INTEGRAL METHOD FOR DETERMINATION OF OPTIMAL SAFE METHODS OF PHYSICAL ACTIVITY FOR SERVICEMEN AT TRANING AND BATTLE ACTIONS

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Abstract
Due to absolutely new requirements to the system of military personnel physical training (especially at the first stage) it is necessary to obtain the positive dynamics of results for the short period of time allowing maximally to realize them during battle actions. These challenge increase the probability of a serviceman's organism overloading because in most cases a contingent consists mainly of physically unprepared to military service people. Our integral method for determination of optimal safe methods of physical activity allows to accelerate adaptation changes to the set terms of motive for people with different level of physical training, morphometric indices of body and individual functional possibilities for a short period of time (about three months) at a minimum volume of executed work, and what is more important it happens without any overloading, displaying of chronic fatigue, and deconditioning.

Key words: servicemen, optimal safe methods of physical activity, functional possibilities.

Statement of problem

One of basic problems of the modern system of physical training in the armed forces is the absence of effective methods for determination of physical activity quantitative informing indices. The later allow to estimate the most optimal, effective, but at the same time safe methods of muscular activity, providing the high level of physical qualities necessary for tasks implementation in training and battle actions. These qualities mostly depend on motive activity and the level of servicemen' organism functional possibilities and their health level.

Due to absolutely new requirements to the system of military personnel physical training (especially at the first stage) it is necessary to obtain the positive dynamics of results for the short period of time allowing maximally to realize them during battle actions. These challenge increase the probability of a serviceman's organism overloading because in most cases a contingent consists mainly of physically unprepared to military service people.

Thus, the use of standard parameters of physical activity and generally accepted methods of control and management in the process of servicemen training will promote only insignificant increase of physical level and in most cases will negatively influence the state of servicemen health as a result of inadequacy of the offered exercise and the process of training.

Ways of decision

Our integral method for determination of optimal safe methods of physical activity allows to accelerate adaptation changes to the set terms of motive for people with different level of physical training, morphometric indices of body and individual functional possibilities for a short period of time (about three months) at a minimum volume of executed work, and what is more important it happens without any overloading, displaying of chronic fatigue, and deconditioning.

For a detailed control, management on the basis of integral calculation of quantitative values of the most optimal and safe method of loading, such indices were taken into account: weight, mass of equipment (weapon, live ammunition, bullet-proof jacket, helmet. The general mass is up to 25 kg), duration of muscular tension, level of muscular strength, amount of motive actions, amplitude of motion and etc. The use of many indices allows to estimate not only adequacy of the method of loading in certain training exercise regarding individual features but also assists the most effective development of physical qualities and certain muscular groups depending on the orientation of training process and tasks in peace-time and battle actions.

To determine initial level of military men training and ability of their organisms to overcome physical activities while performing standard control exercises (according to professional physical training (PPT) guidelines), complex mathematical formulas were worked out. The effective implementation of the above said criteria, especially in a full battle equipment (mass of equipment is about 25 kg), will allow to promote the level of physical training in a peace-time and assist the effective realization of mission during battle actions. These criteria will also help to define objectively the primary physical state and elaborate optimal method of loading to obtain maximal adaptation changes for a short time without harming health.

To solve the announced tasks it is necessary to define basic data of such indices: weight (kg), weight in a full battle equipment (kg), maximal amount of reiterations at implementation of PPT control exercises (to develop force and power endurance) in a full battle equipment (quantity per time) at standard technique of implementation, time of muscular tension at implementation of one reiteration (c), general duration of control exercise execution (c), amplitude of motion .

Coefficient of external resistance size, completely representing the method of physical activity, is determined by the formula:

$$Ra = 1 - \left(\frac{N \times T}{M_T + M_Э} \times Q\right)$$

Ra – coefficient of external resistance size (conventional unit);

N – maximal/maximum amount of reiterations that can be executed in control exercise to the complete muscular fatigue (quantity per time);

M_T – body weight (kg);

$M_Э$ – equipment weight (kg);

T – duration of one reiteration (seconds);

Q – coefficient of amplitude of motion (conventional unit);

1 – maximal limit of adequacy of physical activities to organism

The index of physical (training) activity that represents the critical parameters of physical possibilities is determined by the formula:

$$ITNA = \frac{N \times Ra}{t} \times \frac{T}{Q}$$

ITNA – index of the training loading;

Ra – coefficient of external resistance size(conventional unit);

N – maximal/maximum amount of reiterations that can be executed in control exercise to the complete muscular fatigue (quantity per time);

t – general duration of control exercise execution (seconds);

T – duration of one reiteration (seconds);

Q – coefficient of amplitude of motion (conventional unit);

Note: ITNA<1.00 – physical activities are adequate to functional possibilities of organism and level of training.

There are a few examples (1-2) to demonstrate the efficiency of work of our integral method for determination of optimal and at the same time safe methods of physical activity for servicemen and also their correction while practical implementation

Thus, while implementation of PPT norms in "pulling-ups" the serviceman (aged 22, weight – 75 kg) executed just 8 reiterations with practically complete amplitude of motion to the complete fatigue of working muscular groups and the rate of implementation was about 3 - 4 seconds on every reiteration (example 1). Thus, in the conditions of a full battle equipment use (+25 kg to the body weight), the maximal amount of reiterations executed in this control exercise can be only once (example 2).

Example 1.

A) Determination of coefficient of external resistance size (without a full battle equipment)

$$Ra = 1 - \left(\frac{N \times T}{Mт + Mэ} \times Q\right) = 1 - \left(\frac{8 \times 3}{75 + 0} \times 0{,}9\right) = 0{,}71 \text{ y.e.}$$

B) Determination of physical (training) activity index (without a full battle equipment)

$$ITNA = \frac{N \times R}{t} \times \frac{T}{Q} = \frac{8 \times 0{,}71}{24} \times \frac{3}{0{,}9} = 0{,}8 \text{ y.e.}$$

Example 2.

A) Determination of coefficient external resistance size with a full battle equipment

$$Ra = 1 - \left(\frac{N \times T}{Mт + Mэ} \times Q\right) = 1 - \left(\frac{1 \times 3}{75 + 25} \times 0{,}9\right) = 0{,}97 \text{ y.e.}$$

B) Determination of physical (training) activity index with a full battle equipment

$$ITNA = \frac{N \times R}{t} \times \frac{T}{Q} = \frac{1 \times 0{,}97}{3} \times \frac{3}{0{,}9} = 1{,}06 \text{ y.e.}$$

The results (example 1) of the control testing of muscle strength development prove that the primary level of serviceman's physical health who did not use a full battle equipment while "pulling-ups" corresponds to the parameters of high intensity of work (Ra=0,64-0,71). Systematic application of this method in the process of special physical training allows to achieve maximal adaptative changes in the military man's organism for the most short time with a low level of overloading threat. Simultaneously, the index of training loading does not exceed critical borders (ITNA<1). This fact indicates adequacy of physical activities to functional possibilities.

In turn, results of the research in which serviceman used a full battle equipment (example 2) during control exercise implementation demonstrate quite opposite results in comparison with previous calculations (example 1). So, the results testify that the level of physical activities do not correspond to physical state of the serviceman's organism (ITNA>1). Accordingly, long application of this method (Ra=0,97) in training will cause overloading, fatigue and physical health worsening and also possible decline in physical training level, that will negatively influence other types of training.

Thus, in spite of perspective method of training used in the example 1, there is complete disparity of the attained level of organism physical development to those requirements and tasks that are set in real battle actions. It is necessary to take into account not only morphometric indices, health, age, orientation of

physical training depending on specialization, but also substantial difference between the primary level of their physical condition and loading they are to overcome during battle actions. The use of the integral method for determination of safe methods of physical activity for servicemen, will allow to optimize search of the most adequate parameters of size and intensity of loading and also to adaptive changes in the organism for the increase of maximal effectiveness of this stage of training.

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