

Original Article

Indicators of special training of highly skilled archers in pre mesocycle

YURIY BRISKIN¹, MARYAN PITYN², SERGEY ANTONOV³
^{1,2,3} Lviv State University of Physical Culture, Lviv, Ukraine

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Abstract

The paper summarizes the scientific research data on specific training of athletes in archery. It investigates the training loads of Ukrainian highly skilled archers in pre mesocycle. Installed speaker training loads highly archers with bows in front of Ukraine's before competitive mesocycle. The research paper studies the effectiveness of the control exercises with more complex performance.

Key words: Highly skilled archers, archery, control of training.

Introduction.

Archery with the structure of competitive and training activity is related to the group of sports with difficult coordination. Therefore technical training plays an important role in the training structure of archers [2].

The training in archery is implemented by achieving the maximum of metrically measured result. This requires perfect training of motor skill (for shot) and its implementation in competitions with the highest level of individual abilities of athletes [9].

Also, the recent achievements of Ukrainian athletes and changes of rules in competitions increase the importance of knowledge about special training dynamics of highly-qualified archers [12].

The aim of the study is to identify the special training indices of highly-qualified archers.

1. To identify research areas of special training of archers.
2. To identify the training loads dynamics of highly-qualified archers in the pre mesocycle.
3. To define the effectiveness of highly-qualified archers during control exercises with complicated performance.

Methods. Theoretical analysis and synthesis, the documentary method, pedagogic observation, methods of mathematical statistics.

Results and discussion. Technical training of athletes plays the leading role in realization of the main tasks in the competitive type of sport and in achieving results [6, 8, 15].

In general theory of athletes' training special physical preparation is considered to be the factor which provides for effective technique. However, the improvement of special physical training doesn't lead to the improvement of technical skills. It only arranges conditions for their effective formation.

Some scientific investigations have identified anatomico-topographical division of shots on phases [6]. The effectiveness of exercises for development of physical qualities has been proved [18]. The environmental conditions, as a method to improve sportsmanship of highly-qualified archers have been designed [7].

In archery the level of force abilities, which show the athletes' worth, is not limited. The force which athletes apply while stretching the bow accounts for 16-35 kg, which is not required to be further increased. Besides, the improvement of technological progress as for bows and arrows led to the significant decrease in the importance of training of force abilities. Among special physical qualities the preference, with optimal development of force abilities, should be given to coordination (keeping of pose, evaluation of dynamic and space-time parameters of motion, coordination of movements, etc.) [9]. However, the ways of improving technical training of athletes when achieving the highest level of physical qualities hasn't been identified [4;13].

It should be mentioned that the result of the shot in archery is closely connected to the correct technique of its performance [3; 9]. Taking into consideration the peculiarities of competitive archery, it should be mentioned that in the structure of technique effectiveness in archery, the first place is given to stability and efficiency, and the second one to variance and minimal tactile information value for the competitor.

The main tasks necessary for the technical training of sportsmen in archery include the achievement of high stability and reasonable variance of special moves; transformation of the effective moves during training into competitive efficiency; an increase of safety and efficiency of sportsmen's technical actions under severe competitive conditions [9; 14].

Methodological sources [7; 9; 10 etc.] give an overview of several ways to solve the problem of how to improve technical skills. These are competitive exercises, special preparatory and additional exercises, training equipment.

Yermakov S. S. proves the effectiveness of using individual computer models of biomechanical parameters of athletic exercises as well as the creation of new training equipment. All these will not require an increase in the amount of special load [8].

An effective indicator of sportsmen's special training is the performance of main exercises with more complex moves. We should also mention here the complication and an increase in different variants of initial, intermediate and final positions, and preparatory moves; limitation or expansion of the space for performing exercises; limitation of time for exercises; complication of conditions for spatial and time orientation; performance of exercises under condition which are different than standard [9; 13].

Archer's skills are determined mostly not by the development of the processes of energy exchange, functional abilities of cardiovascular and respiratory systems, but by the technical training of the organism, its tactical abilities and psychological qualities [1; 2; 8]. That's why actualization and completion of scientific knowledge about special training of highly-qualified archers becomes very important.

Due to this, special pedagogic observation, based on the indicators of the special training of highly-skilled archers, has been held. It has been conducted in Kyiv during the training meeting of the sportsmen from the Ukrainian national team in archery, and lasted from the 27th of February till the 12th of March, 2010. In the observation 16 sportsmen from the first team and young team has been involved. Four of them were Honored Masters of Sport of Ukraine, seven – Masters of Sport of International level and five – Masters of Sport of Ukraine. The purpose of the training meeting was to prepare sportsmen for the European Championship in Porech, Croatia. Special training of sportsmen was carried out in mesocycle prior to competitions. Mesocycle included three mikrocycles (two training and one for recovery). The duration of first two mikrocycles was 5 days (four training days and one day for recovery), and of the third one – one training day. It should be noted, that during the training meeting the loads for "winter distance" were expected to be 18 m. Due to the external circumstances, the sportsmen had different number of training days. It was connected with their level of health, injuries, arrival and departure to the place of training camp. However, the sportsmen spent from 6 to 9 training days at training meeting (except the days for recovery).

The main indicator of the special training loads in archery [20; 21] is assumed to be the number of shots performed during the certain interval of time (training lesson, day, mikro-, mesocycle). Taking into account the specific character of the training meeting, the dynamics of the number of training shots has been analyzed (fig. 1). The period from 10th to 12th of March was transitional to the competitions.

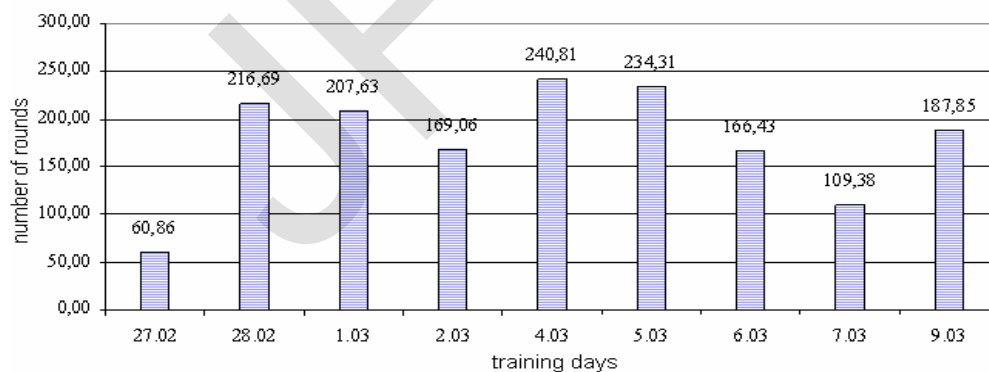


Fig. 1. Changes in the average number of shots made by highly-skilled archers in premesocycle (n = 16).

Summarizing the data for the period of training camp, it can be concluded, that the planning of pre mesocycle loads was carried out with taking into account the concrete period of the competition. Thus, in the first and second microcycles (Fig. 1) we can see two-day "peaks" in the increase of loads. However, in the end of the first microcycle the reduction of loads was considerably less than in the second one. So, it can be stated, that the cumulative effect [11, 20], as a result of training impact in the training camp, and an increase in preparation of athletes has been focused on the time of the competitions during the European Championship. This can be proved by the results of athletes who have won 6 medals of different quality (2 golden, 2 silver, 2 bronze). Ukrainian national team has won medals in all kinds of programs which were presented in European Championship.

It must be noted, that the indicator of training loads has been increasing from the beginning till the end of training camp. In the first microcycle the average amount of shots in the tested group of athletes accounted for 646 shots. In the second microcycle this amount increased to 675 shots. This shows the gradual increase in loads and adaptation processes in the organisms of highly skilled archers [11; 20]. We have not specified the number

of shots in the third microcycle of this mesocycle, because it accounted for only one training day. However, making recounting of the number of shots, the total amount of training loads in the third microcycle could account for 750 shots. Such amounts of training loads in this microcycle is natural [11], because few days later the athletes had to participate in the final major winter competitions with 18-metre distance.

Analyzing the summarized data in the structural formations of the pre mesocycle, we came to conclusion that the loads in training camp gradually increased. It was also assumed that highly skilled archers show the tendency to increase special training loads in accordance with their qualification. In the first case it was sufficiently justified [11, 20, 21] and in the second one - an additional study of data was conducted.

Summarized information from the sportsmen's journals allowed us to make assumption about the differences in quantitative indicators of shots made by athletes in various structural groups of training camp. For this purpose the analysis of connections between training loads in different structural formations of the training process and sportsmen's qualification in the pre mesocycle was made (Table 1). The relation between the number of shots performed in the first microcycle, an average number of shots per day (during the training camp) and the level of athletes' skills has been identified.

Table 1. Relations between qualification of athletes and the amount of training loads in the structural formations of the pre mesocycle.

№	Index	Qualification
1	Number of shots in the first microcycle	0.63
2	Number of shots in the second microcycle	0.37
3	Number of shots in the three microcycle	0.12
4	Number of shots in the mesocycle before the competition	0.39
5	Average number of shots per day	0.57

The received data give the ground to assert that the sportsmen with the level "Master of Sport" and higher levels have directly proportional relation to the average number of shots per training day throughout the whole pre mesocycle. However, the value of the correlation coefficient in microcycles decreases from the first mikrocycle to the third one. In the first and second cases the connection between these parameters is indicated. This may be related to athletes' exercising. Less skilled athletes spend more time to reach the highest level of training if compared to more skilled sportsmen [3]. That's why in the training camp they maintained higher training loads in the second microcycle.

One of the areas of pedagogic observation was the analysis of the bow tensile force of the skilled archers. Analyzing the obtained data we defined that the average tensile force of bow for the male athletes of the main national team of Ukraine, including M. Ivashko, J. Mokrinskaya, A.V. Ruban, V. Havtura, accounted for $20,9 \pm 0,52$ kg., and for the female athletes of the national team, including Dorokhova T., Koval V., Milchenko N., Paleha K. - $17,0 \pm 0,64$ kg. For the athletes who are less qualified than the national team, but who are the members of the youth national team of Ukraine, bow tensile force accounted for $19,3 \pm 0,42$ kg for men (Zhydetsky Z., Ivanitsky G., Marchenko E., Skachok O.) and $15,75 \pm 0,50$ kg for women (Halyanova S., Gogol S., Kurylak M., Sichenikova L.). Thus, it can be stated that the bow tensile force depend on gender and age of athletes. It is quite predictable. Gender peculiarities of the bow tensile force are specified primarily by distances [10] determined in the competitions among men and women. Thus, for men the maximum distance is 90 meters and for women - 70 meters. Moreover, the influence on these parameters is caused by sexual peculiarities of athletes' organism (the amount of testosterone, muscle diameter, etc.).

Taking into consideration that the athletes of different qualification (from MS to HMS) participated in the training camp we grouped indices of bow tensile force according to the level of qualification. It has been identified, that the average bow tensile force for the Honored Masters of Sport accounts for $19,5 \pm 1,9$ kg, for masters of sports of international class - $18,3 \pm 1,84$ kg, and for masters of sports of Ukraine - $17,2 \pm 1,65$ kg. It should be noted that in this case the qualification was taken into account, not gender. So, we can observe an increase of this index from Master of Sport to the Honored Master of Sport.

In order to obtain more valid data, we have defined the correlation between the bow tensile force and the sportsmen's qualification, taking into account their sex. It has been identified, that for the female athletes with bow tensile force from 14.9 to 18.0 kg the level of correlation is $r = 0,71$, and for the male athletes (18,8-21,6 kg) - $r = 0,82$. This indicates that both men and women, who are the members of the national teams of Ukraine, have an increase in force for stretching the bow together with an increase in the level of qualification. However, it should be noted, that these changes are not significant when we take into account the previously mentioned data, and they are varying up to 1,5 kg.

In the training camp for the Ukrainian national teams in archery an investigation of the highly skilled sportsmen's sense of bow force has been conducted. Sportsmen were supposed to perform ten attempts in which they had to show the force of stretching their own bow. We have recorded the attempts which reflected

undervaluation and overvaluation of the sense of force in stretching bow. Rather low level of miscalculations (without taking into account orientation) has been defined for the total number of errors (out of ten attempts) made by athletes involved in the investigation. It accounted for 6.89 kg with an average value in one attempt - from 0.22 to 2.09 kg. It must be noted, that the average number of overestimated force in stretching the bow accounted for 5.12, and underestimated force - 3.93. In the investigation the athletes got into the "corridor" from -0.5 to 0.5 kg of the "force" of their own bow nearly 5.31 times, and at the same time 0.94 times they accurately reproduced the force of their own bow.

Thus, it can be concluded, that for highly skilled athletes the typical features are overestimation of force in stretching the bow and a high level of finding oneself in the "corridor" (from 0.5 to -0.5 kg) of reproducing the force of one's bow.

At the same time, the obtained data revealed that there's no relations between the result of the sense of the bow force in each attempt, general rate of errors (the sum of ten attempts), an average error, number of underestimation and overestimation of muscle force and the number of accurate reproduction of forces showed by athletes with qualification ($r =$ from -0.28 to 0.27). This indicates that athletes with higher qualification retain a sense of muscle force, which they associate with the "force" of their bow.

The received data prove the experts' opinion [12, 13, 21] as for the available resources in the system of archers' training while achieving the highest level of force, which, in its turn, provides for the improvement of technical skills by using directed development of coordination skills.

The obtained quantitative data can supplement the model indicators of the training level for less skilled archers.

One of the areas of the special training is the level of achieving variable skill. This can be controlled by using more complex exercises, which also forms other aspects of archers' special training.

Among the ways of complicating exercises in archers' technical training we should single out [11, 13, 21 etc.] complication and an increase in variants of initial, intermediate and final postures, preparatory actions, restrictions or expansion of space, limitation of time for performing exercises; complicated conditions for orientation in space and time, performance of exercises under the conditions other than standard.

Within the training camp pedagogic observation has been conducted by monitoring the effectiveness of athletes in competitive exercises with difficult conditions of performance. The analysis of methodological literature allowed us to suggest the use of the main exercise "shooting from 18 meters" in the pedagogic observation. More complex conditions of the exercise included three variants of its performance: sitting on a chair, standing on the moving platform, and with closed eyes [4, 7, 12].

Thus, the first starting position of athletes was modified - they performed shots by sitting on a chair. This version of the shot required the athletes to redistribute their muscle force while shooting, which is determined by exclusion and the limited use of individual groups of muscles (lower extremities, lower part of body, etc.) [12, 13, 14]. Sportsmen were offered to perform 16 attempts (two times per eight shots).

In the second version athletes were asked to perform shots from the special moving platforms. This variant of the basic exercise presupposed to perform the shot with the stable position of the body. The main component of this variant was to keep the balance which could be lost due to extra muscle contractions when the shot was performed in a wrong way, redistribution of force, etc. [10, 12]. Sportsmen were offered to perform 16 attempts (twice per eight shots).

In the third variants of the basic exercise, athletes had to perform the final phase of shot with the closed eyes. This option excluded the influence of the previous two complicating factors (sitting on a chair and the moving platform). The main thing in this exercise was athletes' targeting and compliance with a space-time parameters and shot rhythm, and intermuscular coordination [1, 4]. Sportsmen were offered 30 attempts (five times per six shots).

Thus, the set of all exercises with complicated conditions for performing the shot allowed us to determine the ability of highly skilled archers to manage time, space and force parameters of movement, keep balance, rhythm, orientation in space, arbitrary relax muscles, all of which is included into the special training [4; 14].

In order to obtain an objective evaluation, an index of the "average arrow" – the ratio between the scores and the number of shots – has been selected as the criterion of the effectiveness of highly skilled athletes in the control exercises with more complex conditions (Table 2).

Table 2. Average scores of highly skilled archers in more complex exercises.

	Variant of exercise	Number of shots	Average index of accuracy ("average arrow")	n
1	Sitting on chairs	16	9,20±0,33	16
2	Standing on the platform	16	9,26±0,32	16
3	Eyes closed	30	7,50±0,66	14

The analysis of the reliability of results according to the t-criterion indicated that there's no significant differences between the results of athletes while performing exercises "sitting on a chair" and "standing on the platform" ($p \geq 0,05$), and that there are significant differences between the results of the two variants of exercises "sitting on a chair", "standing on the platform" and the exercise "with closed eyes" ($p \leq 0,05$). We think that in the first case it is expected and caused by high results in this exercise. After all, both variants of exercises "sitting on a chair", and "standing on the platform" remain constant visual control of the shots, in spite of unstable conditions or altered functioning of the system "archer - bow"[3, 9, 11, 13]. In the second case, despite the stability of the system "archer - bow", the visual control is limited. It means that the main action the athletes had to perform only with proprioceptive senses, which significantly reduced the effectiveness of the exercise.

In order to identify the opportunities to use these variants of exercises in technical training of athletes with different level of qualification, we have also conducted the correlation analysis of the results of exercises with more complex performance, qualifications, gender of athletes, and their bow tension force (Table 3).

Table 3. Relation between the results of highly skilled archers in control exercises with more complex performance (n = 16).

Indicators	x	1	2	3* (n=14)	4	5	6
The result in the exercise "Sitting on chairs"	1	X	0.53	0.54	0.47	0.57	0.27
The result in the exercise "Standing on the platform"	2		X	0.23	0.58	0.46	0.45
The result in the exercise "With closed eyes"	3*			X	0.24	0.69	0.06
Bow tension force	4				X	0.41	0.89
Qualification	5					X	0.08
Sex	6						X

Thus, the analysis of the amount of training loads and the results of the Ukrainian leading sportsmen in the proposed exercises with more complex performance ("Standing on the platform", "Sitting on a chair", and "With closed eyes") gave an opportunity to identify the parameters of special training and to offer their introduction into the training process of less skilled athletes.

Conclusions. In the training of archers several questions remain unsolved. These are the investigation of typical qualification mistakes, the creation of technical training programs for athletes, taking into consideration their level of qualification, training, etc.

The highly skilled athletes from the national team of Ukraine show the tendency to increase special training loads with an increase in their qualification level.

An increase in the qualification level causes an increase in bow tensile force both for women ($r = 0,71$) and men ($r = 0,82$).

Highly skilled archers show higher overestimation of bow force (5.12 times) if compared to underestimation (3.93 times). And getting into the "corridor" (5.31 times) with 0.94 times of accurate reproduction of the bow force is also significant here. Highly skilled athletes with the increasing level of skills retain the sense of muscle force, which they associate with the "force" of their bow.

The special training level of archers appears in the results of competitive exercises with more complex performance: sitting on a chair, standing on the moving platform, and with the closed eyes.

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