

The influence of dance and power fitness loads on the body morphometric parameters and peculiarities of adaptive-compensatory reactions of organism of young women

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Abstract.

Purpose: study is to research the degree of influence of training sessions in dance and power fitness on the dynamics of body morphometric parameters of women aged 18-21 and to determine the features of adaptive-compensatory organism reactions to the physical stimulus, which will allow to assess the degree of health effect in conditions of muscle activity.

Material: The paper presents the results of studying the influence of dance and power fitness 3-month trainings on the dynamics of morphometric and biochemical indices in women aged 18-21.

Results: to solve the objectives of the study, we formed two research groups: the control group participants used the elements of dance fitness during the training while the main group participants used the power fitness models during their trainings. In the course of the study, it was found out that the morphometric indices (cumulative dimensional parameters of the body composition) showed the most noticeable positive dynamics during 3-month trainings in the control group. The results of biochemical blood tests of both group participants were fixed in the beginning and after 3 months of research in conditions of rest and after training sessions. These results testified significant expenditures of energy during dance fitness training caused most of all by inadequate functional body capabilities in the process of physical activity. The cortisol concentration in blood serum of the control group women showed a decrease of 10.3% in response to physical activity even after a long period of occupation. This indicates the processes of gluconeogenesis caused by energy deficiency and manifests body compensatory reactions to a stressful stimulus.

Conclusions: the obtained results testified that dance fitness classes influenced more effectively on the reduction of women's circumferential body size, decreased body fat mass and increased the level of fitness, which is one of the priority tasks for this type of motor activity. This circumstance is also confirmed by the results reflecting the increase in phosphorus concentration in the blood of control group participants after loading by almost 4.8% compared with the state of rest.

Keywords: dance and power fitness, motor activity, women aged 18-21, morphometric indices, adaptive-compensatory reactions, cortisol, phosphorus.

Introduction

The modern system of fitness industry, in spite of the wide variety of existing types and classifications, mainly consists of 3 main areas: dance fitness, power fitness and bodybuilding (Potop, 2008; Grigore, 2014; Grigore, 2017; Seynnes, et al., 2017; Chernozub, et al., 2015, 2016; Philippou, et al., 2017). Each of these directions is significantly different from others, not only in the structure of training patterns, the volume and intensity of training loads, the technique of performing specialized physical exercises, but also by the efficiency of various tasks solving, according to level of physical capacity, gender and age characteristics (Korobeynikov, et al., 2000; Wells, et al., 2006; Paunksnis, et al., 2017; Wochoński, et al., 2017).

Not only Physical Therapy Specialistss (Lazareva, et al., 2017; Dubachinskiy, et al., 2018) but also scientists in the fields of medicine and biology (Korobeinikov, 1995; Shaner, et al., 2014; Schoenfeld, et al., 2016; Titova, et al., 2018) were for a long time engaged in the problem of finding effective mechanisms for improvement the organism functional state of young women by using different forms of motor activity.

The considerable attention of some studies was concentrated on studying the peculiarities of fitness classes' effects on students, using this form of motor activity, as an adjunct during physical education classes (Vogt, et al., 2014; Ilynska, et al., 2016). A number of works dealt with studying the impact of training in certain types of fitness (pilates, aqua fitness) on the mature women bodies (Martín-Hernández, et al., 2013;

Henselmans, et al., 2016). However, in most cases, the researchers determined the effectiveness of the proposed models of muscle activity on the bodies of examined women taking into account only the peculiarities of morphometric body dynamics and the peculiarities of their cardiovascular system restoration parameters (Goto, et al., 2009; Kraemer, et al., 2015). At the same time, nobody carried out the study of the body adaptive-compensatory reaction peculiarities in women aged 18-21 on the basis of analysis of the dynamics of blood serum biochemical parameters in conditions of prolonged fitness training. This fact indicates that it is almost impossible to assert the effectiveness of using one or another model of motor activity for health improvement without implementing really informative markers of the motor activity loads adequacy, which in the first place include biochemical methods of research, to the capabilities of the human body (Wahl, et al., 2013; Lopatina, et al., 2014). The purpose of the study is to research the degree of influence of training sessions in dance and power fitness on the dynamics of body morphometric parameters of women aged 18-21 and to determine the features of adaptive-compensatory organism reactions to the physical stimulus, which will allow to assess the degree of health effect in conditions of muscle activity. The article is a fragment of the planned scientific work "Development and implementation of innovative technologies and correction of the functional state of a man in conditions of physical activity in sports and rehabilitation", (developing under the state registration).

Material and methods

We examined 50 practically healthy women aged 18-21 who had not previously been engaged in dance and power fitness. Taking into account the purpose and tasks of the study, we formed two research groups: control and main. The control group participants used elements of dance fitness during 3 months of training classes. The participants of the main group used power fitness in training classes.

All women first passed medical examination and integrated biochemical laboratory test (16 indicators). Those who had no medical contraindications took part in the study.

The dynamics of the studied indices of bioimpedansometry (human body composition) was measured at the beginning of the study and during three months of systematic exercising power fitness at the control interval of one month. For evaluation of the above mentioned indicators, a bioimpedance analyzer was used: the diagnostic computerized hardware and software complex KM-AP-01 Diamond - AST (body composition analyzer) (VYUSK. 941118.001 RE) (Chernozub, et al., 2015, 2016). The dynamics of the circumferential dimensions of the body of the examined women was investigated using the anthropometric method.

Laboratory studies of blood serum of the examined women on the concentration of phosphorus before and after the power fitness load were conducted in several stages: before the experiment and after three months of systematic training in power fitness. The concentration of phosphorus in the blood of the examined women was determined using the StatFax 4700 (USA) spectrophotometer in the conditions of a certified medical laboratory. The concentration of cortisol in blood serum was investigated by the method of immunoassay analysis, guided by the physiologically acceptable norm for a given age within the range of 150-660 nmol/l (Smilios, et al., 2014; Wochoński, et al., 2017).

Statistical analysis

The statistical analysis of the research results was performed using the IBM * SPSS * Statistics 20 software package (StatSoft Inc., USA). We also applied the methods of parametric statistics that allow calculating the average arithmetic, standard error of the average. The level of reliability was determined using a dual two-way t-test for the average.

Results

The results of controlling the peculiarities of changing parameters of circumferential body size of the control and main group participants in conditions of using the modeled programs of training sessions during the experimental research are presented in table 1.

Table 1. The dynamics of the circumferential body sizes of the examined groups' participants during the entire study period, n = 50

Parameters	Group of participants	Initial data	After 3 months of training	Difference, %	P
Circumferential shoulder size, cm	control	25,38±0,57	24,09±0,44	-5,1	<0,05
	main	24,76±0,57	23,60±0,32	-4,7	<0,05
Circumferential waist size, cm	control	69,54±0,78	66,16±0,97	-4,9	<0,05
	main	65,04±0,78	62,76±0,57	-3,5	<0,05
Circumferential shin size, cm	control	33,22±0,41	32,62±0,33	-1,8	<0,05
	main	33,92±0,41	33,52±0,33	-1,2	<0,05
Circumferential hip size, cm	control	54,76±1,47	53,34±1,28	-2,6	<0,05
	main	52,96±1,47	52,86±1,11	-0,2	>0,05

The analysis of the obtained results shows that in control group participants the circumference body size decreased on average by 3.6% ($p < 0,05$) after 3 months of training compared with the initial data. The results of the main group participants' controlled anthropometric indicators show decrease of their parameters by 2,4% ($p < 0,05$).

Table 2 shows the results of influence of systematic dance and power fitness exercises, in the training of women of this age group, on indicators of bioimpedansometry (body composition parameters).

It was established that within 3 months of the study, bioimpedansometry indicators show more detected positive changes in the control group participants' parameters. The most noticeable dynamics was detected during control of body fat parameters. Thus, in control group, the control indicator of body fat was reduced by 7.9% ($p < 0.05$) compared to the initial data. At the same time, changes of a similar nature in the main group participants amounted to only 4.9% ($p < 0,05$).

Thus, having analyzed the dynamics of anthropometric data and parameters of bioimpedansometry, we can conclude that using elements of dance fitness in the course of 3 months of systematic training of women aged 18-21 is the most effective for improving their morphometric body parameters.

A series of biochemical studies was conducted to solve the question of training loads adequacy in set conditions of motor activity to the functional capabilities of the examined women. The results of these studies are presented in Fig. 1-2.

Table 2. The dynamics of the body composition of the examined groups' participants during the entire study period

Parameters	Group of participants	Initial data	After 3 months of training	Difference, %	P
Body Mass Index (BMI), c.u.	control	22,35±0,45	21,96±0,39	-1,7	<0,05
	main	19,98±0,41	19,73±0,45	-1,2	>0,05
Body Fat (BF), %	control	25,88±0,71	23,83±0,80	-7,9	<0,05
	main	22,82±0,74	21,69±0,70	-4,9	<0,05
No Fat Body Mass (NFBM), kg	control	45,77±0,58	46,26±0,60	+1,1	>0,05
	main	40,93±0,90	41,09±1,11	+0,4	>0,05
Active Cell Mass (ACM),%	control	48,67±0,39	49,43±0,46	+1,5	<0,05
	main	50,17±0,69	50,80±0,48	+1,3	<0,05

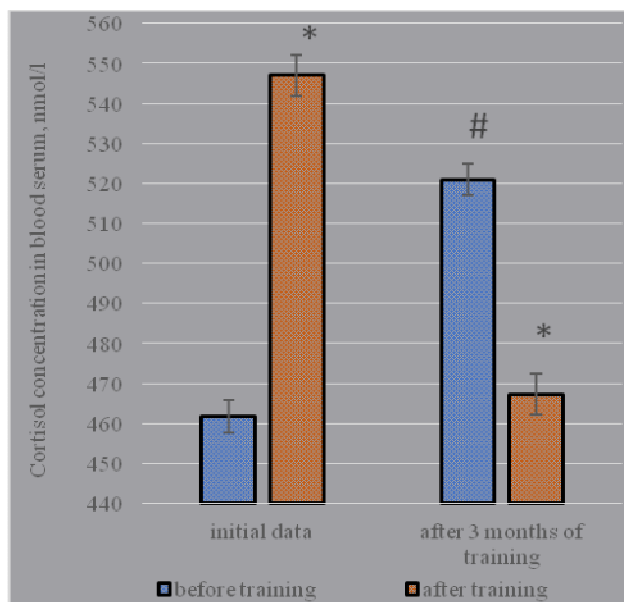


Fig. 1A

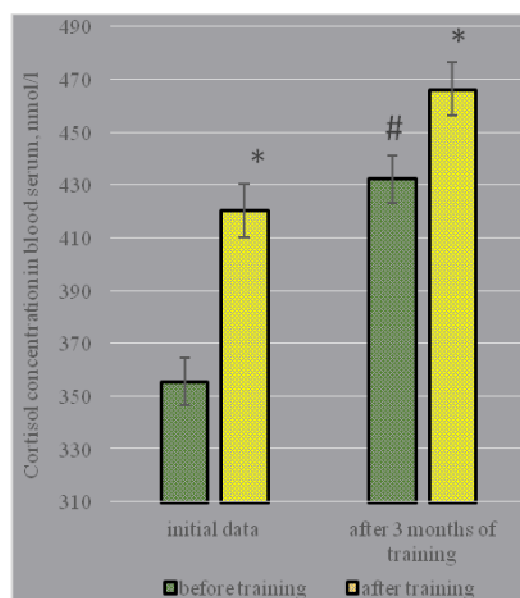


Fig. 1B

Figure 1. Features of changes in the cortisol concentration in blood serum of the control group participants (Fig. 1A) and the main group participants (Fig. 1B) during 3 months of different types fitness training, $n = 50$

Note: * - $p < 0,05$, relative to the state of rest (output data);

- $p < 0,05$, compared with the results of the previous control

Figure 1 presents the results of studying the peculiarities of changes in cortisol concentration in blood serum of both examined group participants in conditions of systematic dance and power fitness exercises during 3 months of training.

Analysis of the results fixed at the beginning of the study shows that after the training session, the cortisol concentration in the blood serum increases both in the participants of the control (Fig. 1A) and the main (Fig. 1B) groups on average of 18.4% ($p < 0,05$) compared with the state of rest, regardless of the models characteristics used by them in training sessions. This fact indicates that both groups had almost identical initial level of adaptation to the stress factor of motor activity.

However, the results established after 3 months of training in set conditions of motor activity show a completely different tendency to changes in the controlled biochemical indicators in the blood serum of the examined participants. Changes in the cortisol concentration, gained in the course of biochemical blood control, show a significant decrease by 10,3% ($p < 0,05$) in the control group after the training session on dance fitness compared to their state of rest. At the same time we observe an increase in the studied biochemical indicator by 7.9% ($p < 0,05$) in response to training load in the main group participants in terms of force fitness training compared to the state of rest.

Figure 2 presents the results of studying the peculiarities of changes in the phosphorus concentration in blood serum of women in both examined groups in set conditions of muscle activity during 3 months of training.

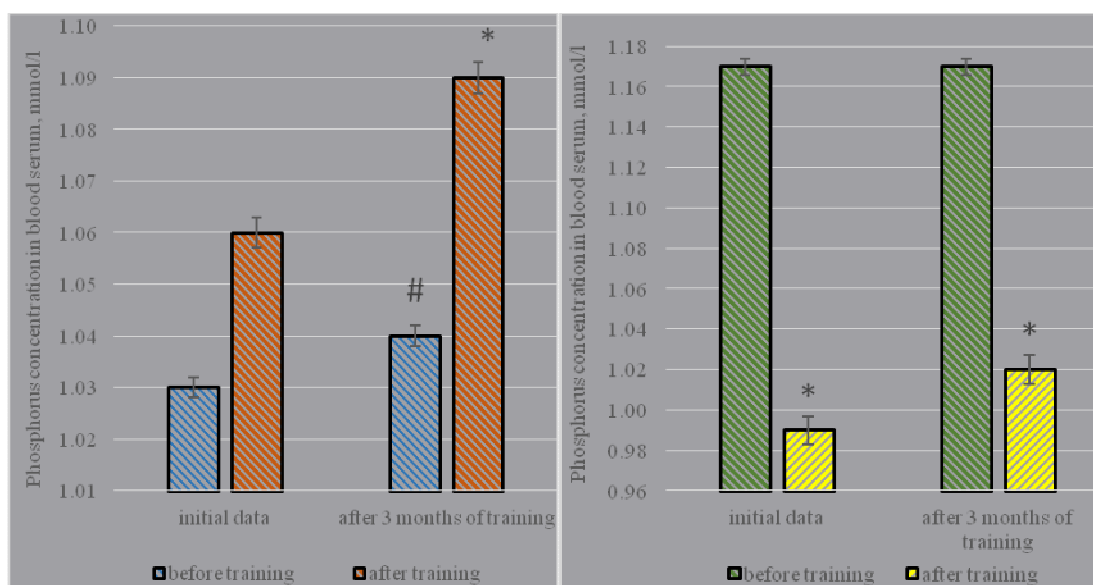


Figure 2. Features of changes in the phosphorus concentration in blood serum of control group participants (Fig. 2A) and the main group participants (Fig. 2B) during 3 months of different types fitness training, $n = 50$

Note: * - $p < 0,05$, relative to the state of rest (output data);
- $p < 0,05$, compared with the results of the previous control

The results analysis shows that the phosphorus concentration in the blood serum of women in the control group increased after training, both at the beginning of the study (by 2.9%) and after 3 months of training (by 4.8%). In the main group participants the studied biochemical parameters of blood show a significant reduction after training compared with the state of rest, both at the beginning of the study (15.4%) and after 3 months of training (by 12.8%).

Discussion

Search for effective mechanisms of increasing the body functionality of young women and improving their morphometric body parameters are the priorities of modern systems of recreational physical activity, which also include different types of fitness trainings.

The obtained data suggest that regular using dance fitness elements during training produces a significant impact on decreasing circumferential body size of women aged 18-21, reduction of their fat mass parameters than using elements of power fitness (Wells, et al., 2006; Duren, et al., 2008; Dubachinskiy, et al., 2018). These changes depend on the frequency of periods, combinations of dance exercises, and the intensity of their performance during classes, different duration of rest periods and muscular tension, different intensity parameters and the load volume during one workout (Henselmans, et al., 2014; Vogt, et al., 2014; Schoenfeld, et al., 2016). All these require significant human energy expenditures, which sometimes do not coincide with their

functional capabilities of organism (Shaner, et al., 2014). At the same time, during power fitness all training parameters and optimize them based on individual abilities may be more clearly control.

At the same time, the issue of forecasting the effectiveness and safety of long-term using dance and power fitness programs made us conduct additional biochemical blood tests in set conditions of motor activity. It was not entirely clear whether rapid positive changes in controlling morphometric indices of the examined women undergoing dance fitness trainings were only the manifestation of compensatory responses to the corresponding physical stimulus or there were positive adaptive changes in their bodies.

The results of biochemical control regarding the changes in cortisol concentration in blood serum of the examined groups' participants in different conditions of motor activity indicate that dance fitness exercises contribute to significant energy expenditure and activate gluconeogenesis processes. Thus we can affirm that the parameters of volume and intensity of physical activity exceed body functional capabilities of these women. This fact is according to some studied data (Smilios, et al., 2014; Henselmans, et al., 2016; Paunksnis, et al., 2017). However, such changes were not observed during power fitness training, which indicates the adequacy of training loads to the individual body capabilities of examined women and the manifestation of adaptation reactions.

Analyzing the peculiarities of phosphorus concentration changes in the blood serum of women of both groups during experimental training, we can assume that this biochemical index increases (proved during dance fitness training) in response to physical activity due to the decomposition of phosphorus compounds and decreases in the ATP resynthesis rate, which leads to compensatory reactions manifestation (Lopatina, et al., 2014; Kraemer, et al., 2015). In this case, resynthesis of ATP occurs by means of glycolysis, which in the end will lead to complete exhaustion of energy resources, strain on the human body and possibly to processes of maladaptation. In turn, the decrease of phosphorus concentration in blood serum after training (proved during power fitness training), in our opinion, points to the aerobic mechanism of ATP resynthesis, which will help improve the body adaptive capacity in women of this age.

A long-term dance fitness training without using informative biochemical criteria for assessing the adequacy of loads to the body functional capabilities, without periodic correction of volume and intensity indicators on the basis of integrated control of the body systems functioning, without constant variation of the sequence and combinations of training exercises, will lead to their functional capabilities reduction, development of maladaptation, and health deterioration after a certain period of time.

Conclusions

Thus, the obtained data showed that despite significant changes in the body morphometric parameters of the control group participants, detected during 3 months of dance fitness training, the results of biochemical blood tests indicated that the corresponding changes were the result of compensatory reactions. Further using of this type of motor activity in the training process without periodic correction of volume and intensity indicators on the basis of integrated control of the body systems functioning will decrease their functional capabilities and may cause of maladaptation and deterioration of health. At the same time using power fitness training leads to slightly lower rates of positive dynamics of morphometric indices. But the biochemical blood test results show that power fitness training really contribute to improving the body adaptive capacity in women of this age and positively affect their recreation possibilities in future.

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