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Health Testing

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The concept of "physical performance" refers to each person, regardless of type of activity. Not a small role is played by the problem of working capacity in the sports sector among professional athletes and coaches, since it is thanks to a high level of working capacity that great results are achieved in competitions and control training.

Nevertheless, the term health has many definitions, one of which is that health is the ability of a person to effectively perform motor or mental activity in specific conditions, which leads to reversible functional changes in the body.

In sports practice, there are many ways to test the performance of athletes. The most popular and effective we will consider now.

For example, several of the tests with maximum exercise capacities are the Vita Maxima test, the Novakki test, where the athlete performs certain motor actions with a progressive increase in work capacity until exhaustion. Therefore, these methods have a huge drawback: the samples are very traumatic for athletes, therefore, a doctor must be present during the test.

There are also tests with submaximal load power, where indicators of physical performance are recorded during the passage of the sample or after its completion. These tests are simpler, and the indicators depend not only on the work done, but also on the characteristics of the recovery processes. These are such tests as the Harvard step test, PWC-170, treadmill and others.

A feature of these tests is that there is a relationship between the power of muscle work and the duration of its performance in the form of an inversely proportional relationship. Let us consider in more detail several of the tests in technical terms.

Harvard step test

This test was developed at Harvard University in 1942 and is one of the most versatile and effective tests in sports. Its technical component is the presence of a stopwatch, metronome, tonometer and bench for a step test with different heights, depending on the gender and age of the athlete.

During the test, the test subject rises to a step of a certain height with a frequency of 30 times in 1 minute for 3 to 5 minutes. The rise frequency is set by the metronome - 120 beats per minute. The determination of heart rate is carried out in the first 30 seconds at the 2nd, 3rd, 4th minutes of rest. Then, the physical performance of the athlete is determined by the formulas [1].

In general, the Harvard step test assesses the rate of recovery of the body after an intense short-term load. Based on the performance of the cardiovascular system. The endurance of the organism as a whole also depends on how quickly it returns to the usual rhythm of work after exercise.

Using the Harvard step test, you can track the degree of increase in fitness or its decrease, for example, during breaks in training.

PWC-170 on a bicycle ergometer

The testing procedure proposed by Swedish scientists was very burdensome, since the athlete had to perform 5 or 6 increasing loads on a bicycle ergometer lasting 6 minutes each until reaching a heart rate of 170 beats [2].

The basis of the PWC170 test is the determination of the physical load power at which the heart rate reaches 170 beats / min, i.e. the level of optimal functioning of the

cardiorespiratory system. The theoretical basis of the PWC170 sample is two physiological patterns:

1) increased heart rate during muscle work is directly proportional to its intensity (power or speed);

2) the degree of increased heart rate during unsaturated physical activity is inversely proportional to the functional capabilities of the cardiovascular system, which is an indirect criterion for physical performance.

Treadmill

Before starting the test on the treadmill with the determination of the IPC, it is necessary to determine the battery charge of the bolograph, charge the backup batteries, turn on the gas analyzer for heating, and then calibrate it. Calibration is performed using a calibration bottle.

At the preparatory stage, it is necessary to check the availability and quality of safety belts, the presence of everything necessary for fixing the mask, as well as the presence of several soft belts for cardiomonitoring. The availability of drugs for urgent emergency care is not of little importance.

Before the start of the measurement program, the subject must be equipped with the necessary equipment. The belt for heart rate monitoring [2] is fastened after preliminary wetting of the electrodes with warm water or an electrically conductive gel. The athlete is also insured with a special belt, where one carabiner of the safety rope is fixed to the belt, the other for the safety cable, which is located at the top along the entire tape of the treadmill. The mask is fixed on the athlete's face, after which they ask the test subject to breathe, then close the mask opening with his hand and ask the athlete to exhale. As a result, air should not be allowed to go outside the mask. Before starting the program, the equipment initialization stage is performed. For this, it is necessary that a tape for measuring heart rate, a pulse oximeter, a gas analyzer be fixed on the

athlete. After the testing itself, the following indicators of external respiration and gas exchange are analyzed:

- 1) minute volume of breathing;
- 2) oxygen consumption rate;
- 3) the rate of carbon dioxide emission;
- 4) maximum oxygen consumption rate;
- 5) relative oxygen consumption;
- 6) respiratory coefficient.

The threshold of aerobic metabolism, anaerobic metabolism, the ventilation equivalent for oxygen, the rate of oxygen consumption at the level of the threshold of aerobic and anaerobic metabolism are also determined.

All these tests are possible thanks to sports engineering, which allows you to correctly and adequately prepare highly qualified athletes and clearly organize the system of medical and pedagogical process.

In the world of high achievements, where it is a matter of fractions of a second, it is the introduction of innovative approaches in working with athletes that can become the very “key ingredient” that will help to beat rivals. Specialists have already called the exclusive technologies developed by the sports engineering department of the sports and technical faculty of BNTU “our competitive advantage”, since they allow making the preparation of national teams more effective.

References:

1. Exercise capacity. Clinical methods [Electronic resource]. – Mode of access: <https://ncbi.nlm.nih.gov/books/NBK404/>. – Date of access: 28.03.2020.
2. Heart rate monitor [Electronic resource]. – Mode of access: <https://en.m.wikipedia.org>wiki>. – Date of access: 22.03.2020.