Yednak V.D., https://orcid.org/0000-0003-0009-8805
Vasiruk M.S., https://orcid.org/0000-0002-9899-4589
Yednak D.V. https://orcid.org/0000-0002-0459-0701

TRAINING MODES AND ENERGY SUPPLY OF MUSCULAR ACTIVITY IN SPRINTING

Ternopil Volodymyr Hnatiuk National Pedagogical University

Annotation. The publication defines and characterises the main modes of work and rest and features of the energy supply of muscle activity in sprinting.

Keywords: sprint, perfo rmance, sports training, energy supply.

Relevance. Growing competition in running athletics, steadily increasing volumes and intensity of training and competitive loads cause the search for new ways of organisation of the educational and training process of athletes of different qualifications. Modern trends in the development of high-performance sports require systematic improvement of the organisational and methodological foundations of sports training. The control of training and competitive loads is the main link in a complex and multifaceted chain of athletes' training management. Effective management of this process, first of all, depends on the coach's knowledge of the laws of adaptation of the athlete's body to loads. Knowledge of training regimes and mechanisms of energy supply of the muscular system determines the distribution of loads by direction and magnitude during a certain period of their preparation. [1]

The aim of the study: to determine the main training modes and features of energy supply of muscular activity in sprinting.

Research methods: analysis, synthesis, generalisation and systematisation of existing scientific data and personal experience.

Results of the research. One of the important aspects of training process management is a rational alternation of physical exercises with rest. The following stages of rest are distinguished: restoration of working capacity, above the initial working capacity, to working capacity, reduced working capacity.

Depending on the stage of recovery of performance at which each subsequent exercise or training session is performed, there are 4 main modes of their alternation with rest. Conventionally, they can be called A, B, D and E (M.V. Leinik). [2]

Mode A is used to develop speed, strength and special endurance. Each subsequent exercise begins at the stage of muscle performance recovery at a heart rate of 120-135 beats per minute for 2-3 minutes of recovery. Exercises of mode A are performed serially, 3-4 in a series, rest between exercises - 2-3 minutes, between series - 3-4 minutes.

Mode B is used for the development of speed, strength, speed-power and coordination capabilities. Each subsequent exercise begins to be performed during the stage of superior performance at a heart rate of 105-115 beats/min. on the 4th-5th minute of recovery. Exercises in mode B are performed serially, 3-4 in a series, rest between exercises - 4-5 min, between series - 5-6 min.

Mode D is used to maintain or slightly improve the functional state and special performance of the athlete's body.

Running loads are divided into:

a) aerobic exercise. Exercise time - from 30 minutes to 2 hours, heart rate - up to 150 beats per minute;

b) load of the mixed aerobic-anaerobic character. Time of the exercise - 3-10 minutes, pulse - 150-180 beats/min;

c) anaerobic-lactate (glycolytic) load. Exercise time - 2-3 minutes, heart rate - 190 beats per minute and above;

d) anaerobic-alactic load. The time of the exercise is 10-15 seconds, the heart rate is 180-190 beats per minute.

All training and competition activities involving aerobic and anaerobic processes are powered by energy.

Aerobic (oxygen) processes take place in the body with the participation of oxygen, in which food substances (carbohydrates, fats, proteins) are subject to oxidation.

Anaerobic processes occur without the participation of atmospheric oxygen due to the breakdown of energy-rich organophosphorus compounds found in muscles and the enzymatic breakdown of carbohydrates.

Additionally, anaerobic processes are divided into glycolytic and phosphogenic (alactate) processes, where the energy source is creatine phosphate and ATP. All of these processes are characterised by maximum intensity.

The works of W. Engelhardt, A. Hill, and A. St. Dieudi have proven that muscles receive the energy they need to work from adenosine triphosphoric acid (ATP), which is found in muscles and cells. The phosphate bond is broken down by enzymatic processes, and ATP is broken down into adenosine diphosphoric acid (ADP) and inorganic phosphate. The energy stored in the compound is released.

The reserves of used ATP energy are replenished from three sources: the breakdown of creatine phosphate (CP), the glycolysis reaction - the incomplete breakdown of glucose to lactic acid, and, finally, the aerobic oxidation of proteins, fats, and carbohydrates to carbon dioxide and water.

All three sources differ in speed and duration, power and capacity. As an energy source, creatine phosphate is three times more powerful than the glycolytic process and 4.5 times more powerful than the aerobic process. The creatine phosphate mechanism allows you to develop the highest running speed. It turns on at the same time as you start running and reaches its maximum power in 2-3 seconds. The disadvantage of this energy source is its low capacity: Only 5 kcal. Since the energy requirements in a sprint are up to 1 kcal/sec, the CF reserves are not enough even for a 100-metre run.

Glycolysis can provide energy for several minutes. But the maximum energy output of this source does not begin immediately after the start of work. For most athletes, it takes 1-1.5 minutes. Sprinters of this composition, using a powerful but short-lived creatine phosphate source, show high sports results only in the 60 and 100 m dash. Those athletes whose glycolysis process starts earlier, 15-20 seconds earlier, achieve high results in both the 100m and

200m dash. Examples of such universal sprinters are: V. Borzov (USSR), P. Menea (Italy), T. Gay (USA), U. Bolt (Jamaica).

In other words, from the energy point of view, a sprinter's talent is due to the innate capabilities of energy supply and is genetically determined.

But it is also possible to improve the mechanisms of energy supply. Creatine phosphate, for example, by repeatedly running short distances (30-80 m) at a speed close to the maximum in the supercompensation phase. Glycolytic – running at distances up to 600 m in the phase of incomplete recovery.

After reaching maximum running speed, the creatine phosphate energy source is exhausted, while the glycolytic energy source has not yet reached its maximum. However, the external repulsive power does not decrease, but even increases. This means that other, non-metabolic energy sources are also used when running at top speed. It is the same mechanical energy of the athlete's body that in the braking phase leads to the stretching of tense muscles, concentrating in them in the form of elastic deformation energy. In the phase of removing the foot from the support, it is again converted into mechanical energy, increasing muscle contraction. This phenomenon is called ***energy recovery. The*** main group of muscles that accumulate external energy are the plantar flexors of the foot. Fast running is possible when the plantar flexors of the foot are more extended. This leads to important conclusions for practice: it is necessary to comprehensively improve the spring functions of the foot.

The higher the stiffness of the muscle (especially its tendon part), the lower the energy dissipation and the greater its accumulation, which is exactly what is needed for fast running.

While the muscles of the hip joint can store 20% of mechanical energy during a running cycle when they are stretched, the extensor muscles of the knee joint can store about 50%. And in the plantar flexors of the foot during the period of support - about 100%. This means that the muscles of the hip joint work mainly at the expense of metabolic energy sources and get tired earlier than others. Therefore, along with strengthening the muscles of the foot, it is necessary to pay attention to the development of local high-speed endurance of the hip joint muscles. First of all, the extensors.

The athlete's posture is of particular importance in running. The most important thing is that the body weight is always placed on the forefoot. It is in this position that all connective tissues are maintained in a state of optimum readiness to perform efficiently. By staying in this position, the runner maximises the use of muscle and tendon elasticity and resilience, thereby reducing energy expenditure. [2]

The effectiveness of "elastic" running is that it is possible to maintain a high pace of steps dueto the release of mechanical energy, without the inclusion of an anaerobic process of energy supply using ATP, providing work for longer sprint distances.

All of these facts indicate that the key problem with speed and strength training is the issue of improving the release of elastic energy from tense muscles and tendons. Therefore, it is simply necessary to consider specialised strength training as being designed for tendons rather than muscles. Tendons can be compared to a rubber band. The energy stored by such bands is directly proportional to the length to which they are stretched. We must remember one rule: weight training increases the strength of the muscle-tendon unit. While flexibility exercises increase its plasticity. In this situation, athletes who need to maintain tendon elasticity can use ***plyometric*** (jumping) training rather than weight training to increase strength. This is because such exercises do not reduce the elasticity of the tendons and can increase their energy release. For a musculotendinous unit, it isnecessary to have a large range of motion and sufficient elasticity at the same time. Dynamic stretching exercises and low-intensity plyometric sprint training can help runners achieve the ultimate goal of running efficiency. [3]

It is important to pay attention to the fact that all jumps must be performed on the forefoot, just as when running. The most important aspect of these jumping exercises is that their purpose is not to push off, but to abruptly remove the foot from the support with a concentrated explosion of thehip flexors.

Conclusion. The analysis of scientific and methodical literature and own experience testify that the constant increase in volume and intensity of training loads and the growth of intensity of competitive activity in sprinting cause the necessity of application in preparation of sprinters of rational alternation of physical exercises with rest, additional means of stimulation of restoration of physical efficiency that will promote the increase of efficiency of the educational and training processand competitive activity of sportsmen.

***References*:**

1. Akhmetov RF, Maksymenko GM, Kutek TB Athletics: a textbook. Zhytomyr: ZhytomyrIvan Franko State University, 2010. 320 c. [Ukrainian].
2. Vasiruk M.S., Yednak V.D. Selection and training in short distance running (second edition, supplemented and revised). - Ternopil: Volodymyr Hnatiuk TNPU Publishing House, - 2022. - 105 p. [Ukrainian].
3. Optimisation of physical and technical training in high-speed and power athletics: monograph. Edited by V. Konestyapin, Y. Svyshcho. - Lviv, 2016. - 220 p. [Ukrainian].