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Study on the Effect of Stability of Athletes' Technical Movements on the Performance of Crossbow Shooting in Crossbow Shooting Competitions

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Abstract: As a competitive sport with minority characteristics, crossbow shooting has a long history of development in China's minority regions. Research and analysis of the stability of the technical movements of athletes in crossbow shooting competition on the crossbow shooting competition performance research, for the analysis of minority crossbow shooting techniques, to promote the dissemination of minority crossbow shooting techniques have important positive reference significance. The article analyzes the influence of the stability of athletes' technical movements on their performance in crossbow shooting competitions through mathematical and statistical methods, etc. It is intended to provide a reference for promoting the technical development of crossbow shooting movements and improving the performance of crossbow shooting athletes in competition.
Keywords: Crossbow shooting; Technical movements; Stability; Score

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Preface

Nowadays, more and more people are paying attention to sports events, and television networks are bringing these little-known minority sports to the screen. Crossbow shooting, a classic minority sport, has received a lot of attention from the general public since its broadcast. Improving the stability of technical movements of crossbow shooting athletes under the strict requirements of the game to achieve the purpose of improving the final performance has become the main content of the current study of crossbow shooting sports. The study and analysis of the influence of the stability of athletes' technical movements in crossbow shooting competitions on the performance of crossbow shooting competitions have essential and positive reference significance for improving the crossbow shooting techniques of ethnic minorities and promoting the dissemination of crossbow shooting techniques of ethnic minorities.

1. Research results and analysis

1.1 Crossbow shooting technology-related content

Crossbow shooting techniques are divided into three main areas: crossbow shooting preparation, crossbow shooting posture, and crossbow shooting action[1].

1.1.1 Crossbow shooting preparation

Crossbow shooting preparation refers to the preparation action before the athlete shoots, mainly pulling the string and setting the arrow. It requires the athlete to place the crossbow in front of the body, bend the knees, and half squat or sit on the bench, step on the crossbow piece with both feet and then hold the middle of the crossbow string with both hands and pull the string into the socket. To place the arrow, pick up the crossbow with both hands and hold it horizontally directly in the front, holding the lower part of the crossbow body with one hand and placing the arrow in the crossbow slot with the other[2].

1.1.2 Crossbow shooting posture

Crossbow shooting posture is mainly divided into stance and kneeling posture. Stance: The athlete is required to have both feet on the ground, standing left and right with shoulder width, holding the lower part of the crossbow with one hand and controlling the trigger with the other hand, with the arm hanging in the air and the crossbow not touching the athlete's body or other related parts. Kneeling position: The athlete's toes of one foot, knee, and the palm of the other foot are on the ground to form triangle support, holding the crossbow with the same grip as the standing position, one elbow can be placed above the knee, and the body of the crossbow is not required to be in direct or indirect contact with the athlete's body[3].

1.1.3 Crossbow shooting action

Crossbow shooting is one of the most important aspects of the sport of crossbow shooting. It mainly consists of three elements:

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crossbow shooting, aiming, and shooting, which is closely related and affects each other.

(1) According to crossbow action

It is the basis of technical movements and is a prerequisite for accurate shooting. The athlete is generally required to hold the lower middle part of the crossbow body with the left hand forward, the left elbow inward, the right hand holding the crossbow neck, and the first joint of the index finger gently resting on the trigger. The crossbow should be kept parallel to the ground and at the same height as the shoulder. At the same time, both hands should be coordinated to keep the crossbow balanced and stable.

(2) Aiming action

It is an important part of the crossbow shooting action and must be aimed correctly regardless of the position used. When aiming, the athlete should concentrate mainly on the level relationship between the collimator and the gap. At the same time, the athlete can close the left eye and aim with the right eye, or the athlete can aim with both eyes open. Aiming with both eyes open can reduce visual fatigue and is beneficial to shooting. When aiming, the athlete should hold his breath, and the breath should not be held for too long, generally not more than 30 seconds is good.

(3) Shooting action

Shooting is a key part of the crossbow shooting action. The correct shooting action is for the athlete to press back on the trigger with the first knuckle of the right hand evenly and squarely, with the rest of the fingers relaxed and with the same force. The correct grip position is the first knuckle of the index finger that can be easily pressed on the trigger. The force of the index finger is the most important action of the trigger. The requirement of force is even force, not sudden force when pulling the trigger, but a soft and even force

2. A before-and-after reference to experimental data on crossbow shooting technology

Table 1 Comparison of the results of shooting five arrows before the experiment between the experimental group and the control group

Comparison of the number of individuals shooting five arrows with the average score of ten training sessions (rings)										
Mean number of rings	40	41	42	43	44	45	46	47	48	49
Experimental group (person, n=30)	8	2	5	4	3	2	2	2	1	1
Control group (person, n=30)	9	4	6	4	2	2	2	1	1	0

By the selected experimental group and the control group, each group of 30 athletes. Before the experiment, it is known that the average score of people in the experimental group is 42.7 rings, and the average score of people in the control group is also 42.6 rings. The average score of training of athletes in both groups is comparable.

2.1 A study of the effect of understanding the concepts related to crossbow shooting techniques on crossbow shooting performance

During crossbow shooting drills, coaches demonstrate the technique. At the same time, by observing the technical movements of the crossbow shooter and providing careful instruction, the student builds a concept of the crossbow shooting technique. After the students understand the concepts, they are allowed to practice on their own. For the control group, the coach explained and demonstrated the movements and let the athletes imitate the exercises without emphasizing the concepts related to the crossbow shooting technique. After one week, the results of the two groups were as follows.

Table 2 Effect of knowledge of concepts related to crossbow shooting technique on performance

Mean score of ten training sessions for the individual shooting of five arrows (rings)										
Mean number of rings	40	41	42	43	44	45	46	47	48	49
Experimental group (person, n=30)	2	2	3	2	6	5	4	2	2	1
Control group (person, n=30)	6	8	2	12	1	1	0	0	0	0

The above table shows that the athletes in the experimental group had an accurate personal understanding of the concepts related to the crossbow shooting technique with an in-depth understanding of the concepts related to the crossbow shooting technique. In terms of training performance, they also improved significantly with a per capita score of 44 rings, but not as significant as the athletes in the experimental group. This result strongly suggests that first establishing the concepts related to the technical movements of crossbow shooting athletes has an essential role in improving the athletic performance of crossbow shooting athletes.

2.2 According to the study of the effect of crossbow technique stability exercises on crossbow shooting performance

Crossbow relying, as the foundation of crossbow shooting technique, has an important impact on improving crossbow shooting performance. From the stand crossbow relying exercise and the kneeling crossbow relying exercise, the experimental group instructors require the movement to have the feet apart, as wide as the shoulders, in a standing position, with the left hand reaching forward to hold the lower middle of the crossbow bed, the left elbow inward, the right hand holding the crossbow neck, the first joint of the index finger resting on the trigger, and the crossbow to be horizontal, as high as the shoulders. Through practice, after one week of training, the athletes in the experimental and control groups mastered the crossbow shooting crossbow relying technical movements as follows[4].

Table 3 Analysis of the mastery of standing crossbow relying and kneeling crossbow relying in the experimental and control groups

	Stand crossbow relying	Kneeling crossbow relying

	Good	Average	Poor	Good	Average	Poor
Experimental group (people, n=30)	20	8	2	22	7	1
Control group (people, n=30)	12	9	8	19	6	5

According to the analysis of the data in the table, in the experimental group, the mastery of standing crossbow relying and kneeling crossbow relying was relatively good. In the control group, the mastery of standing crossbow relying and kneeling crossbow relying was worse than that of the athletes in the experimental group. There were athletes in the control group who had poorer mastery in standing crossbow relying and kneeling crossbow relying.

At the same time, the study analyzed the effect of crossbow relying technique stability on performance as follows:

Table 4 Effect of crossbow relying technique stability on the performance of the experimental and control groups

Mean score of ten training sessions for individual shooting five arrows (rings)										
Mean number of rings	40	41	42	43	44	45	46	47	48	49
Experimental group (person, n=30)	1	3	2	1	8	9	1	2	3	0
Control group (person, n=30)	5	6	8	9	1	1	0	0	0	0

By analyzing the above table, we can see that in the experimental group, the average score of the athletes who went through the crossbow relying technique stability training was 44.9 rings, while the average score of the control group was only 41.1 rings, and the score of the control group was much lower than that of the experimental group. It can be seen that the more consistent the crossbow shooting athlete's crossbow relying technique is, the better the crossbow shooting training performance.

2.3 Study on the effect of aiming stability exercises on crossbow shooting performance

As an important part of crossbow shooting, aiming plays a key role. Two main forms of training are taken in aiming training: The first is the close-range aiming training. The second is to practice through the four-point aiming method. The four-point aiming method mainly refers to: placing the crossbow on a dependency, requiring the height of the dependency to be the same as the crossbow shooting position is taken. Through the analysis of the above two forms of aiming, the athletes in the experimental group can practice through close range aiming training and four-point aiming training, while the control group adopts the traditional training form, and after one week of training in both groups, with 30 mm as the base point requirement, the aiming base points of the two groups are recorded as follows:

Table 5 Analysis of targeting bases for the experimental and control groups

Range	1-4 mm	4-30 mm	Over 30 mm
Experimental group (people, n=30)	18	8	4
Control group (people, n=30)	6	16	8

Analysis of the data in the table shows that the experimental group aimed within 30 mm of the base point and aimed within a more precise base point range. In the control group, the athletes had a larger range of aiming bases, with the vast majority of athletes in the middle range, fewer people in the precise range, and athletes who were beyond the 30 mm base point. The experimental comparison shows that the experimental group using close-range aiming training and four-point aiming training is more stable in their aiming technique than the control group not trained with these two training methods.

The analysis of the study on the effect of targeting stability on performance is as follows:

Table 6 The effect of targeting stability on performance in the experimental and control groups

Mean score of ten training sessions for individual shooting five arrows (rings)										
Mean number of rings	40	41	42	43	44	45	46	47	48	49
Experimental group (person, n=30)	2	1	3	4	9	4	3	2	2	0
Control group (person, n=30)	8	6	8	5	1	1	1	0	0	0

By comparing the results of the aimability training, it was found that the average score of the experimental group shooting five arrows after participating in the aimability training was 45.9 rings, while the average score of the control group athletes who did not participate in the aimability training was 42.6 rings. The athletes in the experimental group with higher aiming stability shot five arrows with a much higher average score than the control group. The more accurate the aiming, the stronger the aiming stability, the better the athletes' crossbow shooting performance.

3. Conclusion

Crossbow shooting as a traditional national sport, its idea of competition and communication deserves to be passed on to modern people. In the sport of crossbow shooting, the more stability the athletes' technical movements, the better their crossbow shooting competition results.

To guarantee the stability of crossbow shooting technical movements, it is first necessary to have a deep grasp of the concepts and requirements related to crossbow shooting. To improve the stability of the technical movements of the crossbow shooting athlete, a thorough analysis of the crossbow shooting movement is needed to understand that the crossbow shooting movement is the most important aspect of the sport of crossbow shooting. The correctness and stability of crossbow shooting technical movements are

related to the hit rate of the arrow shot.

Crossbow shooting mainly consists of three elements: crossbow relying, aiming, and shooting, which is interrelated and affect each other. Only by training the stability of crossbow relying, aiming, and shooting can we improve the stability of the athletes' techniques in the crossbow shooting competition so that we can efficiently improve the stability of our bodies and movements and improve the performance of crossbow shooting.

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