Quantification of physical loads by using the criterions of exercise pulse cost

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Introduction

Adaptation to influence of physical loads in sports training may be quantitatively described by relationship “dose-effect” (1). The value of trained function increase for the period of observation is assumed as a parameter of achievable effect. A dose of influence of physical load is defined as the product of intensity of exercise energy expenditure on the period of the physical load action. This period assumed to be the sum of exercise time, the rest pauses time, and part of the recovery time that is related with the fast component of the oxygen debt. The absolute values of a heart rate usually used in practice of sports for an estimation of a level of exercise energy expenditure, find out linear relationship with a level of aerobic energy production only in the limited area of the exercises, that are not exceeded critical power value where the maximum of oxygen consumption is achieved. For wide range of exercises will be more correctly to use overall pulse criteria, such as the pulse sum of work, the pulse debt, the pulse cost of exercise which are derived from the time course analysis of the heart rate kinetics during periods of the work and recovery (2).

Methods

26 well-trained male swimmers, middle-distance runners and skaters (age 18-24 years, height 162-186 cm, body mass 62-83 kg), ranging from club to international level, volunteered to take part in the study. All subjects performed 5 all-out tests – 10 s, 30 s, 60 s, 120 s and 360 s duration without preliminary warm-up. The gas volume, the O₂ and CO₂ fractions in the expired air were measured using a monitor system (Beckman MMS). O₂-intake, O₂-debt, O₂-requirement, aerobic and anaerobic energy output were calculated with a special computer program. The blood lactate concentration is determined using an enzymatic method Dc Lange. Acid-alkaline balance parameters were determined using a pH and blood gases microanalyzer (Instrumentation Laboratory IL-213).

Results and Discussion

On graphs fig. 1A the changes of parameters work pulse sum, pulse debt, pulse cost of exercise are represented as a function of work limiting time. On graphs fig. 1B are submitted the changes of pulse sum level (calculated as ratio coincident pulse sum to exercise time).

Fig.1. Changes of pulse cost parameters in exercises of different limiting duration. 1 – pulse cost of exercise, 2 – pulse debt, 3 – work pulse sum.

Changes of parameters total pulse cost in dependence with values of exercise limiting time close reproduce appropriate relationships for parameters oxygen requirement and energy cost of exercise (3). Thus, pulse cost indices may be used as objective criteria for quantification physical loads as well at the development of programs of optimization of training in various kinds of sports.

References