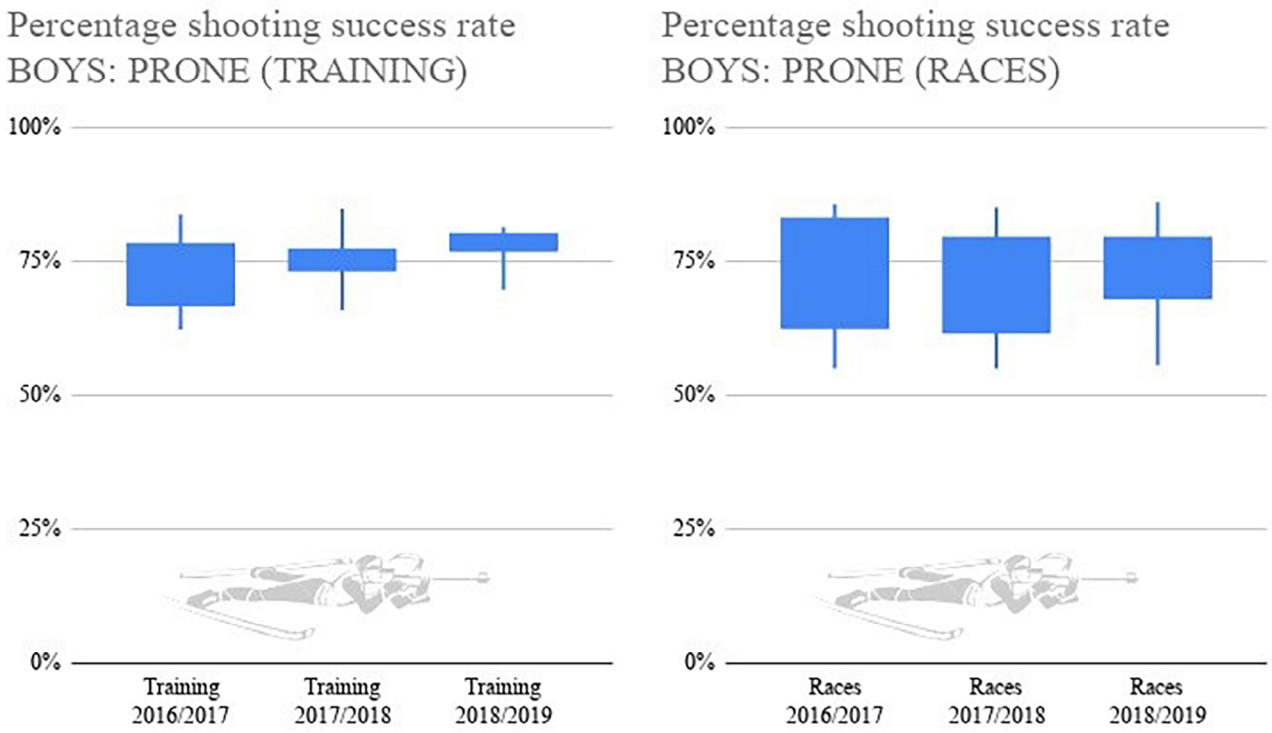

Figure 4 *The percentage shooting success rate in the group of boys (n=8) in both prone in training and races in the three-year period*

The average percentage shooting success rate in standing shooting positon in the group of boys (n=8) is: in training 2016/2017: 58.9%, 2017/2018: 66.3%, 2018/2019: 72.1%; in races 2016/2017: 56.3%, 2017/2018: 60.7%, 2018/2019: 63.3% (Figure 5.).

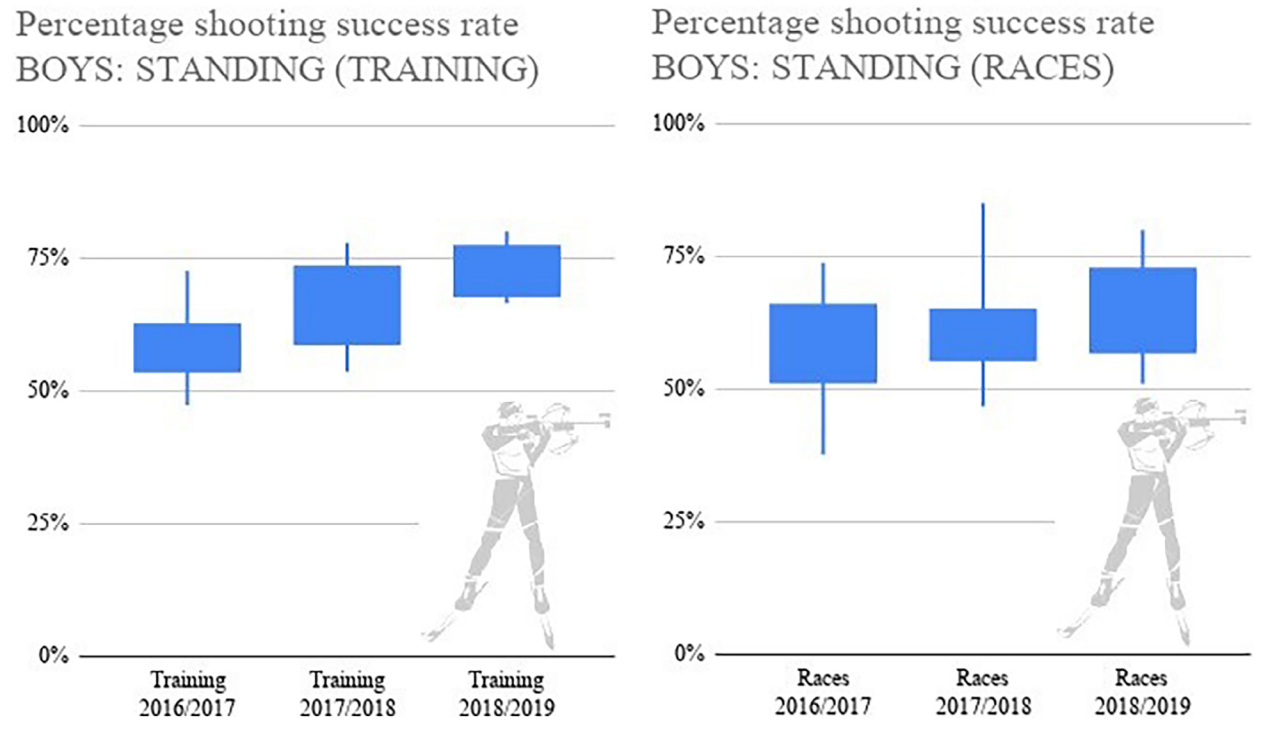

Figure 5 *The percentage shooting success rate in the group of boys (n=8) in standing in both training and races in the three-year period*

The total average percentage shooting success rate in the group of boys (n=8) is: total in prone 2016/2017: 72.0%, 2017/2018: 72.9%, 2018/2019: 75.3%; total in standing 2016/2017: 57.6%, 2017/2018: 63.5%, 2018/2019: 67.7% (Figure 6.).

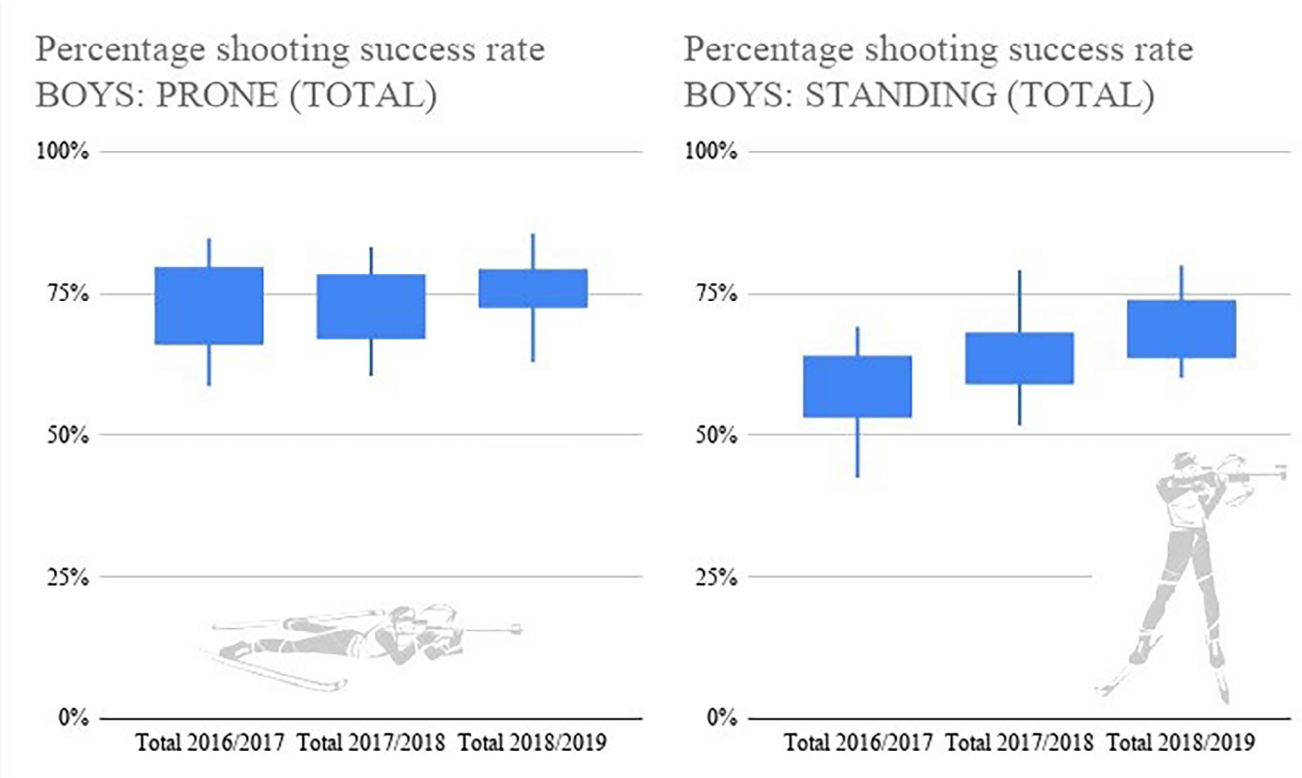

Figure 6 *The total percentage shooting success rate in the group of boys (n=8) in both prone and standing in both training and races in the three-year period*

Discussion

The results demonstrate the year over year improvement in shooting performance in both boy and girl groups in both prone and standing shooting position. The results of shooting performance in training show evident higher success rate than in races it is in both boy and girl groups. It closely corresponds with the real experience with this age category. However, it is necessary to take into account the fact that there is the considerable difference between the number of bullets fired in training and the number of bullets fired in races. Approximately 6000 bullets were fired during training in the appropriate exercise intensities but only about 300 bullets were used in races in the highest exercise intensities during every year of the research.

Furthermore, we must mention the limiting factors of our study. Firstly, a low number of participants (nineteen athletes) can be considered as one of them. This was caused by the strict rules of the selection of the biathletes to the study which we mentioned above. The next limiting factor was the season of the measurement. It was necessary to do it during summer time because the quality of measurement would be negatively influenced by frozen fingers of biathletes and other similar difficulties during winter.

The next important point relates with the fact that all participating biathlete were novices in long rifle shooting in the beginning of the research. Previously, they had been categorized into pupil categories and athletes use the air gun for training and races in these youngest categories. In addition, young biathletes manipulate with the air gun only in prone position. Biathletes start learning to shoot in standing position at the age of 15 and that is often difficult for them. They get good shooting skills in this new position after many months or years of the systematic training. Accordingly, it corresponds with results of our study that the greatest improvement of shooting skills was during the first year of the study on average (Žák et al., 2018).

The goal of youth biathletes and their coaches should be to achieve such the percentage shooting success rate as top biathletes racing in the World Cup. Their percentage shooting success rate is around 90% in both prone and standing shooting position in training. Skattebo and Losnegard (2018) presented in the study the percentage shooting success rate in races of the top ten biathletes in the World Cup at the 2005 to 2015 – on average of 87% in prone and on average 81% in standing shooting position.

In youth and junior categories there is the main objective to stabilize the percentage shooting success rate in training circa 85% in prone and 75% in standing. These percentage success rates are considered as very good in these age categories. The next step of the athlete's development is to transfer these success rates into races. In practice, it usually takes 4 or 5 years to achieve this, but it is very individual. In the study, Sattlecker et al. (2017) showed this age difference in several parameters compared to competitors of the World Cup, European Cup and young federal biathletes.

Among other things, the results show better ability to shoot cleanly in the girl group against the group of participating boys. In the real training process, girls are often able to concentrate better on shooting activities for longer time than boys that can related with above mentioned results. Furthermore, data of the study reveal slight decreasing or stagnation of shooting performance in the group of boys in prone (in both training and races) and in standing (in races) in the second year of research and, at the same time, their second year of learning long rifle shooting. This phenomenon corresponds with researchers' experience (Žák et al., 2018) because biathletes often work very hard and concentrate on all training activities (like so called dry shooting and so on) during the first year of training. However, their effort subsides in the following year. The coach must to intervene intensively in this case and to choose the right form of activation and motivation of his athletes for further shooting training.

Conclusion

In general, the gradual improvement of percentage success rate in time is expected to occur in young biathletes that are in the intensive training process, but our study brings unique data of concretely values at this age of athletes that has not been known yet. The obtained data could be used by biathlon trainers to compare the current level of shooting skills at a given age of their young athletes. At the same time, a normative standard of biathlon shooting skills in a given age could be created in the case of gathering more data. That is one of the goals of the Czech Biathlon Union.

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