

## DOSING METHOD OF PHYSICAL ACTIVITY IN AEROBICS CLASSES FOR STUDENTS

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**Annotation.** *Purpose:* reasons for the method of dosing of physical activity in aerobics classes for students. The basis of the method is the evaluation of the metabolic cost of funds used in them. *Material:* experiment involved the assessment of the pulse response of students to load complexes classical and step aerobics (n = 47, age 20-23 years). In complexes used various factors regulating the intensity: perform combinations of basic steps, involvement of movements with his hands, holding in hands dumbbells weighing 1kg increase in the rate of musical accompaniment, varying heights step platform. *Results.* on the basis of the relationship between heart rate and oxygen consumption was determined by the energy cost of each admission control load intensity. This indicator has been used to justify the intensity and duration of multiplicity aerobics. Figure correspond to the level of physical condition and motor activity deficits students. *Conclusions:* the estimated component of this method of dosing load makes it convenient for use in automated computer programs. Also it can be easily modified to dispense load other types of recreational fitness.

**Keywords:** dosage, exercise, aerobics, student.

### Introduction

One of ways of optimization of students' physical education is increasing of motivation to practicing of physical culture and sense of responsibility for own health, formation of strove for healthy life style [8, 11, 16]. Rather promising step in solution of this problem is application of the most popular kinds of motion functioning in students' physical education [5, 10, 14]. Concerning trainings of students' age girls leading places in popularity rating are traditionally taken by different health related aerobics [5, 14]. Important characteristic of all aerobic trainings is the fact that that a lot of different movements are used in them. This peculiarity gives emotional attractiveness to such trainings and advantage over those kinds of aerobic, in which monotonous exercises of cyclic character are used. On the other hand, exactly this feature often becomes a reason of one of the most important aerobic problem – complexity of high quality control and load's monitoring at different aerobic trainings.

To day there exists a lot of publications, which make ground for optimal parameters of load dozing in health elated trainings – walking, running, swimming, walking on staircase. There have been found dependences between cardio-vascular system's responses and speed of movements, length of steps, kind of swimming, inclination of running surface that permitted to work out methods of prognostication of loads' intensity in appropriate kinds of aerobics [19, 20, 21, 22]. In aerobic trainings it is more difficult to find such dependences owing to great variability of complexly coordinated movements, characterized by many parameters.

Alongside with high health related potential of aerobic it is very difficult to regulate its complexes in comparison with cyclic kinds of trainings [5, 18]. In our opinion, an important achievement on the way of unification of health related aerobics' technologies is application off block method of aerobic choreography's construction [1, 6, 7]. It permits to clearly structuralize content of complex to be used in training and, to some extent, to envisage loads. Such combinations serve as a base for further complexes' complication and making them more various by means of using of many methodic techniques – variation of music accompaniment, variation of basic movements, involving of arms' movements, using of turns and travelling, using of weights. However, their selection is often spontaneous and conditioned only by coach's wish to make training program more interesting, without consideration of physiological purposefulness of certain methodic techniques' application at trainings of certain contingent. It points scientific searches to improvements of loads' simulation and dozing at aerobics' trainings. At present there exist works, which ground means of loads' optimization for persons with different physical condition with the help of regulation of musical accompaniment, alternating of arms' and legs' works, application of jump exercises, regulation of step-platform's height and so on [4, 12, 13, 15]. The listed techniques permit to influence on trainings' intensity but, alongside with it, they do not permit to determine degree of its change. Therefore the question about variation of duration and multiplicity of trainings, which depend on intensity, still remains unsolved. Dozing of loads in girl students' aerobic trainings is complicated also by the fact that trainees differ by level of physical condition that require searching of means how to differentiate loads. In our opinion working out of method of physical loads' dozing will facilitate solution of this problem, in which, as a criterion for regulation of loads' parameters we used unified indicator, videlicet – metabolic equivalent of aerobic means' intensity, in compliance with whose value it is possible to prognosticate duration and multiplicity of trainings, ensuring optimal scope of motion functioning.

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### **Purpose, tasks of the work, material and methods**

*He purpose of the research* was to give basis for means of dozing of physical loads at aerobic trainings of girl students on the base of metabolic value of the used means.

*The tasks of the research* stipulated determination of metabolic value of complexes of classic and step aerobics on the base of girl students' pulse responses to the applied loads and determination of degree of its change under influence of different means of loads' intensity regulation (change of music accompaniment temp, work with arms, change of step-platform's height, application of weights).

*The methods and material of the research:* in the research 47 girl students of Ivano Frankovskiy national medical university participated. They were offered to fulfill at 1<sup>st</sup> training four 15 minutes complexes of classic aerobic (complexes KA-1, KA-2, KA-3, KA-4), at 2<sup>nd</sup> training – three 15 minutes complexes of step-aerobic (CA-1, CA-2, CA-3).

Complex KA-1 stipulated cyclic fulfillment of bloc combination of classic aerobic basic steps (in position hands on waist) based on 4 musical squares (4x32 counts). Temp of music accompaniment corresponded to 128-132acc/p/min. Complex KA2 was analogous to previous one but also stipulated additional arms' movements, Temp of music was 128-132 acc/p/min. Complex KA-3 included legs and arms' movements, applied in complex KA-2, but every arm was loaded with dumbbell of 1 kg weight. 128-132 accents per minute. Complex KA4 was analogous to complex KA-1, but temp of music accompaniment was increased up to 138-140 acc/p/min.

Complexes CA1, CA2, CA3 envisaged fulfillment of movements on step-platform. In complex CA1 the height of ste-platform was 15 cm, in complex CA2 - 20 cm, CA3 - 25 cm. With it, choreographic combination in all three complexes was the same and consisted of basic steps of step-aerobic. Combination was based on 4 musical squares (4x32counts).

In the course of researches we determined level of maximal oxygen consumption  $VO_{2max}$  of girl students as well as their pulse responses to loads of experimental complexes. On the base of dependences between heart beats rate (HBR) and oxygen consumption  $VO_2$  we determined metabolic equivalent of their intensity (MET) and, accordingly, caloric value ( $kcal/p/min^{-1}$ ). The obtained data we used for foundation of algorithm of dozing of physical loads' parameters.

#### Results of the research

As a result of fulfillment of aerobic experimental complexes by girl students we determined, that the lowest by intensity was load of experimental complex KA1 that corresponded to 50.64 % from MCK (see table .1). Using of arms' movements in complex KA2 facilitated additional increasing of HBR in average by 17.2 beats per minute and was 65.2 % from MCK. The same by physiological responses was load of complex KA4, which stipulated increasing of music accompaniment temp (67% from MCK). The load of complex KA3, in which weights were used was the most intensive – 76.2 % from MCK. Fulfillment of exercises on 15 cm step-platform (CA1) resulted in increasing of HBR up to  $146.7 \pm 2,0$  b.p.m, that corresponded to 53.2% from MCK. Increasing of step-platform's height up to 20 cm and 25 cm in complexes CA2 and CA3 facilitated increasing of intensity accordingly up to 69,6 % and 77.8 % from MCK .

Table 1

*Pulse responses and oxygen consumption during fulfillment of aerobic experimental complexes by girl students*

Complex	HBR $\bar{X} \pm m$	Intensity % from MPK	VO <sub>2</sub>		
			ml.kg <sup>-1</sup> min <sup>-1</sup> $\bar{X} \pm m$	MET $\bar{X} \pm m$	kcal.kg <sup>-1</sup> hour <sup>-1</sup> $\bar{X} \pm m$
KA1	140.0±2.7	50.46	21.2±0.6	5.7±0.2	5.8±0.2
KA2	161.2±3.1	65.2	27.2±0.8	7.4±0.2	7.5±0.2
KA3	174.1±2.7	76.2	31.9±0.9	8.8±0.3	8.9±0.3
KA4	163.5±2.7	67.0	29.9±0.9	7.7±0.3	7.8±0.3
CA1	146.7±2.0	53.2	29.2±0.6	29.2±0.4	33.2±1.0
CA2	165.8±1.9	69.6	6.0±0.1	8.0±0.1	9.1±0.2
CA3	175.9±1.8	77.8	6.1±0.1	8.1±0.1	9.3±0.2

According to determined pulse responses we determined level of energy supply of aerobic experimental complexes. In comparison with value of main metabolism, which is 1 MET, complex KA1 caused increasing of energy consumption  $5.8 \pm 0.2$  times, complex KA2 –  $7.5 \pm 0.2$  times, KA3 –  $8.9 \pm 0.3$  times and KA4 –  $7.8 \pm 0.3$  times.

Metabolic value of complex CA1 in respect to basal metabolism increased  $6.0 \pm 0.1$  times, CA2 -  $8.0 \pm 0.1$  times, CA3 -  $9.1 \pm 0.2$  times. Using value MET, which is equivalent to  $3.5 \text{ ml.kg}^{-1}\text{min}^{-1}$  and knowing that caloric equivalent of 1 l of  $\text{O}_2$  is approximately  $4.85 \text{ kcal.}^{-1}$  we calculated caloric value of aerobic experimental complex. It was used as a criterion of intensity in the offered method of dosing of physical load.

When selecting parameters of physical loads one should remember that their effectiveness to large extent depends on to what extent they can ensure scope of motion functioning, eliminating energy consumption deficit, which appears as a result of immobile life style [17]. Results of researches, made by R. Pafenbarger and E. Olsen witnessed that minimal risk of morbidity was registered among persons, who have weekly scope of motion functioning not less than 1500-2000 kcal [9]. Just this value was adopted by us as the basis for determination of weekly scope of energy consumption, which shall be ensured by aerobic trainings. Appropriate scope of motion functioning can be ensured by variation of physical loads' parameters, correlation of which is expressed in the so-called principle FIT: F - frequency, I - intensity, T - time. Dependence between these indicators and scope of physical loads can be expressed as equation:

$$V = F I T (1),$$

where V – volume of loads in kcal.p.week; F – frequency of trainings in quantity of week days, I – metabolic equivalent of trainings' intensity in  $\text{kcal.kg.min}^{-1}$  T – time of one training in minutes.

In spite of the fact that minimal scope of week motion functioning was accepted as 1500 kcal/week., for persons of active life style it can be less. In connection with this, for optimization of loads' dosing process at aerobic trainings it is important to determine individual deficit of motion functioning, the value of which is expressed by difference between recommended energy consumption of motion functioning and actual energy consumption:

$$D_{mf} = E_{rec} - E_{act} (2),$$

Where  $D_{mf}$  is deficit of motion functioning; Где  $D_{mf}$  - дефицит двигательной активности;  $E_{rec}$  – recommended energy consumption for motion functioning (1500 kcal),  $E_{act}$  – actual energy consumption of motion functioning.

In this connection loads' dosing in aerobic is reduced to selection of FIT parameters' correlation, which permit to eliminate existing deficit of weekly motion functioning. Dependence between such indicators can be written as the following expression:

$$D_{wmf} = FIT (3),$$

Where  $D_{wmf}$  is deficit of weekly motion functioning, F – multiplicity of aerobic trainings a week, I – intensity of trainings, T- time. Basing on caloric value of means, used at trainings, we can prognosticate total volume of energy consumption and effectively distribute it during week, varying parameters of duration and multiplicity of trainings.

In table 2 we present recommendations concerning rational levels and multiplicity of trainings for persons with different levels of physical condition (PCL), offered by L.Ya. Ivaschenko et al.[3]. These recommendations were modified by of intensity level expressing in them not only in % from MOK, but also in units, reflecting its metabolic equivalent.

Table 2  
*Recommended intensity level and multiplicity of aerobic trainings for girl students, depending on PCL*

PCL	Intensity level		Multiplicity training.p.week <sup>-1</sup>
	% MPK	MET	
Low	40-45	3.2-3.6	4-5
Below middle	45-50	3,6-4.7	4-5
Middle	50-60	4.7-6.3	3-4
Above middle	60-65	6.3-7.8	2-3
High	65-70	7.8-8.4	2-3

With the help of table 2 we can judge degree of adequacy of some aerobic means to girl students' functional potentials and solve the question concerning purposefulness and effectiveness of their application.

Recommendations on multiplicity of trainings in a week and information about caloric value of chosen means permit to calculate time of one training by formula:

$$T = D_{mf} / FI (4),$$

where T – time of training (min);  $D_{mf}$  – deficit of motion functioning to be removed with aerobic trainings,  $\text{kcal.week}^{-1}$ , F – multiplicity of trainings, training/week<sup>-1</sup>, I- metabolic equivalent of trainings' intensity,  $\text{kcal/min}^{-1}$ .

It should be noted that energetic value of complex KA1 corresponded to  $5.8 \text{ kcal/kg}^{-1}/\text{hour}^{-1}$ . For 1 minute this value is  $\approx 0,1 \text{ kcal/kg}^{-1}/\text{hour}^{-1}$  and is convenient for application as basic criterion of energetic value of a training.

Application of different means of intensity's increasing results in increasing of energetic value of a training; that is why they were identified with metabolic factors of intensity. Relation of values of metabolic factors of intensity of classic and step-aerobic complexes to metabolic factor of intensity of complex KA1, permits to determine specifying metabolic coefficients, which make it possible to correct time of trainings in proportion to increasing of energetic value of exercises. Thus, in compliance with value of factor of aerobic basic complex, which is  $5.8 \text{ kcal/kg}^{-1}/\text{hour}^{-1}$  its coefficient (Kf 1) corresponds to 1. Coefficient of first factor of first height of step-platform ( Kf 2 ) corresponding to  $6.1 \text{ kcal/kg}^{-1}/\text{hour}^{-1}$ , is equal to 0.95, coefficient of second level of step-platform's height (Kf3) with value of  $8.1 \text{ kcal/kg}^{-1}/\text{hour}^{-1}$  is equal to  $-0.72$ , coefficient of third level of step-platform's height (Kf4), the value of which is  $9.3 \text{ kcal/kg}^{-1}/\text{hour}^{-1} - 0.62$ , coefficient of factor, which was conditioned by involving of arms' movements in work (Kf5) with value of  $7.5 \text{ kcal/kg}^{-1}/\text{hour}^{-1} - 0.77$ , coefficient of factor of increasing of music accompaniment rate (Kf6), with value of  $7.8 \text{ kcal/kg}^{-1}/\text{hour}^{-1} - 0.74$ , coefficient of factor of weights' application (Kf7), with value of  $8.9 \text{ kcal/kg}^{-1}/\text{hour}^{-1} - 0.65$ .

Formula 4 and presented above coefficients of metabolic factors permit to determine rational parameters of physical loads according to algorithm, which stipulates the following steps:

1. Determination of deficit of motion functioning (D mf), which shall be removed by aerobic trainings. Determination of quantity of aerobic trainings, which shall ensure appropriate energy consumption, i.e. multiplicity of trainings a week. It can be within 2-6 trainings a week and depends on level of physical condition and resources of trainees' free time.

2. Determination of rational time of one training, which shall ensure required energy consumption. It depends on trainings' intensity, which can vary within large limits. For making loads' dozing procedure standard we offer, first, determine time of trainings with fulfillment of basic complex of classic aerobic (KA), whose metabolic coefficient of intensity is determined by multiplication of this complex's caloric value, corresponding to  $0.1 \text{ kcal/kg}^{-1}/\text{min}^{-1}$  by mass body (kg). Having divided weekly scope of loads by multiplicity of trainings and metabolic equivalent of aerobic basic complex, we shall receive time of trainings, which ensures required energy consumption.

3. When using different kinds of varying of loads' intensity (loads, having other metabolic equivalent), received as a result of all above rendered procedure, time of trainings shall be multiplied by error coefficient of the factor, which is used in training. If several metabolic factors are used, time of trainings shall be multiplied turn by turn by coefficient of every factor.

The worked out method of loads' dozing was used with simulation of aerobic trainings for girl students with different level of physical condition and experimental testing proved its purposefulness [2].

#### Conclusions:

Dependence between HBR at time of physical work and energy consumption for its fulfillment permits to determine energetic value of this work. It is purposeful to use this indicator for foundation of correlation of intensity parameters, time and multiplicity of physical load in compliance with level of trainees' physical condition as well as with deficit of motion functioning, which it is assumed to be removed at the cost of these trainings. Analysis of girl students' pulse responses to fulfillment of aerobic complexes, in which aerobic loads are varied by different methods, permitted to determine metabolic value of every of them and it, in its turn, permits to prognosticate more exactly energy consumption at aerobic trainings and plan scopes of motion functioning and correlation of parameters of physical loads with higher quality.

The calculated component of this method of loads' dozing makes it convenient for application in automatic computer programs. Besides, it is easy to modify it for loads' dozing in other kinds of health related fitness.

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