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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:
The paper presents the correlation of physiological determinants and performance sprinters, taking into account the effects of vibration, negative air ionization, listening to binaural beats. *Objective:* trained sprinters tested (n=15) age of 20±0,7. The study was conducted for 4 weeks long in the autumn-winter of preparatory period of macro cycle training. *Methods:* psycho diagnostic, colored test by M. Luscher, motor tests. *Results:* revealed were the complexity and diversity of connections depending on the training objectives. Research reveals relationship the rate of motor response to visual stimuli of sprinters: correlated with the 60 m and 30 m speed running with low start (r=0,62), and the standing triple jump with a distance (r=-0,78) and barbell squats on the shoulders (r=-0,54). Sports results 60 m sprint, correlated with simple motor response to visual stimulus (r=0,66) and results of motor testing. *Conclusions:* effects of using recovery techniques aimed at normalizing psycho-physiological condition runners were observed improving of productivity accompanied by the response of sportsmen on background of anxiety decreasing. Methods will have the greatest operational efficiency in the current period and recovery based on selective impact on the level of the neuromuscular system runners.
Key words: physical condition, sprinters, recovery, motor response

Introduction

To compensate progressive fatigue between workouts a sprinter possibly under conditions of use of timely recovery aimed at activation or relaxation functions of runners. For sprint it is characterized the high intensity of cycle work, the main burden of which falls on neuromuscular and capsular ligaments of the lower extremities. Therefore, it should be timely to use the recovery tools for the central nervous system as a prerequisite for the orderly functioning of the neuromuscular system and the muscles that are most tired. Recently, considerable popularity acquires non-drug recovery means. These include functional music listening, the impact on air, using vertical vibration.

Analysis of recent publications. Research of J. Lane et al. (1998) shows that the use of binaural beats β- and θ-range performance improves psychomotor tasks and improve psychological state. R. P. Le Scouarnes et al. (2001) show that binaural beats in θ-range help to reduce anxiety. V. Abeln et al. (2014) notes that the effect of stimulating binaural beats around 2-8 Hz, for young players helped to improve sleep and improve psychological state. Studies of A. Minh (1984) and Z. J. Grabarczyk (2000) noted that inhalation of negative air ion improves health and increase relaxation.

Maintaining normal blood flow affects the delivery of oxygen to muscles, macroergic resynthesis, lactate and restore a power in a period of rest after training of high intensity. Numerous studies (E. B. Lohman et al., 2007; N. Lythgo et al., 2009) show that the vertical vibration can increase blood flow to the tissues through the vasodilation. According to M. R. Rhea et al. (2009), training on vibration significantly reduces pain after weight training and repeated sprint exercise. Therefore, the effects of the above-mentioned means for psycho physiological condition and condition of the neuromuscular system can contribute to recovery of sprinters. It is important to identify the degree of connection of special physical qualities of sprinters with their level of functional status, to determine the parameters of the use of recovery. So **the purpose of the work was:** to identify the degree of connection of the psycho physiological state and special physical preparedness of sprinters under the influence of drugs rehabilitation.

Material & methods.

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Participants

The study involved sprint runners who trained: as first ranking up to the candidate master of sport (n=15).

Anthropometry data and indicators of integrated hemodynamic. Age - 20±0,7; Height - 181±0,4; weight - 78±0,7; heart rate - 64±0,8; systolic blood pressure - 128±0,2; diastolic blood pressure - 64±0,5.

The structure and characteristics of the training cycle. Preparatory period of 11 weeks divided into general preparation period (5 weeks) and basic training (6 weeks).

Test protocol. Psychological tests:

- Assessment of psycho physiological condition was carried out in combined computer psycho diagnostic complex «Effecton Studio 2007» (Russian Federation) [9]. Tests runners were presented on a computer in a variety of visual and audio stimuli to which the athlete responded by pressing keys on the keyboard (the program calculates the average response time and standard deviation): a simple motor response to visual stimulus (test «Shooting range» - response quick discoloration (2 attempts)); simple motor response to auditory stimulus (test "Duel" - to respond to the sound stimulus (2 attempts))$
- Colored test by M. Luscher (adaptation of L. Sobchik) [15] to the calculation of the deviation from the norm autogenously Valneffer [14].

Motor tests:

- to determine the level of flow rate in distance we used: 30 and 60 m running with low start. Time of running fixed Swift timing (Lismore, Australia);
- in order to determine the level of power-speed we used: standing long jump; standing triple jump; vertical jump by V. M. Abalakov [1];
- to determine the level of power capacity we used: repeated squats with a barbell on the shoulders with a maximum weight (the angle of the knee joints 90).

Protocol of vibration. We used Vibrotrainers Turbo Sonic X5 (Turbo Sonic, Hood River, Oregon, USA.) At a frequency of 40 Hz amplitude 4 mm, exposure time 1–1,5 min.

- after the first training, if scheduled second, the athlete stood at the feet massagers, sit in on a chair so that angle bending in knee joints was equal to 90^o (exposure 1,5 minutes), next passed in vertical position (time 1,5 minutes);
- after the second training before the first two positions are added lasting 1 minute each:
- 1-st position: massage gastrocnemius: athlete sitting on a soft saddle which on the level of simulator, lay key calf on vibrotrainer;
- II-nd position: massage biceps femurs: athlete sitting on soft saddle which on the level of simulator, lay hip on vibrotrainer. If scheduled only single training complex procedures was identical as used after second training.

Air ionization protocol. We used Anion Air Purifier (BSE-988) (BSE Blue Star Electronics Industry Co., Ltd. Guangdong, China) in sessions lasting 20 minutes. The range of concentrations of negative air ions, on average, 1-10 ths. air ions in 1 cm^3. The athlete placed on a distance from 0,3-1,0 m from the vehicle and not closer than 0,5 m from the wall of the room. Room temperature +18-22 C°, relative humidity less than 80%. A stimulation course started with small doses with gradual bringing to full dose for 5-7 procedure.

Protocol of listening to binaural beats. Athletes listening CD «Relaxation», comprising θ-rhythm (4-7 Hz), lasting 20 minutes. The athlete took a comfortable position in the room for rest. Runners were recommended to close their eyes, relax, and listen to music without analyzing. We used the stereo headphones type Sony LF-700 (Minato, Tokyo, Japan) and music portable media players such Transcend MP710 (Transcend Information. Inc., Taipei).

Data collection and analysis. Control was conducted before, after and during training. Testing of motor characteristics was performed after a day of the rest at baseline and after mezocycle.

During the tests the safety of athletes was controlled and the proper progress of the training. The study was conducted in accordance with the Helsinki Declaration. The study was approved by the ethics committee of the Kharkov State Academy of Physical Culture. All participants gave informed consent and were acquainted with the procedure of the study.

Statistical analysis of the data. To assess the relationship of obtained measurements we calculated the Pearson correlation coefficient. All analyses were performed by using the statistical Statistica package, version 10 (Statsoft Inc., Tulsa, Oklahoma, USA). The level of significance was set at $P<0,05$.

Results

In general preparatory mezocycle a reliable relationship between simple motor reaction to light and auditory stimuli (r=-0,63), and between the vertical and standing triple jumps (r= 0,58) is revealed. Thus, it is revealed the rate of motor response to visual stimuli of sprinters correlated with the 60 m and 30 m speed running segments with low start (r=0,62), and the standing triple jump with a distance (r=-0,78) and barbell squats on the shoulders (R = -0,54). The length of the standing triple jump correlated with speed running at 30

meters (r=-0,62) and 60 m with low start (r=-0,58), and with a barbell squats on shoulders (r=0,59). The high degree of correlation has the results of 30 m and 60 m running with low start (r=0,93).

In the basic mezocycle a close correlation is observed between the rate of covering intervals of 30 m and 60 m with low start (r=0,94), as well as 30 meters speed running and the standing long jump (r=-0,90). A simple motor response to auditory stimulus correlates with a simple motor response to visual stimuli (r=-0,71). A simple motor response to visual stimuli was correlated with the results of all motor tests, except standing vertical jump and deviations from the autogenous norm by M. Luscher test. The result of standing long jump was correlated with the result of the standing triple jump (r=0,77) and barbell squats (r=0,68). Result of triple jump was correlated with squats (r=0,58) and the 30 m speed running with low start (r=-0,60). Results of squats with a barbell on the shoulders correlates with the 30 m speed running with low start (r=-0,51). Thus, the result of the standing triple jump and squatting with a barbell on the shoulders was correlated with the speed of a simple motor response to light (r= 0,64; r= 0,55), and the sound stimuli (r=0,54; r= 0.80). Instead, the result of the 60 m running with low start in the competition significantly correlates with the performance of simple motor response to visual stimuli (r=0,66) and results of motor tests, except the length of the standing triple jump .

Discussion

In preparatory mezocycle an synchronous improvement was observed of the simple motor response to visual and auditory stimuli. Thus, a simple motor response to visual stimuli correlates with running speed, speed-power and power training, indicating the interdependent nature of their manifestation. Curiosity calls the relationship between the improvement of security capabilities and simple motor response the visual stimulus. Perhaps the power load creates a higher level of excitement of receptor-effector communication by recruitment of more motor units. This indicates that speed improvements can strengthen muscles. Correlation between the display of speed, quality and a power-speed shows the harmony of their development. Communication between motor reactions is explained by the improved neural transmission. This indicates an improvement in motor control and muscle coordination. Vertical height jump is correlated only with a distance of the triple jump, which indicates specificity of display in vertical jump of power-speed sprinters. The connection of the triple jump with squats with a barbell on shoulders indicates a significant contribution of the power component in the manifestation of speed-power skills of sprinters. Thus, we fixed the normal course of the adaptation processes of sprinters before the scheduled training load.

In the basic mezocycle an improvement of the speed simple motor response to auditory stimuli was correlated with an increase of speed- power and power capabilities. This improvement of production forces may be associated with overcoming fatigue, increased recruitment of the muscle fibers which were rapidly shrinking. Thus, a simple motor response to visual stimuli correlated with the speed running of sprinters. Therefore, the level of speed, in this period, grows at the expense of speed-power and power components of physical condition sprinters. This may indicate improving of contractility of the muscles. Improving of the running technique from the start shows a positive effect on selected recovery tools of psycho physiological condition of runners. As a whole, this suggests improving the ability of the muscles of sprinters generates mechanical power, which is a key element for improving their functioning. After all, the ability to respond quickly to a stimulus associated, to some extent, with the muscular system [4; 12]. This is also evidenced to the relationship of competitive distance of the (60 m) running in winter competition with improved response. Although it was not found significant links between autogenous deviation from the norm and other parameters that are monitored. However, it is possible to agree with the opinion [16] that psychological interventions lead to increased performance of athletes and is the forerunner for a high level of their sportsmanship.

Conclusions

The data indicate the complexity and variety of relationships between functional condition and special physical preparedness of the trained sprinters, depending on the training problems under solution. Harmonization of these connections provides means directed to a comprehensive normalization of the functional condition of sprinters and adequate processes of adaptation to the training load which increases progressively. This approach should include the ability to selectively influence on the level of the neuromuscular system of runner who receives the greatest load during training. The technique of the parameters that had recommended will be mostly effective in the operational and current recovery periods. **Prospects for further research.** Further testing of the recovery means is planned in the training of qualified elite sprinters during the period of competition.

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References

Abalakov, V. N. (1960). New equipment for the study of sports. *Physical Education and Sports*, 36.

Abeln, V. (2013). Brainwave entrainment for better sleep and post-sleep state of young elite soccer players - a pilot study. *European Journal of Sport Science*, 14(5), 393-402.

Bompa, T. O. and Carrera, M. (2005). Periodization training for sports. 2nd ed., Champaign, III.; Leeds, Human Kinetics.

Brown, A. M., Kenwell, Z. R., Maraj, B. K. V. and Collins, D. F. (2008). "Go" Signal Intensity Influences the Sprint Start. *Medicine and Science in Sports and Exercise*, 40(6), 1142-1148.

Grabarczyk, Z. J. (2000) Air ionization in environment of life and of work. *CIOP: Warszawa* [In Polish].

Lane, J. D., Kasian, S. J., Owens, J. E., & Marsh, G. R. (1998). Binaural auditory beats affect vigilance performance and mood. Physiology and Behavior, 63(2), 249 252.

Le Scouarnec, R. P., Poirier, R. M., Owens, J. E., Gauthier, J., Taylor, A. G., Foresman, P. A. (2001). Use of binaural beat tapes for treatment of anxiety: a pilot study of tape preference and outcomes. *Alternative Therapies in Health and Medicine*, 7, 58–63.

Lohman, E. B. 3rd, Petrofsky, J. S., Maloney-Hinds, C., Betts-Schwab, H., Thorpe, D. (2007). The effect of whole body vibration on lower extremity skin blood flow in normal subjects. *Med Sci Monit*, 13(2), 71-6.

Mihuta, I. Y. (2006). Psychological service in education effecton Studio. *Lipetsk: LEGI,* 298.

Minh, A. (1984). Hygiene. *Lipetsk: Medicine*, 320 -325.

Lythgo, N., Eser, P., de Groot, P., & Galea, M. (2009). Whole-body vibration dosage alters leg blood flow. *Clinical physiology and functional imaging*, *29*(1), 53-59.

Paradis, G., Zacharogiannis, E., Tziortzis, S. (2004). Correlation of reaction time and performance in 60 and 200 m sprint running. *Med Sci Sports Exerc*, 36(Suppl), 310.

Rhea, .M. R. (2009). Effect of iTonic whole-body vibration on delayed-onset muscle soreness among untrained individuals. *J Strength Cond Res,* 23(6), 1677-1682.

Shiposh, K. (1980) The value of autogenic training and biofeedback feedback electrical activity of the brain in the treatment of neuroses.

Sobchik, L. N. (1990) The method of color choices. Modified Luscher color test (metod. manual). *Moscow. personnel center at Ch. Ctrl. Labour and social. Problems. IPCC.* M., 87.

Weinberg, R. S., & Gould, D. (2011). Foundations of sport and exercise psychology (5th ed.). Champaign, IL: Human Kinetics