THE PHYSIOLOGICAL EFFECTS OF INTERVAL-TRAINING IN OBSTACLE RUN OF THE MILITARY PENTATHLON

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OUTLINE

1. INTRODUCTION

For some years, an essential military sport was needed which could be attractive and could really answer the demands of modern combat.
The Military Pentathlon is a modality of sport with high difficulty and exhaustive practice that requires almost 5 years of preparation so that the athlete can reach international level. When this preparation is accomplished in an orderly, methodical and progressive way, the athlete can compete for a period of 10 years. This depends on the development of several characteristics, inherent to that sport, which requires several physical and technical qualities to be acquired throughout a long-term perspective (Manual C 20-25 / Military Pentathlon).

Success is mainly due to constant training that induces physiologic alterations in whole body systems, particularly in the skeletal muscles and in the circulatory and breathing systems.
The effects of training can be studied and classified through the following alterations: 1) the ones that happen in the tissue level, meaning biochemical alterations; 2) the ones that happen systematically, affecting the circulatory and breathing systems, including the system O2 transport; 3)and finally, those related to alterations of blood pressure and the acclimatization in ambient temperature (FOX, BOWERS & FOSS, 1991).
In order to obtain high athletic results, we should use different training methods (HARRE, 1997), but this study mainly seeks to point out the physiologic effects achieved through Interval-Training, that will optimize the role of the athlete as well as the necessary physical qualities demanded in Obstacle Run which includes 20 obstacles, disposed in the distance of 500 meters.

2. REVISION OF LITERATURE

2.1 Basic Procedures for Interval-Training (IT)

According to PLATONOV (2001) certain procedures for the optimization of the IT must be followed such as:

a. The application of the “principle of overweight” in training with interval charges are done by:
1) Increasing amount of training;
2) Increasing intensity of the efforts;

3) Decreasing intervals among the efforts.

b. The application of “principle of the advantageous pausing”. According to his principle, WEINECK (2000) states that a rapid drop of heart frequency occurs after the end of the effort, and the measuring of its effect on the heart provides feedback on the condition of the athletes' training. Since frequency drops in a logarithmic way, the pause must be brief to be advantageous, because it would take too long to allow a complete recovery. Until the recovery is complete it would be necessary to wait too long. Thus, when Heart Beat (HB) reaches 140-120 bpm, the next repetition is initiated right away.

2.2 Physiological Considerations of Interval-Training

The physiological considerations of the I.T. are based on two different stimuli at body systems: the effort made by athlete and the interval among efforts; both are responsible for the physiological adaptations on the heart, energy systems and neuromuscular system.
During the effort, especially at its end and in the beginning of the interval, a strong resistance in the peripheral circulation is noticed, due to the muscular contractions that make the circulation difficult. The heart, according to HOLLMANN (1989), decreases in size, because it works on the limit or a little above its capacity, depending on the biological individuality, causing a short diastolic charge, in consonance with the Law of Frank-Starling, which is going to normalize gradually.
The heart working (180 bpm) against the peripheral resistance will allow the muscular fibers to hypertrophy, due to repetitive efforts.
During the interval, will be a general muscular relaxation, providing a smaller resistance to the peripheral circulation, when an increase of the systolic debit occurs. Then, an increase of the heart volume occurs, evidenced by an enlargement of the heart chambers.
In reference to the energy consumed during the effort, due to the debit of O2 absorbed, the phosphates energy sources (ATP-CP reserves) are rapidly consumed. The blood levels of lactic acid will rise, being resynthesized in the liver, where it will become glycogen according to Meyer-Hoff reaction. The accumulation of lactic acid, during the efforts, can reach so high levels that will gradually increase the athlete’s acid lactic tolerance. During the intervals, the systematic repletion of the ATP-CP reserves will increase those reserves and the liver’s capacity of resynthesizing lactic acid will increase gradually.
During high intensity efforts, the neuromuscular system will be continuously stimulated to promote faster and stronger movements. Those stimuli will create better transmissions of the nervous pulses to the muscles, better recruitment of motor units, muscular hypertrophy, better neuromuscular coordination and, at last, faster execution of movements.

Regarding heart frequency, it should raise to the mark of 180 bpm, reaching the minimum limits from 140 to 120 bpm when the systolic debit increases, what will start happening 30 seconds after the athlete's recovery.

Referring to blood pressure, it increases during the effort, presenting a significant decrease during the interval, in parallel to what happens to the heart beat.
During the effort, all the capillary blood vessels enlarge, and they remain under this condition up to 20 seconds after the beginning of the interval, when the lowering of the blood pressure occurs, increasing after 90 seconds; the capillary vessels go back to normal 3 to 4 min after the effort. It is this constant cycle that, in addition to the physiological effects from the resistance on the peripheral circulation, that allows the hypertrophy of the heart walls and the expansion of its chambers.

In this way, the physiologic considerations are supported by the study of the results of this specific competition, on the final bulletins of several world or national championships, and in several training controls made by team coaches, particularly of high level teams.

The author tried to identify parameters such as: the athletes' evolution in each training or competition to prove the effectiveness of the referred method, with the consequent physiological effects.

It has been stated that among the Brazilian athletes' Armed Forces during 1999, 2000 and 2001, there was a great improvement in the course performance from the initial period to the pre-competitive training, and after interval practice.

From 1996 to 2001 we have had the best results among Brazilian athletes, in those years in which the coaches prefered to use interval-training method in Obstacle Run.. Thus, we found that the best results took place due to physiological adaptations caused by the method we already mentioned above.

In ROCHA'S & CALDAS'(1978) studies some advantages and disadvantages of the IT are mentioned:

1) Advantages:
   a) Larger demand of the cardiovascular and breathing systems;
   b) Improvement and development of chemical reactions;
   c) More precise conditions for the evaluation related to the biological individuality;
   d) Better control, avoiding the overtraining;
   e) Larger time saving in physical conditioning. One hour of that method corresponds to three, in normal race;
   f) Technical improvement (better neuromuscular coordination); and finally
   g) Larger defense against stress.

2) Disadvantages:

   a) It quickly reaches the mental and physiologic fatigue;
   b) No benefit of the stamina; and
   c) Overcharge of the muscle-articulating system.

2.3 Physical Qualities for the Obstacle Run

Based on the KUZNEZOV & BAKARINOV's researches (1973), TUBINO (1979), stated in specific studies for decathlon that: when the universality of this sport is considered and taken as a way to success, the authors started to understand this modality as a unique specialty.

Thus, they recommend an initial identification of all the physical qualities necessary to Decathlon, just to diagnose the priorities among the conditions.
The Military Pentathlon, a sport practiced by the Armed Forces, should also be seen as a unique specialty (modality). Therefore, among the physical qualities and motor abilities demanded, inherent to the effort and the peculiarities of the Obstacle Run, some principles of the application and their physiological effects obtained by training are as follows:

a. Resistance

Let us examine some effects of the IT upon the quality of anaerobic resistance:

1) According to ROCHA & CALDAS (1983); they are:
   a) Heart hypertrophy;

b) Increasing higher tolerance to the debit of O2, due to the increase of the available energy reserve;
c) Increase of alkaline reserve in the blood;
d) Maintenance of high work rhythm for a long time; and
e) Improvement of muscular hypertrophy.

2) According to BARBANTI (1997), they are:
a) Heart hypertrophy;
b) Larger capillarisation in tissue level or larger volume and larger number of capillaries; and
c) Increase of muscular irrigation and blood volume.

b. Strength

Some of the effects of training on the strength parameter are:
1) The increase of the transversal section of the muscle's, muscular fibers, resistance of muscles, neuromuscular influx and neuromuscular capacity;
2) Larger capacity to move heavier loads; and
3) Larger possibility of self displacement.

c. Speed

Some of the effects of training on the speed parameter are:
1) Rapid conception of the motor image by the brain;
2) Improvement in the transmission of the nervous pulses to the muscles;
3) Improvement of the anaerobic work;
4) Qualitative longitudinal increase of the muscles;
5) Automatism of specific gesture;
6) Improvement of muscular potency, of heart hypertrophy (anaerobic work) and of the antagonistic relaxation of the muscles; and finally
7) Faster execution of movements.

The most prominent and inherent motor abilities to a pentathlete are: coordination, rhythm, static, recovered and dynamic balance, explosion and flexibility.

2.4 Interval-Training in the Obstacle Run

The Obstacle Run is used by athletes of this modality and by troops during its military physical training as well. Its training is covered of peculiar characteristics, being based on interval efforts (C20-55).
The training for the Obstacle Run with interval charges, in its use with the variability already presented, is justified in preparation programs due to the following reasons:

1) It develops the anaerobic capacity faster than other methods;

2) It adapts the athletes' anaerobic physiologic mechanisms, so that they can bear intensity variations and anaerobic efforts, during the performances, specially in Obstacle Run;

3) It qualifies the athletes to take part in competitions with progressive intensity and in specific physical demands;

4) When the trainers use the physiologic control through the measuring of the heart frequency among the efforts, it allows them to obtain valid information for a follow up of the athletes' organic condition evolution.

However, there will not be practicing at the Obstacle Run during the whole training period. First of all, the run in the track is such an extremely tiresome activity, that could provoke a great overcharge to the muscle-articulating system, and also because, in order to start the IT work in Obstacle Run, the troop and the athletes would need a previous physiological preparation.

The Course has 20 obstacles, and it can be carried out as a whole or divided in two, three or more parts for the accomplishment of the IT. The pentathletes call each of these groups of obstacles as an “arm”.

Using this terminology, we can say that the course can be accomplished in one, two, three or more arms.

The application of the IT in the Obstacle Run may provide the athlete an improvement of speed, lactic anaerobic resistance, explosive force, coordination, agility and balance, besides the obtaining of the rhythm of competition. It is important to consider that the technique should be a constant concern of the entire training, and that the speed at which each obstacle is approached and executed consists in a fundamental component of the technique.

3 .CONCLUSION

From the initial phases of the sport of high productivity, sports training is presented, , as a way to obtain excellence as a result of the work. The high performance of the athletes in the CISM’s competitions, certainly, is a result of the integration of the several training methods, embracing the six types of the athlete's preparation, which are: physics, tactics, technique, psychological, complementary and supplementary (these two last ones related to the nutritional part), and of the relevant scientific progresses involving the physiologic effects of the specific exercise, as well.
And it is in the specificity of the execution of the Obstacle Run that points out how Interval-Training contributes to the development of the demanded physical qualities.

Interval-Training is the method that presents larger scientific basis and provides the coach with a methodical and rational measure of load evaluation, besides saving training time.

From “interval-training” of GERSCHLLER-REINDELL arose several other fractional methods, that come with modifications in the training factors, allowing the creation of a great number of combinations of interval works.

Concisely, it is possible to say that, through the interval methods, occurs the insertion of accentuated training incentives, related to the enlargement of the heart, as well as to the improvement of the metabolism of hydrates of carbon, or the anaerobic capacity, that are more or less accentuated, depending on the intensity, inclusion and length of the chosen course.

Finally, after reviewing literary studies involving physiological effects on interval training, in addition to the comparison of the results of military pentathletes in the Obstacle Run, it is possible to conclude that the physical qualities demanded by the course tend to improve by interval training. It will be necessary to continue the studies and the practicing of several methods of interval training in order to optimize the performance of our athletes, having as a slogan: overcoming is the limit!