

Dynamic of kayak rowing technique in the process of competition activity

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Abstract

Purpose: To study the dynamic of kayak rowing technique in the process of competition activity and influence of special physical qualities on technique of athletes' movements.

Material: in the research 17 elite athletes participated.

Results: it was found that with boat speed the values of maximal and average efforts, applied by athlete to oar; duration of efforts; the moment of torso turn start in respect to water catching and in the moment of stroke fulfillment confidently and steadily correlate. The studies showed that power of stroke plays decisive role for speed sustaining at the beginning and in the middle of distance. By the end of distance the significance of indicators, characterizing effectiveness of athletes' movements; boat motion during strike; duration of efforts noticeably grow.

Conclusions: dynamic of rowing technique is pre-conditioned by re-constructions of system of movements at different levels of its organization and control. Constant and substantial varying of contribution of movements system's secondary elements conditions stability and effectiveness of movements' biomechanical characteristics and workability indicators.

Keywords: Kayak, technique of movements, bio-mechanic, power, workability.

Introduction

One of promising directions of elite training process's intensification is usage of individualization principles in control over trainings. Individualization determines effectiveness of adaptation mechanisms usage and possibility of functional potential's maximal realization in conditions of competition activity [18]. Sport result at elite level is conditioned by combination of numerous factors. It requires searching of individual conditions for optimization of different organism systems' functioning with reaching extreme workability of athletes [4, 14, 27]. Competition functioning in cyclic kinds of sports is not a homogenous process. It implies solution of multiple tasks, the sum of which gives idea about final results [22, 26]. Most of scientists conventionally mark out start, distance and finish segments [1, 21, 24, 25]. Recent years experimental pre-conditions for more detail dividing of competition distance, considering specificity of a kind of sports, have been created [3, 10, 13]. The task of competition functioning structure's optimization implies improvement of separate components' fulfillment. Besides, it is necessary to seek the most effective variants of qualitative and quantitative interconnection of different sides of athletes' special fitness. In this case it is necessary to consider individual features of athletes [5, 19, 28]. Effectiveness of the mentioned elements can significantly influence on final sport result [8, 16, 20].

Competition functioning of elite athletes is regarded as significant factor of pedagogic and physical impact. This factor is characterized by extreme character of conditions, in which different sides of special physical fitness are demonstrated. Besides, competition activity is an effective mean of maximal realization of athletes' functional potentials [2, 6, 12, 17]. Optimization of control over training process implies solution of a number

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of theoretical and practical questions, connected with methodic means of improvement of athletes' motor abilities' effectiveness [7, 9, 11, 30]. Besides, working out of bio-mechanical pre-conditions of competition functioning structure's optimization, becomes very important [15, 29].

The purpose of the work is to study the dynamic of kayak rowing technique in the process of competition activity and influence of special physical qualities on technique of athletes' movements.

Material and methods

Participants: in the research 17 elite athletes (members of kayak rowing combined team of Ukraine) participated.

Organization of the research:

Special aspects of athletes' movements' coordination structure were studied in natural experiment, simulating competition functioning (500 meters' distance). Dynamic of kinematic and dynamic characteristics was analyzed as well as bio-electrical activity of arms', chest, back and abdomen muscles. We registered amplitude and frequency of bio-potentials' oscillations; rhythm structure of bio-electrical activity; integrated bio-electrical activity of muscles in absolute and relative units. Besides, we calculated effectiveness and motor efficiency indicators. Besides, we determined variability of the tested motor characteristics. Control of rowing speed was realized with the help of electronic leader of speed [23].

Statistical analysis: we calculated the following: mean values of indicators and their errors ($X \pm m$); difference between mean values and confidence of these differences (t , p). Besides, we found the value of dispersion (variant around average - σ , CV). Correlations between the studied indicators were also determined (r).

The researches, in which athletes participated, were conducted in compliance with Ukrainian health

protection legislation, Helsinki declaration 2000 and directive №86/609 of European community on people's participation in medical-biological researches.

Results

The received data witness about presence of substantial changes in dynamic and character of correlations between movements' structure indicators on competition distance. The longer segment of distance is passed the higher is the value of functional changes in athletes' organisms. Besides, athletes' power, motor efficiency and effectiveness of athletes' efforts reduce. We found dependences of distance length and relative contribution of some rowing technique's bio-mechanical characteristics in formation of resulting motor effect.

Indicators, which confidently correlate with boat speed at the beginning of distance, were also found. Specific weight of such indicators noticeably reduces with distance passing. But the role of other indicators in sustaining of workability substantially increases. When passing distance the following indicators confidently and steadily correlate with boat speed: maximal and average forces, applied by athletes to oar ($r=0.87$; $p<0.05$); Duration of efforts' sustaining ($r=0.67$; $p<0.05$); The moment of torso turning start in respect to water catching ($r=0.76$; $p<0.05$); Speed of torso turn at the moment of water catching and in stroke fulfillment ($r=0.79$; $p<0.05$).

Indicators of confident correlations with boat speed on all distance are: power of stroke and in rowing cycle ($r=0.79$; $p<0.05$); time of force application in stroke ($r=0.73$; $p<0.05$); boat's movement in stroke period ($r=0.81$; $p<0.05$). Our study also showed that stroke power plays decisive role for sustaining speed at the beginning and in the middle of distance. By the end of distance the role of the following indicators increases: motor effectiveness of athletes ($r=0.74$; $p<0.05$); boat's movement during stroke ($r=0.69$; $p<0.05$); time of forces application ($r=0.78$; $p<0.05$).

There is noticeable tendency to re-distribution of muscular activity indicators in the process of distance passing by athletes. Passing of the beginning of distance is characterized by maximal usage of torso rotation's inertia. It is ensured by activity of abdomen external oblique muscles ($r=0.72$; $p<0.05$). In the middle of distance traction component of force is realized with accent on maximal rigidness of force transmission for athlete's torso to arms and oar ($r=0.76$; $p<0.05$). Achievement of maximal working effect (by the end of distance) is facilitated by force component, which is ensured by movements of athlete's arms (at the account of deltoid muscles), ($r=0.88$; $p<0.05$).

For *start* acceleration the most significant are the following indicators: athletes' power ($r=0.66$; $p<0.05$); speed of progressing and the value of functional changes in organism ($r=0.77$; $p<0.05$); speed of reaction to start command ($r=0.87$; $p<0.05$). When rowing on *distance* all main indicators of special fitness are approximately of the same importance. When passing *finish* segment effectiveness of applied forces and their symmetry take

the first place ($r=0.76$; $p<0.05$). In the process of distance passing, there happens gradual reduction of athlete's power. It can be conditioned by strategy of forces' distribution or correlation of different physical levels.

Let us regard peculiarities of competition distance passing by elite athletes: 1) with speed power qualities' prevalence; 2) with prevailing of special endurance; 3) with equal level of speed power qualities and special endurance.

For athletes of first group, indicators, which reflect power and efficiency of the fulfilled work, are more characteristic. For second group indicators of effectiveness of the applied forces and movements' symmetry are more characteristic. In third group we registered average level of special endurance indicators. Athletes with prevailing speed-power qualities and special endurance do not significantly differ by speed of distance passing and by heart beats rate. But by other indicators of special endurance we found confident difference. Athletes with uniform levels of physical qualities differ by all registered indicators.

The lowers boat speed was registered at 250-375 meters from start. Athletes with prevalence of special endurance pass distance more evenly. In these athletes reduction of boat speed is expressed weaker. The dynamic of boat's speed is directly connected with reconstruction of athletes' movements' structure [4, 9].

With it, it is necessary to note very bad compensation of weakening power of work. Only at segment of 200-300 meters from start reduction of boat's speed is observed. But simultaneously improvement of movements' symmetry is registered. More noticeable reconstructions in motor coordination were found in athletes, who have prevalence of special endurance. For them it is characteristic reduction of applied forces with simultaneous increase of arms movements' asymmetry.

Thus, in passing distance we can note several distance segments. Effectiveness of these segments' passing is connected with qualitative changes in athletes' motor coordination. The most often such segments are 200-250 m and 400-450 meters from start.

Analysis of the received results permits to mark out a number of *mistakes* in motor technique. Conventionally they can be grouped by levels of athletes' motor structure. First group includes mistakes, which appear at level of muscular coordination. Second group consists of mistakes in rhythmic and space structures of athlete's movements. Third group implies mistakes in dynamic of forces' application.

Results of the research showed close interconnection between mistakes, appearing at three levels. The first level includes mistakes, connected with wrong rigidness of forces' transmission in system "athlete's body-arms, oar –oar paddles – water". The second level is connected with irrational usage of body mass. The third level implies bio-mechanical mistakes (excessive movements of athlete's arms. The presence of mistakes in athletes' technique is strictly individual. It was found that for one group of athletes it is characteristic the absence of mistakes at the

beginning of distance and the presence of them at the end. For other group of athletes it is characteristic irrational motor structure and technical mistakes at the beginning of distance and absence of mistakes at finish segment. The third group is characterized by the presence of mistakes during all distance.

Elite athletes have higher qualitative reconstructions in motor structure, when passing distance. For athletes with prevalence of speed power qualities it is characteristic: sharp reduction of speed by the end of 200 meters' segment; keeping of boat's speed at the account of effectiveness of forces' application to oar. After passing 400 meters segment these athletes significantly improve motor symmetry. It is a compensatory mechanism with exhaustion of potentials. In this case effectiveness of forces' application to oar is also observed.

Analysis of elite athletes' competition functioning puts forward studying of motor functioning's compensatory mechanisms. It permits for athlete to demonstrate higher average speed and achieve good sport result. We found the dynamic of bio-mechanical characteristics and its interconnection with physical qualities. These data witness about different contribution of special fitness components in athletes' motor structure. In a number of cases physical qualities' level renders de-stabilizing impact and prevents from effective motor actions. In other cases, these changes are compensatory and facilitate sustaining of working effect. Both groups of changes are interconnected. The value of this interconnection is more expressed if athletes' qualification rises. In elite athletes the quantity and quality of compensatory changes sharply increase. It is a response to changes of de-stabilizing character.

Discussion

The received data witness that in assessment of sport movements' technique main attention should be paid to compensatory adaptive processes [5, 7, 28]. In athletes' training it is not necessary to orient on elimination of de-stabilizing changes in motor structure.

With rising of athletes' qualification and fitness the role of adaptive reactions, which take place in motor structure, increases. Such reactions determine opportunities for achievement final high sport results. The level of athletes' fitness is determined by quality of compensatory processes in his motor structure [21, 29].

Interconnections between competition activity elements and athletes' fitness have integral character. With it, effectiveness of motor actions on start is connected with level of specialized speed-power qualities. Effectiveness of motor actions on finish is determined by level of special endurance. Balanced correlation of these qualities permits for athlete to achieve high sport result. With it, optimal motor structure in conditions of competition activity is ensured [1, 7, 15].

Conventionally, athletes can be divided into three groups according to motor structure, competition functioning and special fitness [8, 9, 30]. These groups are: athletes with prevalence of speed-power qualities; athletes with prevailing of special endurance and athletes with equal levels of speed-power qualities and special endurance. With it physical qualities and their correlation play connecting role. Correlation of physical qualities reflects in structure of special and technical fitness. In its turn it reflects in the structure of athletes' competition activity [2].

Practical possibility of working out of motor actions' individual model characteristics, including the most significant for the given athlete technical parameters, becomes evident. Such individualized model can be corrected in the process of change of athlete's physical and anthropometrical parameters. Directly in passing competition distance the moments of discordance of motor structure elements are registered by bio-mechanical indicators. On the base of it the tactic of passing of different distance segments is formed.

The presented by us actual material permits to rather reasonably formulate the tendency of motor characteristics' changes. Such characteristics depend on individual features of athletes' adaptive reactions. It permits to mark out the complex of indicators, reflecting the following: effectiveness and efficiency of motor actions; variability and symmetry of athletes' movements.

The presented by us system of diagnostic of athletes' motor structure is based on specific means of integral and bio-mechanical motor characteristics' determination. In this connection it becomes evident that it is important to work out adequate tools for measuring of athletes' motor functioning parameters. It permits to study motor structures in natural conditions of training or competitions without any limits [21, 29].

Conclusions

The research showed that motor structure on competition distance substantially changes. Dynamic of motor coordination structure is pre-conditioned by reconstructions of movements' system on different levels of its organization and control. With it, constant and substantial varying of contribution of movements' system's elements is observed. It conditions significant stability and effectiveness of integral bio-mechanical motor characteristics and workability indicators of athletes.

Conflict of interests

The author declares that there is no conflict of interest.

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