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

YEFREMENKO A.¹, SHESTEROVA L.¹, KRAJNIK Y.¹, NASONKINA H.¹, SHUTEEV V.¹, SHUTEEVA T.¹, DRUZ V.¹, PYATISOTSKAYA S.²
¹Department of Athletics, Kharkov State Academy of Physical Culture, UKRAINE
²The department of computer science and biomechanics, Kharkov State Academy of Physical Culture, UKRAINE

Published online: September 26, 2016
(Accepted for publication September 05 2016)
DOI:10.7752/jpes.2016.03140

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=Y0,78) 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 ions 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.
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 «Effector 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° (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;
  - 1-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 cm³. 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 0-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

898

**JPES ®**

www.efsupit.ro
parameters that are monitored. However, it is possible to agree with the opinion [16] that psychological
physical preparedness of the trained sprinters, depending on the training problems under solution. Harmonization
psycho physiological condition of runners. As a whole, this suggests improving the ability of the muscles of
power and power training, indicating the interdependent nature of their manifestation. Curiosity calls the
relation of competitive distance of the (60 m) running in winter competition with improved
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
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 (60 m) running 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.

Acknowledgements
This study was carried out in the scope of «Modeling of technical and tactical activities of skilled
athletes in swimming and speed-power kinds of athletics» according to the scientific direction of the Kharkov
State Academy of Physical Culture.

References

YEFREMEMKO A., SHESTEROVA L., KRAJNIK Y., NASONKINA H., SHUTEV V., SHUTEVA T.,
DRUZ V., PYATISOTSKAYA S.