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KINEMATIC CHARACTERISTICS OF A SPRINTING TECHNIQUE AND MORPHOFUNCTIONAL STRUCTURES OF ITS PROVIDING

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Abstract

Introduction

The overall performance of a coach and the efficiency of performances of sportsmen are defined completely by the depth of understanding of regularities which are the cornerstone of the mechanisms, which provide the performance of competitive exercises. The most comprehensive investigations of these questions in track and field athletics are devoted to studying of sprint that significantly promoted the improvement of the process of a coach (Yefremenko, 2013 -2015; Shesterova, Yanhao, 2014-2016). However, the uniform generalization in the received scientific results isn't reached. It considerably reduces the overall performance of a coach.

The optimization of the training process and the efficiency of performance of a sportsman are defined by the depth of knowledge of the interdependent relations of kinematic and dynamic characteristics of the performed physical actions and their connections with the morphofunctional educations, which provide their implementation. At the same time the final result depends on the motive endowments of a sportsman, the level of preparedness and the current functional state.

The purpose of the research. To present the uniform system of the interdependent relations of the biomechanical and physiological regularities which provide the fastest movement of the general center of body weight GCBW of a sportsman when passing by him the established distance of run and to establish the structure of creation of an optimum algorithm of the training process taking into account individual physical development of a sportsman on the basis of provisions of the theory of training. The achievement of the purpose defined the need of the solution of the following tasks:

1. To carry out the analysis of literature and to systematize scientific achievements on the considered problem.
2. To select the fundamental laws of mechanics which define kinematic and dynamic characteristics of movement of biokinematic links and center of mass (GCBW). On the basis of what to establish the coherence of movement of GCBW with a speed of movement of biokinematic links.
3. To define the communication between intensity of the performed work and the duration of its preservations depending on the level of preparedness of the the corresponding morphofunctional mechanisms which provide its performance.
4. To develop the method of creation of an optimum algorithm of ensuring physical preparedness of a sportsman taking into account his specific features of physical development and physical state.

Material and methods

Analytic survey of scientific data on the questions of the research of sprint and mechanics of movement of a body in supported and unsupported phases of its movement; construction of semantic sign spaces with the uniform measure entered into them that allows to compare the share importance of parameters of various dimension at their contribution to the achievement of the final result; mathematical modeling of interaction of functional systems in dynamics; methods of analogy and similarity of manifestation of the principles of the interacting systems in preservation of their equilibrium state.

Results

The analytical expressions which describe a trajectory of movement of GCBW of a body and CBW of two biokinematic link pendulums are established on the basis of laws of mechanics. Circles of cycloid, parabola, helicoid concern to them. It allowed, using the method of mathematical modeling, to establish the specific features of the performance of walking and run inherent in a concrete somatotype. A type of a constitution is defined at which it is possible to develop the run speed when the phase of a support can become less than phase of a flight, that provides extremely possible speed of movement of GCBW of a sportsman on the basis of the results of the researches of videograms of run of the ex-world record-holder in run on 100 m Asafa Powell, the works of Mil Koch, Kadzh Tomazin, Stephanie Letzelter, Akira Ito, Masaki Ishiyaka, etc., and also the executed model constructions.

Conclusion

The modern requirements of the development of sport define conditions of the organization of the training process in which it is necessary to provide the systematic control and the analysis of dynamics of the passing changes in biomechanics of the mastered movements, physiological processes of the training and competitive loads providing performance, psychological preparedness of the sportsman for extreme and special conditions. The implementation of such control demands the corresponding preparation of the coach's structure and necessary technical providing. The existence of modern control methods of the dynamics of the development of exhaustion in change of movements of biokinematic links of a body allow to carry out in real time on video filming this task. However, the coach can't provide the performance of all these functions at full satisfaction of these conditions. The trained professional has to be appropriately in ensuring the training process, and the training in the contents has to consist of not only the direct physical activities, but also the subsequent analysis of the video record of the actions and computer processing of their performance. The solution of these tasks assumes opening of the new specialization in specialized educational institutions, which provides the scientific and technical maintenance of the educational-training process and competitive performances. It is natural that the solution of this task has to be carried out step by step, but now there are all bases to start the beginning of its realization.

Key words: kinematic characteristic, sprinting technique, morphofunctional structures.

Introduction

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provide the performance of competitive exercises. The most comprehensive investigations of these questions in track and field athletics are devoted to studying of sprint that significantly promoted the improvement of the process of a coach (Yefremenko, 2013 -2015; Shesterova, Yanhao, 2014-2016). However, the uniform generalization in the received scientific results isn't reached. It considerably reduces the overall performance of a coach.

The optimization of the training process and the efficiency of performance of a sportsman are defined by the depth of knowledge of the interdependent relations of kinematic and dynamic characteristics of the performed physical actions and their connections with the morphofunctional educations, which provide their implementation. At the same time the final result depends on the motive endowments of a sportsman, the level of preparedness and the current functional state.

The existence of laws of mechanics which define the movement of centers of mass of biokinematic links of a body, forming the movement of GCBW; the physiological laws which define the nature of the carried-out physical activity and their corresponding mathematical description on the condition of the existence of the necessary hardware providing, allow to carry out a full individualization of the training process taking into account the level of physical development, physical preparedness and the current physical state of a sportsman.

The determined biomechanical consistent patterns of a sprinting technique allow to increase the efficiency of training of sportsmen in sprint. The biomechanical characteristics of a trajectory of movement of GCBW in a phase of the starting dispersal give the chance to establish an optimum starting position of a pose of a body of a sportsman in the performance of the low start, which is defined by a distance of starting blocks concerning the line of start and the axial line of run. His further movement which is provided due to the pendulum movement of the extremities, creating carrying power in a running step, can be reached its value, when the duration of a phase of a flight of a body becomes more than the duration of a phase of a support.

The analysis of the physiological processes, which causes the exhaustion reasons, defines those means from an arsenal of physical exercises, which need to be used in special physical training of a sportsman for the increase in potential opportunities of his haemo-cardio-respiratory interactions, which allow to provide the longer performance of work of the maximum intensity.

The purpose of the research. To present the uniform system of the interdependent relations of the biomechanical and physiological regularities which provide the fastest movement of the general center of body weight GCBW of a sportsman when passing by him the established distance of run and to establish the structure of creation of an optimum algorithm of the training process taking into account individual physical development of a sportsman on the basis of provisions of the theory of training. The achievement of the purpose defined the need of the solution of the following tasks:

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The solution of the stated tasks in the submitted project is defined by the fact that their formulation is present at all scientific researches which are aimed at the development of track and field athletics and sport in general.

Material and methods

Analytic survey of scientific data on the questions of the research of sprint and mechanics of movement of a body in supported and unsupported phases of its movement; construction of semantic sign spaces with the uniform measure entered into them that allows to compare the share importance of parameters of various dimension at their contribution to the achievement of the final result; mathematical modeling of interaction of functional systems in dynamics; methods of analogy and similarity of manifestation of the principles of the interacting systems in preservation of their equilibrium state.

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works of Mil Koch, Kadzh Tomazin, Stephanie Letzelter, Akira Ito, Masaki Ishivaka, etc., and also the executed model constructions.

The determination of an optimum speed of passing of the corresponding distance of run, at which the time of its passing will be minimal, became possible on the basis of the established dependence, which reflects the duration of preservation of the work of the set intensity. The specification of phases of run at a distance of 100 m, which is presented in publications of Milan Koch and other authors and added with features of operating modes of the muscular activity, consisting of a static stress, providing a working pose of running exercise and cyclic movements of biokinematic links of a body, allowed to establish that a static stress of a working pose of a running movement is the most significant reason of the development of exhaustion.

The method of the differentiated preparation of the morphofunctional systems making a basis of special physical training of haemo-cardio-respiratory interactions in the performance of running exercises is developed on the basis of the known physiological mechanisms which define the formation of high-speed endurance. The optimum algorithm of its development in which specific features of physical development, physical state and level of physical preparedness are considered, is developed on the basis of the received structure of the allocated components entering a dynamic stereotype of the performance of run at various distances. It considerably increases the overall performance of a coach and the efficiency of performances of sportsmen.

Discussion

The increase of the overall performance of a coach and the efficiency of performance of sportsmen demands the most complete idea of kinematic characteristics of the technique of the carried-out competitive exercise and knowledge of the morphofunctional structures which provide it. Each type of track and field athletics has the specifics of manifestation of these requirements. It makes the basis of selection of the persons which are the most predisposed to classes of a concrete type of track and field athletics that defines a success of performance of a sportsman at the correct subsequent organization of the training process. The solution of the formulated question assumes the account of morphofunctional features of the engaged individual, his features of the development of a necessary dynamic stereotype of movement, the current physical state. However, despite all the variety of types in track and field athletics and the specific features which are engaged in these types, the general principles of the organization of creation of the educational-training process and the way of increase of its efficiency exist. It is the most expedient to consider their representation on the example of training of sportsmen in sprint as the most studied type of track and field athletics.

The biomechanical analysis which is directed to the establishment of kinematic characteristics of the carried-out movements in sprint, became possible due to that neatly certain phases of a "dispersal" of body weight are established in it, which is carried out at an exit from the start and the subsequent dispersal on the first three steps when GCBW reaches the necessary height of the subsequent its movement of distances. The full starting dispersal is reached after the performance of ten steps of an exit from the starting blocks. Kinematic characteristics of a further run are defined by such characteristics as frequency and length of a running step, time of their support and flight.

The efficiency of the starting dispersal is estimated by the index of activity (I) representing the relation of the time of a flight (t_n) to the time of a support (t_o). The size of activity index $I = t_n/t_o$ in run changes from zero and reaches a value of unit, and it can exceed a value of unit at sprinters of high qualification. The duration of preservation of the maximum index of activity in run is defined by the potential of high-speed endurance (Luhtanen, Komi, 1980). The general time of a support according to the offer of Luhtanen and Komi (1980) was divided into a phase of depreciation and pushing away.

The great interest to the research of start and starting acceleration is explained by the fact that the contribution of these components in sprint occupies up to 64% of the general result in run on 100 m (Teller, Doolittle, 1984). The special attention of a number of researches is explained right by it (Luhtanen, 1997; Teller, Doolittle, 1984) to the detailed analysis of a position of a body of a sportsman when performing the low start which is defined by an arrangement of starting blocks concerning lines of start and the axial line of run that influences the position of GCBW of a runner over the support plane at the order "Attention" (Akira et al., 2006).

The distance of starting blocks concerning the line of start defines the orientation of net force with the reaction of the support influencing length of the first step. The distance between blocks of rather axial line of run determines the width of a distance of feet of the first step. The provision of the forward starting block can deviate by several degrees from the parallel direction to the axial line of run depending on the individual anthropometrical data of a sportsman. Such arrangement of starting blocks is optimum for the manifestation of the maximum effort in the starting dispersal and the subsequent position of a supporting leg in the first starting step for providing the optimum direction of the developed effort in it.

These provisions are defined by kinematics of movement of GCBW at its starting dispersal. The resultant movement of GCBW in smooth run is carried out after a helicoid (a screw line with a reduction of radius of its rotation to its optimum value that is carried out on the first steps of run). Optimum conditions of movement of GCBW on the helicoid trajectory are fully defined by a depreciation phase in the period of a

support which, in turn, depends on preparedness of a muscle work in the plyometrics mode of the operating loading throughout the whole distance of run.

All these characteristics in an essential measure depend on the anthropometrical data of a sportsman, his physical development and physical state. Have been expressed in absolute values of measurements, they are difficult comparable among themselves at different sportsmen. Any performed physical actions submit to laws of mechanics and are carried out on strictly certain trajectories of movement regardless of growth, weight, level of physical preparedness and physical state (Bernstein, 1947, 1966).

The dispersal of the general center of body weight on the set movement trajectory, which is formed under the influence of two orthogonal to each other forces is carried out in a phase of the starting dispersal from a provision of the low start. One of them provides gravitation counteraction, and another horizontal movement in the set direction. The interaction of these forces defines the performance technique of an exit from starting blocks and kinematics of starting steps. The movement of GCBW from the moment of a separation of hands from a support, is connected with its exit to the necessary height of the subsequent movement in smooth run. In all cases the initial pose of a sportsman defines the finding of GCBW concerning the support plane, and the net force of dispersal passes through him and sets a trajectory of the movement of GCBW on the vertical and horizontal direction. This movement in an unsupported state can be carried out only on the parabolic trajectory to the following stage of an unsupported situation on other leg.

The vertical component of net force arises due to a movement of a swing leg, a back extension in the period of a support of two legs on starting blocks and pendulum swing movements of the hands which are carried out in the direction opposite to each other. As a result of it, a raising of GCBW on height of the trajectory of smooth run is reached. The dispersal of GCBW is carried out on the parabolic trajectory providing the maximum flying range. Such result is achieved only at the movement on a parabola with an angle of a departure 45° concerning the support plane. Actually this angle makes about $40,6^\circ \pm 1,19^\circ$ at an exit from starting blocks. The reason of such divergence with theoretical provisions of ballistics of movement of a body in unsupported state is that GCBW of a runner in starting situation is already placed over a support at a certain height.

The starting position of GCBW at the correct performance of technique lies on an intermediate point of a parabola with an angle of a departure 45° . This angle of a tangent appears significantly less in an intermediate point. The more GCBW is lifted, the more possible redistribution between a vertical and horizontal component of net force towards a horizontal component to a large extent is that provides higher initial speed of the starting dispersal of GCBW. This effect is especially accurately shown at insignificant distances of movement of an object and rather small speeds of his movement. It should be considered also in throwings, shotput, long jumps, triple jump in track and field athletics types.

The technique of performance of low start is defined by a sportsman's pose which depends on arrangement of starting blocks concerning the line of start and the axial line of run that defines an optimum position of legs at start (Akira Ito, etc., 2006). The defining factor in the dispersal of GCBW is force impulse which is developed by a sportsman at an extension of legs in knee joints. The main factor of dynamics of this process is the speed of increase of force and the duration of its action. In this case the important role is played by the initial and final value of force which is reached at the time of a separation of a supporting leg from the starting block. The duration of this process defines the operating force impulse. Practically it is about a need of the accounting of the continuous growth of force in an interval of its action.

This fact remained unconsidered in the research of technique of the starting dispersal of GCBW of a sportsman. Speed of the development of force is defined as size equal to valued cdt , but at the same time boundary values of the developed force during its action remain unaddressed. Initial and boundary values of force are defined completely by an angle of an extension of legs in knee and coxofemoral joints. This characteristic of change of force is defined by its increment on an extension angle in joints of biokinematic links and it is represented as size equal to value $dF/d\varphi$. Its value on everyone linear changes of an angle of an extension, which proceeds on an arithmetic progression, changes under the law of a geometrical progression. The dynamics of its growth is described by a logarithmic spiral in the polar system of coordinates.

Characteristics of an increment of speed on an angle of an extension of biokinematic links $dF/d\varphi$ define initial and boundary conditions of the passing process of the developed effort. In turn, speed increment size per a unit of time dF/dt reflects the speed of its development.

Ratios of force, angle of an extension and duration of course of the process define the optimum conditions of the starting dispersal of body weight in the set direction. A big angle of an extension of biokinematic links in a knee joint increases the initial value of force of the interaction with the reaction of a support, but reduces the duration of its action that significantly influences force impulse size (Pugach, 2013; Druz, 2015).

Specific features of manifestation of this general regularity are reflected in the coefficient of curvature of a logarithmic spiral that reflects the speed of increase of force and is the congenital characteristic. These features are the cornerstone of methods of the current continuous control of a functional condition of a sportsman during the direct performance of the motive activity by him (Ashanin, 2012). The increase in an angle of an

extension of legs in knee and coxofemoral joints defines the initial value of increase in force and its further growth, but at the same time the process course time is reduced. The determination of the maximum value of size of an impulse of force is reduced to a usual variation task. Proceeding from the result of its decision, the arrangement of starting blocks, and, therefore, and the starting pose are defined at the order "Attention!". Any deviation from the caused starting pose leads to the reduction in the rate of the dispersal of GCBW and length of the first starting step.

The most effective method of modeling of kinematics of the movement of GCBW are physical models, which allow observing dependence of kinematic characteristics of the parabolic movement of GCBW on the dynamic opportunities, which provide its movement on this trajectory in an available form. A method of mathematical modeling becomes highly effective when using computer technologies.

The activity index revealed in empirical researches (Koch, Tomazin, 2006) submits the extremely important kinematic characteristic of run which at the accounting of the dynamic conditions defining its change, reflects the analytical communication between step phases in run. The representation of this dependence in the sign semantic space with the entered uniform measure of their comparison allows to establish specific features of their ratios and to carry out an assessment of current state which defines the achievement of result, available to it (Pugach, 2013).

The use of the index of activity gives the chance to establish optimum conditions of the performance of a triple jump and a long jump. The last reflects the maximum manifestation of the value of the index of activity when the phase of a flight surpasses a support phase in the finishing jump step. At the same time, the ratio of the time of depreciation and push changes in a phase of a support. The index of activity in smooth run allows to establish accurately the first phase of acceleration and the second which is characterized as run with the maximum speed. Studying of biokinematic characteristics of steps of smooth run in which carrying power sufficient for providing a phase of a flight of GCBW is reached, shows that this effect results from cycloidal movement of GCBW of two-link pendulums of the "waving" extremities. The comparison of speed of movement of GCBW on the trajectory of a cycloid specifies that the circle forming a cycloid and size of the arising carrying power, are caused by analytical dependence.

This communication is described by exponently when ranging these characteristics in size of their individual share in receiving the final result. Similar to the activity index reflecting the relations of a phase of a support and a phase of a flight, it is possible to enter an index of the relation of carrying power of the moving two-link biokinematic pendulums to a sportsman's weight. In this case the duration of a flight of GCBW, which moves on the parabola, determining the length of a step and the maximum horizontal speed, the index of activity of the relations of a phase of a flight and a phase of a support, will reach the extreme value.

The duration of such mode of intensity of run is defined by the possibility of ensuring the metabolic process of the morphofunctional systems, participating in the performance of this mode of their work. In this case the physiological processes which generate the effect of exhaustion act as the defining factor of the duration of performance of work of the set intensity. This phenomenon is characterized as high-speed endurance. Depending on the intensity of the performed work, the presence of the share importance of the factors causing the process of exhaustion is various (Rosenblat, 1975; Druz, 1987, Pugach, 2011)].

The main essence of the development of high-speed endurance is connected with the increase of resistance of an organism to work in anaerobic conditions. The solution of this task is reached by the increase in volume of loading in trainings which are aimed at the development of high-speed endurance. The most effective ways of the achievement of this purpose is either the performance of exercise with the maximum intensity through certain intervals of rest, or the performance of full exercise with the consecutive increase in its intensity. Both methods form high-speed endurance through a natural form of presentation of anaerobic loading to an organism of a sportsman for the increase of his resistance to anaerobic conditions.

The complexity of these methods consists in need of the accounting of specific features of the creation of an optimum algorithm of the increase in anaerobic loading. In studying of this problem it was paid the attention to those components of the carried-out physical exercise in the structure of the general dynamic stereotype which are the most involved in the formation of exhaustion when performing the work of the maximum intensity. The most significant in this regard is the static stress of the muscles providing a working pose for the performance of elements of a running step. The increased intensity of cyclic actions leads to the increase in a static stress of the muscles providing the preservation of a working pose, and it leads to the manifestation of the phenomenon of "Lingard", which is connected with the compression of blood vessels and violation of regional blood circulation.

The coefficient of profitability of use of oxygen at the level of tissue respiration is the second factor for the importance, accelerating the development of exhaustion. Not less significant in this case is the contact area which provides the exchange processes and intensity of their course. All this complex unites the concept efficiency of the interdependent haemo-cardio-respiratory relations in the operating morphofunctional structures of a dynamic stereotype of the performance of a running exercise of sprint.

The development of these mechanisms has to make the basis of the special physical training of a sportsman which is directed to the increase of high-speed endurance. It has to make the purposeful differentiated structure of influence on the corresponding morphofunctional educations as the system of the development of the special motive quality. Static efforts in a certain mode of their performance belong to such exercises which are directed to the differentiated preparation of haemo-cardio-respiratory interactions; the breathing exercises, forces of muscles of a breath which are directed to the increase; the breathing exercises which are directed to the increase of oxygen capacity of blood and enzymatic activity of tissue respiration. The exercises, which are connected with a returnable breath in the closed limited hermetically space, concern to the last.

The arsenal of the physical exercises, which provide the special differentiated preparation of the morphofunctional systems of life support significantly depends on the intensity of the shown running loading, which influences a share ratio of the factors, defining the development of the process of exhaustion. It is connected with the change of maintenance of an essence of the development of endurance to the performance of work of the set intensity. Inasmuch the work is represented as the work of the set intensity for the period of its preservation what corresponds to the area of the entered rectangle under exponentially, reflecting the character of the relation of these sizes, it allows to define its optimum available intensity, which will be executed for the shortest interval of time.

The existence of the determined analytical consistent patterns of the kinematic and dynamic characteristics of run changing depending on its intensity allows exercising in real time in the presence of computer providing and video film-making equipment control and correction of the training process. The realization of this task became possible thanks to introduction of the new control methods which are based on the determined consistent patterns and representation of the received supervision in the sign semantic spaces with introduction to them of a uniform measure of the compared characteristics (Pugach, 2013).

Run as a characteristic form of cyclic activity and intensity of its performance demands the adequate morphofunctional compliance that imposes certain specifics on the constitution of a somatotype of a sportman. It is natural that the feature of individual structure of a constitution defines the congenital predisposition to specifics of a concrete motive activity. The measure of such predisposition characterizes the degree of congenital endowments of the individual to the chosen motive activity (Azhippo et al., 2015).

Constitution proportions play the special role in the structure of a somatotype of a sportsman concerning run and intensity of its performance. The modern classification of the qualitative structure of a constitution of a body regardless of its general sizes allows selecting those model characteristics of a constitution which reflect a qualitative predisposition to the corresponding type of motive activity and a measure of its manifestation. It indicates the presence of two characteristics at an assessment of motive endowments which influence the achievement of the final sports result. The qualitative structure of a constitution of a body and absolute values, the parts of a body making it, are concerned them. Proportions of biokinematic links in the structure of a constitution, reflect the quality indicators of kinematic characteristics of creation of cyclic movements.

Absolute values of the sizes of the corresponding parts of a body at identical proportions of its structure, but their different sizes, demand various dynamic efforts for providing the same kinematic characteristics of the carried-out movements.

As the efficiency of performance is estimated on an absolute value of the achieved result in track and field athletics, many gifted individuals on the qualitative predisposition to a concrete motive activity can't realize themselves in this sport. It is expedient to consider and to study a question of introduction of height-weight classification of categories of the sportsmen who are engaged in track and field athletics in general and track and field athletics run in particular for expansion of the contingent of persons who are interested to be engaged in track and field athletics.

The sport of records is a natural factor of selection of motive and gifted individuals. The further improvement of congenital endowments demands the use of special motive preparation, which consists of the corresponding arsenal of the physical exercises, promoting the growth of the dynamic opportunities, providing the carried-out sports movements. In other words the implementation of the aimed orientation of the formation of a body of a sportsman according to the elected by him sports specialization.

The differentiation of the structure of the creation of sprint on its compound components and the definition of kinematic and dynamic characteristics of physical actions in each their phase allows to construct algorithm of the consecutive development of sprint with the maximum effect of its performance. Features of the creation of such algorithm include the assessment of level of endowments to the considered activity, the initial level of preparedness to the performance of the corresponding complexity of the task, the current functional state. The received final result (K) can be presented in the form of a degree monomial ($K=O \times \Pi \times C$) in such representation. Each characteristic which is submitted in dimensionless units, can have the maximum manifestation equal to unit or occupy a possible value ranging from 0 to 1. The optimum algorithm of training assumes registration of the duration of the development of each subsequent step of its complication.

Characteristic of this sequence consists that such individual abilities as speed of training and limit of learning ability are opened at the control for its assimilation. It allows predicting the prospects of achievement of the most difficult level of assimilation in the existing algorithm of training at the initial stage of training.

The animation modeling of a body movement of a sportsman with introduction of the individual kinematic and dynamic parameters, characterizing its movement, is not less important and interesting task which is connected with the development of innovative technologies of training and the organization of the training process. It allows seeing the technique of performance of movements which should be mastered. The variation of speed of viewing allows using the method of ideomotor assimilation of the observed movement that significantly accelerates the subsequent formation of a dynamic stereotype, does better the result of training in the technique of the mastered movements (Van Sinna, 2012).

This method allows analyzing in more detail video materials of records of technique of the carried-out movements and estimating the degree of the developing exhaustion on changes of kinematic characteristics of a running step.

The separate component in training of sportsmen, which defines the competitive reliability, is psychological preparation. It is the least studied party in the organization of the training process. The developed and modified methods of an assessment of the competitive reliability allow defining the extent of influence of an emotional pressure on the productivity of competitive performance. Such assessment is carried out on the basis of the comparison of results of competitions to results of selection performances and the comparison of results of performances in competitions of various level of responsibility that allows estimating the factor of influence of the importance of competitions and responsibility for the reliability of performance of the sportsman at competitions (Pugach, 2014).

The division of such concepts as extreme conditions and special conditions is carried out in the course of these researches, which equally can influence the level of an emotional pressure and emotional nervousness. The results of the conducted researches allow claiming that emotional stability as well as physical motive endowments is an inherited quality. Sport in this case, acting as a factor of a natural selection leaving on the arena only those who appear the most adequately ready to the corresponding loadings of the competitive activity both from its physical, and mental components.

The objective technique of its assessment is developed for the determination of emotional stability, in which cornerstone is the control for dynamics of arterial pressure and the amplitude of frequency characteristic of heart rate. It is established on the basis of the conducted researches that the number of the persons who are possessing the emotional stability, which provides the competitive reliability from selection of 700 people, is made by no more than 1,5% of the investigated contingent (Malakhov et al., 2014).

Resolving the issue of the increase of the overall performance of a coach and the efficiency of performances of sportsmen, it is necessary to provide the comprehensive control of a condition of a sportsman and to carry out the process of training of a sportsman taking into account his specific features of physical development, physical fitness, physical state, level of motive endowments and emotional stability. Such formulation of the question demands the attraction of modern technical means of control and processing of the obtained information, use of mathematical modeling as integral method of the research in sport and forecasting of a possible development of the proceeding process for the purpose of the prevention of a failure at the present stage of the development of sport.

Conclusion

The modern requirements of the development of sport define conditions of the organization of the training process in which it is necessary to provide the systematic control and the analysis of dynamics of the passing changes in biomechanics of the mastered movements, physiological processes of the training and competitive loads providing performance, psychological preparedness of the sportsman for extreme and special conditions. The implementation of such control demands the corresponding preparation of the coach's structure and necessary technical providing. The existence of modern control methods of the dynamics of the development of exhaustion in change of movements of biokinematic links of a body allow to carry out in real time on video filming this task. However, the coach can't provide the performance of all these functions at full satisfaction of these conditions. The trained professional has to be appropriately in ensuring the training process, and the training in the contents has to consist of not only the direct physical activities, but also the subsequent analysis of the video record of the actions and computer processing of their performance. The solution of these tasks assumes opening of the new specialization in specialized educational institutions, which provides the scientific and technical maintenance of the educational-training process and competitive performances. It is natural that the solution of this task has to be carried out step by step, but now there are all bases to start the beginning of its realization.

Recommendations

The presented results allow recommending using the method of the differentiated development of morphofunctional systems of life support in the structure of special physical training of high-class sportsmen.

It is necessary to pay attention to the development of regional blood circulation of the muscles providing preservation of a static stress of a working pose in the increase of level of high-speed endurance. It is necessary to carry out the special exercises of static character or the movement in the slowed-down mode for this purpose.

It is expedient to carry out a returnable breath in the hermetically closed space with a limited volume of respiratory mix for the increase of efficiency of ensuring gas exchange at the level of tissue respiration and the increase in oxygen capacity of blood. The volume of such space depends on the intensity of run. It has to make 1,5 – 2 full breaths for sprint distances. It is expedient to carry out breath in a tube at an immersion depth under water on 1/3 from maximum at which it is already impossible to carry out a breath for the increase of the efficiency of external breath.

It is expedient to use insignificant burdenings which have to be placed on biokinematic links over their center of weight for the development of the muscular complex, which provides kinematic characteristics of the movement. The additional burdening and its location are defined individually and depend on anthropometrical characteristics of the corresponding biokinematic links of a body. Such method is characterized as professional body-building.

The performance of all loadings has to be carried out according to the individual algorithm of the development of the educational-training material that will allow setting the optimum mode of the current loading according to the appropriate program of data processing, and to establish speed of training and a limit of individual learning ability according to the saved-up information. The accumulation of such material has not only practical, but also scientific value for the further development of the theory of sport.

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