Customized training service with health and fitness tests for cyclic sports elite in post-covid-19 rehabilitation period

UDC 76.015

Dr. Hab., Professor **V.P. Guba**[1]
PhD, Associate Professor **V.V. Marynich**[2]
[1]Russian State University of Physical Education, Sports, Youth and Tourism (SCOLIPE), Moscow
[2]Polessky State University, Pinsk, Belarus

Corresponding author: rodin67@bk.ru

Abstract

Objective of the study was to analyze the respiratory system functionality in the cyclic sports elite in the clinically monitored post-COVID-19 rehabilitation periods to offer training system customization options sensitive to the respiratory system health conditions.

Methods and structure of the study. We sampled for the study the 19-22 year-old cyclic sports elite (n=16, including 6 males and 10 females) qualified CMS, MS and WCMS. The sample was tested four times per day as follows: (1) morning test; (2) post-aerobic-training test; (3) post-high-intensity (sub-maximal) anaerobic training test; and (4) rehabilitation-period test using a portable electrochemical NO-analyzer (NObreath, Bedfont Scientific Ltd.). The bronchial asthma and allergic rhinitis diagnosed individuals were excluded from the sample.

Results and conclusion. An individual training system will be prudently managed with the workouts customized to the energy corridor of aerobic and anaerobic metabolism. There are good reasons to believe that the post-COVID-19 regress is due to a sort of 'energy pits' with the athlete being unable to attain the pre-disease workloads within the anaerobic zone with the required anaerobic power. Premature transition in the anaerobic energy supply range in the early training process stages may expose the athletes to overstress risks, with regress in the functional fitness.

The study found the elite cyclic sports sample being less tolerant to trainings within the anaerobic metabolism zone; and for this reason we recommended the training system being prudently customized to make a special emphasis on the aerobic capacity development practices dominated by breathing exercises including those facilitated by breath training machines. We also recommended expanding the range of medical services and functional fitness tests in the training process using special individualized medical/ biological support service protocols with a special attention to the elite athletes' functional fitness test data flow variations.

Keywords: *elite athletes, functional fitness, COVID-19, respiratory system disorders, preventive care.*

Background. Modern sports communities report facing problems in their efforts to train and keep the elite athletes fit in post-COVID-19 rehabilitation periods. Clinical study reports show that standard rehabilitation protocols with the respiratory system complications prevention components are not always effective enough in the respiratory system health assurance even in cases of minor/ subclinical symptoms of the disease. National health systems are still contradictory in the disease control/ rehabilitation issues, databases, rehabilitation service recommendations and service timing/ management aspects, and pharmacological support standards in cases of long-lasting symptoms and many other related issues. Particularly sensitive in this context are the modern elite cyclic sports with their great energy costs and dominant

aerobic energy mechanism, as their training systems need to be efficiently customized to the post-disease conditions with a special attention to the external respiration system functionality test data flows.

Many analysts in the above context have been interested in the NO (nitric oxide II) tests as this oxide is considered a fair biological marker of allergic and inflammatory conditions. Exhaled NO (NOex) level is known to notably grow in cases of prolonged respiratory system inflammations and/ or allergic conditions. Some aspects of this marker application, however, are still rather contradictory despite its extensive practical application experience in studies. It should be mentioned that many sports-specific NOex test methods are still underdeveloped. We believe, therefore, that the NOex tests and analyses in elite cyclic sports training systems in the post-COVID-19 rehabilitation periods could be beneficial for the practical sports research and sports health service.

Objective of the study was to analyze the respiratory system functionality in the cyclic sports elite in the clinically monitored post-COVID-19 rehabilitation periods to offer training system customization options sensitive to the respiratory system health conditions.

Methods and structure of the study. We sampled for the study the 19-22 year-old cyclic sports elite (n=16, including 6 males and 10 females) qualified CMS, MS and WCMS. The sample was tested four times a day as follows: (1) morning test; (2) post-aerobic-training test; (3) post-high-intensity (sub-maximal) anaerobic training test; and (4) rehabilitation-period test using a portable electrochemical NO-analyzer (NObreath, Bedfont Scientific Ltd.). The bronchial asthma and allergic rhinitis diagnosed individuals were excluded from the sample.

Results and discussion. Resting NOex was tested to average 24.5±4.5 ppb; and to widely vary in trainings to peak at 35 ppb in the post-anaerobic-training tests, with the falls down to 14.2±3.8 ppb in the rehabilitation-period tests. The NOex production was naturally tested to grow with the physical stress and fall in rehabilitation rehab time, with some variations indicative of the remaining pathological conditions associated with hyper-responsiveness of the airways – reasonably believed to be indicative of the virus-related long-lasting respiratory system conditions.

The NOex variations snapshot tests in the intensity-stepping physical trainings found the wavelike NOex production patterns significantly correlated with the anaerobic workout intensity. The 20+ ppb NOex growth tested in some individuals may be indicative of hyper-production of this biological marker due to the chronic respiratory system inflammation on the verge of clinical conditions.

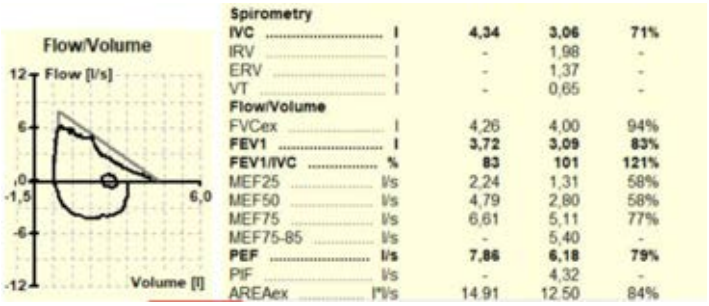
The above NOex tests were combined with spirographic tests that found insignificant falls in the FEV-1 (1-second forced exhale volume test) considered a marker of bronchial patency deficiency) under 80% of the norm. We believe that the still high FEV-1 test rates in the sample may be interpreted as indicative of good compensatory adaptation and high respiratory system resource due to the endurance training. A few individuals were tested with the 25+ ppb NOex rates and qualified with the dynamic monitoring group subject to special respiratory system malfunction prevention and correction service.

Special breathing practices with the central nervous system control effects will be in special priority in the respiratory system disease prevention service. These practices help improve the individual volitional breath control, strength and endurance of the main and supplementary respiratory system muscles, static/ dynamic respiratory volumes and capacities; and mobilize the cardio-respiratory system resource. Thereby they contribute to the hypoxia tolerance resource, speed up the respiratory system recovery processes and optimize the individual psycho-functional conditions.

Equally important for the post-COVID-19 respiratory system recovery service are the medical tests in the training process with special individualized medical/ biological support service protocols sensitive to the training stages. Such service will include the repeated external respiration tests, functional fitness tests with rhythmographs, biochemical marker tests (ALT, ALAT, creatine kinase, urea tests), plus special research to find the respiratory system damage/ chronic inflammation indicators with the risk assessment elements. The NOex should be prioritized among the other key respiratory system health test markers in the training process tests.

An individual training system will be prudently managed with the workouts customized to the energy corridor of aerobic and anaerobic metabolism. There are good reasons to believe that the post-COVID-19 regress is due to a sort of 'energy pits' with the athlete being unable to attain the pre-disease workloads within the anaerobic zone with the required anaerobic power. Premature transition in the anaerobic energy supply range at the early train-

Table 1. *Post-anaerobic-zone training functional fitness test data*

Functional fitness by rhythmographs	Respiratory system functionality
Very low current FF (-2). Individual adaptability heavily compromised (1).  Physiological functions have seriously sagged [1].	 FeNOex – 35 ppb Finding: Airway patency reduced the middle bronchi. Respiration resource low.

ing process stages may expose the athletes to overstress risks, with regresses in the functional fitness: see Table 1 hereunder.

Conclusion. The study found the elite cyclic sports sample being less tolerant to trainings within the anaerobic metabolism zone; and for this reason we recommended the training system being prudently customized to make a special emphasis on the aerobic capacity development practices dominated by breathing exercises including those facilitated by breath training machines. We also recommended expanding the range of medical services and functional fitness tests in the training process using special individualized medical/ biological support service protocols with a special attention to the elite athletes' functional fitness test data flow variations.

References

1. Avdeev S.N. Influenza A virus pneumonia and acute respiratory distress syndrome. H1N1. Pulmonologiya. Application. 2010. No.1. pp. 32-46.
2. Bilichenko T.N., Chuchalin A.G. Morbidity and mortality of Russian population from acute respiratory viral infections, pneumonia and vaccine prevention. Terapevticheskiy arkhiv. 2018. V. 90. No. 1. pp. 22-26.
3. Galkin A.A., Demidova V.S. Central role of neutrophils in pathogenesis of acute lung injury syndrome (acute respiratory distress syndrome). Uspeikhi sovremennoy biologii. 2014. V. 134. No. 4. pp. 377-394.
4. Guba V.P., Marinych V.V. Theory and methodology of modern sports research. Moscow: Sport publ., 2016. 232 p.
5. Barnes P., Kharitonov S. Exhaled nitric oxide: a new lung function test. Thorax, 1996; 51: pp. 233-237.
6. Leone A., Gustafsson L., Francis P., Persson M., Wiklund N., Moncada S. Nitric oxide is present in exhaled breath in humans: direct GC-MS confirmation. Biochem Biophys Res Commun 1994; 201: pp. 883-887.

THEORY AND PRACTICE OF PHYSICAL CULTURE

Научно-издательский центр "Теория и практика физической культуры и спорта" *(Москва)*

Номер: **7** Год: **2021**