

Original Article

Correlation between physiological parameters and indicators of special physical readiness of trained sprinters under the influence of recovery means

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Abstract. This paper presents the correlation of physiological determinants with performance sprinters by, taking into account the effects of vibration, negative air ionization, and listening to binaural beats. *Objective:* Trained sprinters were tested (n = 15) that were an average age of $20 \pm 0,7$. The study was conducted over 4 weeks in the autumn-winter during the preparation period of macro cycle training. *Methods:* psycho diagnostic, coloured test using M. Luscher, and motor tests. *Results:* We revealed the complexity and diversity of connections depending on the training objectives and the relationship of the motor response rate to the visual stimuli of the sprinters. This : correlated with 60 m and 30 m speed running with a low start ($r = 0,62$), the standing triple jump at a certain distance ($r = -0,78$) and barbell squats on the shoulders ($r = -0,54$). The results of the 60 m sprint, correlated the simple motor response to the visual stimulus ($r = 0,66$) and the results of the motor testing. *Conclusions:* The effect of using recovery techniques, which were aimed at normalizing the psycho-physiological condition of the runners, improved of the productivity that was accompanied by the response of the sportsmen as the background anxiety decreased. These m will have the greatest operational efficiency during the current period and of recovery based on the selective impact on the neuromuscular system of the runners.

Key Words: physical condition, sprinters, recovery, motor response.

Introduction.

To compensate the progressing fatigue between trainings of a sprinter, it is possible under conditions of timely use of means of recovery of working capacity which are allocated for activation or relaxation of functions of an organism of runners. Big cyclic work by intensity is characteristic for sprint, which main loading is on the neuromuscular and capsular-connected system of the lower extremities. Therefore, it is necessary to use in proper time means of recovery of the central nervous system as prerequisites of the appropriate level of functioning of the neuromuscular system, and muscles which suffer the greatest fatigue. Recently, the considerable popularity is gained by non-drug means of recovery. Listening of functional music, influences on a condition of air, use of vertical vibration belong to them.

Analysis of the last publications.

The research J. Lane et al. (1998) demonstrates that use of binaural beats of β - and θ - diapasons promotes the improvement of performance of psychomotor task and the improvement of psychological condition. R. P. Le Scouarnec, et al. (2001) demonstrates that binaural beats in θ - diapason promote decrease in uneasiness. V. Abeln, et al. (2014) notes that the influence of stimulation by binaural beats about 2-8 Hz, on young football players, promoted the improvement of dream and the improvement of psychological condition. It is noted in the researches of A. Minh (1984) and Z. J. Grabarczyk, (2000) that inhalation of negative air ions promotes the improvement of health and the increase in relaxation.

The support of normal blood flow influences the delivery of oxygen to muscles, resynthesis of macroergs, removal of lactate, and recovery of force during rest after training of high intensity. Numerous researches (E. B. Lohman, et al., 2007; N. Lythgo, et al., 2009) show that vertical vibration can increase blood flow in tissues through vascular distention. According to M. R. Rhea and et al. (2009), trainings on vibration trainer significantly reduce pain after training with encumbrances and repeated sprint exercises. Therefore, effects of influence of the above-mentioned means on psycho-physiological condition, and also condition of the neuromuscular system, can promote recovery of working capacity of sprinters. At the same time, it is important to find the extent of communication of special physical qualities of sprinters with the level of their functional status, for the sake of the determination of parameters of use of means of recovery. Therefore **the purpose of the work was:** to find the extent of communication of psycho-physiological condition and special physical readiness of sprinters under the influence of means of recovery of working capacity.

Design of the research.

Objects of the research. Runners on short distances who had qualification from the I category till CMS, took part in the research (n = 15).

Data of anthropometries and indicators of integrated haemo-dynamics. Age - $20 \pm 0,7$; height - $181 \pm 0,4$; weight - $78 \pm 0,7$; heart rate - $64 \pm 0,8$; systolic arterial pressure - $128 \pm 0,2$; diastolic arterial pressure - $64 \pm 0,5$.

Structure and characteristic of the training cycle. The preparatory period lasting 11 weeks was divided into the period of the general preparation (5 weeks) and the basic preparation (6 weeks).

Methods of the research. The assessment of psycho-physiological condition was carried out in the complex computer psycho diagnostic complex "Effecton Studio 2007" (Russian Federation) [9]. Tests were shown the runners on the computer in the form of different visual and sound incentives, to which the sportsman reacted pressing of keys on the keyboard (the program counts the average time of reaction and the mean-square deviation): simple motor response to a visual irritant (the test "Tir" - response to a fast change of color (2 attempts)); simple motor response to an acoustical irritant (the test "Duel"- response to a sound irritant (2 attempts)).

Psychological tests: the eight-colored test using M. Luscher (in adaptation of L. Sobchik) [15] with the calculation of the deviation from the autogenic norm of Valneffer [14].

Protocol of vibration. Vibration platform Turbosonic X5 was used (Turbosonic, Hood Rive, Oregon, USA.) at frequency of 40 Hz, amplitude is 4 mm, time of an exposition 1 - 1,5 min.

- after the first training if the second is planned, the sportsman stood by feet on the vibration massage machine, sat on a chair so that the angle of bending in knee joints equaled 90^0 (an exposition 1,5 minutes), then, passed into a vertical position (duration of 1,5 minutes);

- 2 more positions lasting 1 minute are added after the second training after the first two positions:

- I position: massage of gastrocnemius: the sportsman sitting on a soft eminence, at the level of the exercise machine, put calves on the vibration platform;

- II position: massage biceps femoris: the sportsman sitting on a soft eminence, at the level of the training apparatus, put a hip on the vibration platform. If only one training is planned, the complex of procedures was identical usable after the second training.

Protocol of air ionization. Anion Air Purifier (Bse-988) (BSE Blue Star Electronics Industry Co., Ltd. Guangdong, China) was used in sessions lasting 20 min. The range of concentration of negative air ions, on average, is 1 - 10 thousand AI in 1 sm^3 . The sportsmen took seats on a distance from 0,3 m till 1,0 m from the device and not closer than 0,5 m from room walls. Air temperature indoors + $18-22^\circ \text{C}$, relative humidity is no more than 80 %. The stimulation course was begun with small doses, with the gradual bringing to a full dose on the 5th - 7th procedure.

Protocol of listening of binaural beats. Sportsmen listened to the disc "Relaxation" which includes θ - beat (4 - 7 Hz), lasting 20 min. The sportsmen accepted his comfortable position indoors for rest. It was recommended to the runner to close eyes, to relax and to perceive music, without analyzing. Stereo earphones of the type SONY Lf-700 (Minato, Tokyo, Japan) and musical portable media player of the type TRANSCEND MP710 (Transcend Information. Inc., Taipei) were used.

Protocol of testing. The control was carried out before, after, and also during the training. Testing of the level of motive qualities were held after day of rest at the beginning of the research and till the termination of mesocycle. Safety of sportsmen and the appropriate course of the process of training were controlled during the tests. The research was conducted according to standards of the Helsinki declaration. All participants gave their informed consent and were acquaintance with the research procedure.

Motive tests. Run of 30 and 60 m with a low start was used for the determination of level of speed of run on a distance. Standing broad jump; standing triple jump; vertical jump according to V. M. Abalakov were used for the purpose of the determination of level high-speed and power qualities [1]. Repeated barbell squats on shoulders with the maximum weight (an angle in knee joints 90^0) was used for the determination of level of power abilities.

Statistical data processing. Pearson's correlation coefficient was counted for an assessment of interrelation of the received measurements. All analyses were made with use of the statistical package Statistica, version 10 (Statsoft Inc., Tulsa, Oklahoma, USA). The significance value was established on $P < 0,05$.

Results of the research. The reliable interrelation between simple motor response to light and acoustical irritants ($r = -0,63$), and also between standing vertical and standing triple jumps ($r = 0,58$) was found in all-preparatory mesocycle. At the same time, speed of motor response to a visual irritant at sprinters, correlates with speed of run of 60 m and 30 m of pieces with a low start ($r = 0,62$), and also length of standing triple jump, ($r = -0,78$) and barbell squats on shoulders ($r = -0,54$). Length of standing triple jump correlates with speed of run at 30 m ($r = -0,62$) and 60 m with a low start ($r = -0,58$), and also barbell squats on shoulders ($r = 0,59$). Results of run on 30 m and 60 m with a low start ($r = 0,93$) have a high degree of correlation.

The close correlation connection is observed between speed of run of pieces of 30 m and 60 m with a low start ($r = 0,94$), and also speed of run of 30 m and standing long jump ($r = -0,90$) in the basic mesocycle.

Simple motor response to an acoustical irritant correlates from simple motor response to a visual irritant ($r = -0,71$). Simple motor response to a visual irritant correlated with results of all motive tests, except, vertical standing jump and deviation from autogenic norm, according the test of M. Lyusher. The result of broad jump correlated with result of standing triple jump ($r = 0,77$) and barbell squats ($r = 0,68$). The result of triple jump correlated with barbell squats ($r = 0,58$) and speed of run of 30 m with a low start ($r = -0,60$). Results of barbell squats on shoulders correlated with speed of run of 30 m with a low start ($r = -0,51$). At the same time, result of standing triple jump and barbell squats on shoulders correlated with speed of simple motor response as on light ($r = 0,64$; $r = 0,55$), and on sound, irritants ($r = 0,54$; $r = 0,80$). But, the result of run on 60 m with a low start at competitions authentically correlates with indicators of simple motor response to a visual irritant ($r = 0,66$) and results of pedagogical tests, except, lengths of standing triple jump.

Discussion.

Synchronism of the improvement of simple motor response to visual and acoustical irritants is observed in all-preparatory mesocycle. At the same time, simple motor response to a visual irritant correlates with speed of run, high-speed and power and power preparedness which testifies to the interdependent nature of their manifestation. Curiosity causes the communication between the improvement of level of power abilities and simple motor response to a visual irritant. Perhaps, power loadings create the highest level of excitement receptor – effective communications, at the expense of recruitment of bigger quantity of motive units. At the same time it is noted that the improvement of speed can promote strengthening of muscles. The correlation of manifestation of high-speed qualities among themselves and high-speed and power qualities testifies to harmony of their development. Communication of motor responses among themselves is explained by the improvement of nervous transfer. It demonstrates the improvement of motor control and muscular coordination. Height of vertical jump correlated only with length of triple jump that testifies to specificity of manifestation, in vertical jump, high-speed and power qualities of sprinters. Connection of triple jump with barbell squats on shoulders, testifies to the significant contribution of a power component to manifestation of high-speed and power qualities of sprinters. Therefore, the normal course of processes of adaptation of sprinters to the planned training load is recorded.

The improvement of speed of simple motor response to an acoustical irritant correlated with the growth of level of high-speed and power and power abilities in the basic mesocycle. At the same time the improvement of production of force can be connected with overcoming of fatigue, the increase in recruitment of muscles fibers which fast-twitch. At the same time, simple motor response to a visual irritant correlated with speed of run of sprinters. Therefore, speed level, during this period, grows at the expense of high-speed and power and power components of physical readiness of sprinters. It can demonstrate the improvement of reducing ability of muscles. The improvement of technique of run from start, demonstrates positive influence of the chosen means of recovery on psycho-physiological condition of runners. In general, it demonstrates the improvement of ability of muscles of sprinters to generate the mechanical power which is a key element for the improvement of the level of their functioning. Ability to react quickly to incentive is connected, somewhat, with the muscular system [4; 12]. Also the communication of run of the competitive distance of the winter period (60 m) with the reaction improvement demonstrates about that. Though, the essential communications between deviation from autogenic norm and other parameters, which were measured, weren't found. But, it is possible to agree with thought [16] that psychological interventions lead to the increase of working capacity of sportsmen and are the forerunner for the high level of sports skill.

Conclusions.

The obtained data indicate the complexity and the variety of communications between functional condition and special physical readiness of the qualified sprinters, depending on training tasks which are solved. The harmony of these communications is provided by the means, allocated for complex normalization of functional condition of an organism of sprinters and ensuring adequate course of processes of adaptation to a training load which progressively grows. Such approach has to include the possibility of selective influence on links of the neuromuscular system of the runner which receive the greatest loading during training. The developed technique, by the parameters which were recommended, will show the greatest efficiency in the operational and current periods of recovery of working capacity.

Prospects of the subsequent researches. Approbation of the complex of means of recovery in training of the qualified sprinters during competitions is planned for the further.

Conflict of Interest. The authors declare that there is no conflict of interests.

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