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Physical state of middle-aged women with consideration of experience training of aerobic orientation

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Purpose: *to study the physical state of middle-aged women with long-term experience of regular training of aerobic orientation.*

Material & Methods: *in the work presented results of the study of 2 experimental groups with experience training of aerobic orientation from 3 to 5 years and more than 10 years. The features of physical state were certain.*

Results: *it is set – women with experience of training more than 10 years had significantly lower body weight and body fat percentage, the best power indicators and tolerance to physical activities, higher aerobic possibilities in the absence of significant differences in the indicators of the respiratory system.*

Conclusions: *the results showed a positive effect on the physical state of middle-aged women with long-term training of aerobic orientation.*

Keywords: *physical state, women, middle-aged, aerobic exercises.*

Introduction

Recent studies show the close connection of health and physical work capacity with lifestyle, volume and character of physical activity of middle-aged women [2; 14]. The concept of the middle-aged specifies on the transitional state of organism of the human body when starting processes that affect all organs, systems and their regulation, increasing the likelihood of pathological conditions, but it should be noted that the above-mentioned changes at this age have of the compensatory character when the loss of one qualities is replaced by other [3; 13].

The question of optimal physical activity combined with a balanced diet and lifestyle that support indicators and parameters of the body of women are reflected in the works of both domestic and foreign authors [1; 3; 7]. Numerous studies have identified a number of patterns of dynamics body composition, functional state of middle-aged women, depending on the forms and methods of physical activity. The expediency and efficiency of the use of loading of aerobic orientation are proven [16]. Currently, the most popular are aerobics fitness training that have a stable positive motivation, a large number of areas [4; 8; 15]. A variety of means and methods which used in modern aerobics by properly organized classes can give general-health and electoral effects, but it should be noted that at this time there are differences in the results of studies related with modality of training programs, assessment criteria, characteristics of surveyed (age, status) and the duration of investigations. Thus, as a result of the impact of a six-month study program combining aerobic and strength training in middle-aged women with abdominal obesity enabled state improving lifestyle of women, reduction in serum lipids, and therefore the content of fat, increase lean body mass [8–10]. However, new technologies allow us to understand the molecular mechanisms that demonstrate the negative impact on the strength capabilities and adaptive processes in the body because of combination of aerobic and strength training, which creates negative changes in cellular protein that controls energy balance of the cell and inhibit genome eEF2, which is an important factor for protein's synthesis, which leads to disorders of skeletal muscle adaptation [11].

A study of the twelve-week aerobic exercise, which included cycling and walking for 30 min. / day at a relatively low intensity (60% of maximum heart rate) in the plasma levels of Klotho with special emphasis on arterial stiffness in postmenopausal women revealed that aerobic exercises caused an increase in the plasma concentration of Klotho, which increases the resistance of cells to disruption of the normal functioning and aging. The study also showed a correlation between plasma concentration and arterial stiffness Klotho [12].

Thus, facilities of fitness-aerobics help to improve functional status and to increase physical activity of middle-aged women, although some aspects concerning their selection and impact, combining with other types of exercise has not been studied and require clarification. There are no publications to study the impact on women with long-term experience of aerobic training. Comparison of the dynamics of adaptive changes, functional status, body composition of women who have had aerobic training for over a year we have not been found in the modern researches. That demand study and analysis and determines actuality of theme, defines the purpose of work.

The connection of work with the scientific programs and themes

The study was carried out within the topic "Differentiation use of means and methods of physical education based multifunctional criteria of physical development, functional state of the cardiovascular, respiratory and sensory-motor systems»

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The purpose of the research

Examine the physical state of middle-aged women with long-term experience of regular physical activity of aerobic orientation.

Task of research:

1. On the basis of the literature study information on the effects of regular physical activity of aerobic orientation on middle-aged women.

2. To study the physical development of middle-aged women with long-term experience of regular physical activity of aerobic orientation.

3. Define the parameters of routine indicators of cardio-respiratory system of middle-aged women with long-term experience of regular physical activity of aerobic orientation.

4. To analyze the level of physical state of middle-aged women with consideration of experience of regular physical activity of aerobic orientation.

Material and Methods of research

In the work presents the results of the inspections of 19 women, who were divided into two experimental groups. The first experimental group (EG_1) consisted from 10 women who had experience of regular training (3 times per week) aerobic orientation since 3 to 5 years, the average age of this group of women was 37,9±5,9 years. The second experimental group (EG_2) consisted from 9 women with experience of regular training of aerobic orientation over 10 years, the average age of women – 44,6±5,5 years. At this stage were study the features in physical state, which were characterized on the basis of analysis of parameters of physical development and routine performance of the cardio-respiratory system.

The estimation of physical development was conducted by means of the basic anthropometric measuring: lengths of the body (LB, cm) and the masses of body (MB, kg), circumferences of neck (cm), waist (cm), chest (cm), thigh (cm), and dynamometry (kg). Body fat was determined by means of device of OMRON (BF, %), body mass index (BMI, kg/m^2) was calculated as weight (masses of body (kg)/height (m^2)), vital capacity of lungs (VCL, ml) was determined by dry-air lung-tester. Research of hypoxia's firmness of organism, were conducted by tests with a breath-holding on exhalation (Genchi, c) and inhalation (Shtange, c). Indexes of the cardiovascular system – heart rate (HR, min^{-1}), systolic blood pressure (SBP, mmHg) and diastolic blood pressure (DBP, mmHg) were measured in relative muscle and mental rest. Conducted measurements were the basis for calculating of the Kerdoe's vegetative index (KVI), adaptation potential of Baevsky (AP), coefficient of efficiency of circulation of blood (KECB), level of physical state (LFS) of Pirogova and Skybinskaya's index (IS) [6]. Study of aerobic capacity (VO_{2max}) was conducted by system of estimation of somatic health level (SHL) of G.L. Apanasenko. Authenticity of differences between groups was determined on the basis of non-parametric criterion of Mann-Whitney.

Results of the research and their discussion

The results of the analysis of parameters of physical development of the women studied groups are presented in table 1. Analysis of the data showed that MB of women EG_2 was significantly lower ($p<0,05$) than EG_1: EG_1 – 62,5 (54,0; 71,0) kg, EG_2 – 55,0 (54,5; 62,0) kg, while LB of women in both groups had no plausible differences: EG_1 – 163,0 (160,0; 165,0) cm, EG_2 – 163,0 (162,0, 172,0) cm. The last stipulated reliable differences of BMI ($p<0,05$) in EG_2 were less – in EG_1 – 23,7 (20,0; 26,8) kg/m^2, in EG_2 – 21,0 (20,8; 21,1) kg/m^2 (table. 1). Substantially complement information about physical development of these groups of women indicators of BF, the analysis of that witnessed substantial predominance BF in EG_1. BF in EG_1 was 30,7 (27,0; 32,7)%, and in EG_2 – 23,6 (22,5; 28,2) %. That's, women with longer experience of regular aerobic exercise indicated significantly smaller contribution of fat tissue in the structure of the component body. Complemented by the results of measurement data circumferences of the body, namely – the waist and thighs, which in EG_2 were certain less ($p <0,05$): circumference of waist in EG_1 – 75,5 (70,0; 88,0) cm, in EG_2 – 73,0 (72,0; 75,0) cm; circumference of thigh in EG_1 of – 52,5 (49,0; 54,0) cm, EG_2 – 51,0 (49,0; 52,0) cm.

That reduction in BF women of EG_2 was by decrease the layer of fat on the lower limbs and trunk (waist). A similar trend was observed in terms of circumference in pause of the chest, but in our study of probability wasn't proven ($p > 0,05$). Enough informative indicators was carpal dynamometry, which was absolute values differed significantly in women EG_1 and EG_2. It concerned the power right hand, which was significantly ($p > 0,05$) greater in women EG_2: EG_1 – 23,5 (22,0; 24,0) kg, against EG_2 – 25,0 (24,0; 26,0) kg. That was confirmed by calculating the strength's index (SI), whose meaning in EG_2 significantly higher ($p<0,01$). Some attention, from the standpoint of the characteristics of the muscular component of the body structure and strength abilities studied groups of women, deserve indicators measuring circumference of neck that in women EG_2 significantly ($p > 0,05$) higher, EG_1 – 31,5 (30,0; 32,0) cm, EG_2 – 32,0 (31,0, 33,0) cm (table 1).

An important characteristic of the physical state of the person are parameters of functioning cardio-respiratory system that define adaptive and reserve capacity of the organism and ability adequate course of adaptation and gamogenetic mechanisms. Typically any characterization of cardio respiratory system begins from the most accessible for measuring parameters such as heart rate and blood pressure (BP). To interpret the physical condition using a number of account indexes which can qualitatively describe the progress of the above-mentioned mechanisms.

Taking into account results, that we got in the investigated groups of women it should be noted that on the indicators of HR and BP of group EG_1 and EG_2 authentically ($p<0,05$) differ and show more economy variant of systemic hemodynamic in EG_2. Indicators of HR in EG_2 – 73,9 (72,6; 78,5) min^{-1} against 79,4 (71,3; 89,2) min^{-1} of EG_1; indicators of SBP in EG_2 – 100,0 (98,0, 104,0) mmHg against 110,0 (108,0, 120,0) mmHg in EG_1 (table 2). Thus, data of measuring of DBP differences not marked. Besides, it is worth noting, that indicators of SBP and DBP, as characteristic for middle-aged women are substantially higher, than got by us in the surveyed groups of women, who regularly had physical activities of aerobic orientation

Table 1

Features of parameters of physical development of women EG_1 and EG_2

Indicator	EG_1	EG_2
MB, kg	62,5 (54,0; 71,0)	55,0 (54,5; 62,0)*
LB, cm	163,0 (160,0; 165,0)	163,0 (162,0; 172,0)
Circumference of neck, cm	31,5 (30,0; 32,0)	32,0 (31,0; 33,0)*
Circumference of waist, cm	75,5 (70,0; 88,0)	73,0 (72,0; 75,0)*
Circumference of chest (pause), cm	86,0 (83,0; 91,0)	86,0 (84,0; 86,0)
Circumference of chest (inhalation), cm	91,0 (87,0; 93,0)	90,0 (87,0; 91,0)
Circumference of chest (exhalation), cm	84,5 (80,0; 88,0)	84,0 (82,0; 86,0)
Chest's amplitude, cm	6,0 (5,5; 6,5)	6,0 (5,0; 7,0)
Circumference of thigh, cm	52,5 (49,0; 54,0)	51,0 (49,0; 52,0)*
Dynamometry (right hand), kg	23,5 (22,0; 24,0)	25,0 (24,0; 26,0)*
Dynamometry (left hand), kg	21,0 (20,0; 22,0)	20,0 (18,0; 22,0)
Dynamometry of trunk, kg	50,0 (49,0; 52,0)	47,0 (43,0; 59,0)
VCI, ml	3050,0 (2900,0; 3300,0)	3100,0 (3000,0; 3500,0)
BF, %	30,7 (27,0; 32,7)	23,6 (22,5; 28,2)*
BMI, $kg \cdot m^{-2}$	23,7 (20,0; 26,8)	21,0 (20,8; 21,1)*
VCI, $ml \cdot kg^{-1}$	54, 8 (40,3; 56,1)	50,0 (48,7; 57,7)
SI, %	36,9 (33,8; 40,7)	41,9 (37,3; 47,3)**

Note. ** – data probable differences, p<0,05; ** – p< 0,01*

and range within the limits of 120/80 mmHg.

Fully logical were reliable (p<0,01) differences of derivative indexes in basis of calculation of the fixed data of HR and SBP – Robinson's index and KECB. Thus, the Robinson's index and KECB in EG_2 was 66,0 (60,0; 72,0) and 2100,0 (1980,0, 2160,0) against 78,0 (72,0; 84,0) and 3120,0 (2640,0, 3600,0) in EG_1, accordingly. To assess the tolerance of the organism to physical loading (as part of the physical state) we considered the speed of recovery of the cardiovascular system after a standard exercise – 20 squats in 30 seconds (Martine's test). We can see in the table 2, that in EG_2 time of restitution is significantly lower (p<0,05), confirming improved tolerance because of long-term of regular exercises of aerobic orientation, which is quite expected.

Certain noteworthy deserves estimation of SHL of Apanasenko; qualitative characteristic of it has directly proportional dependence from VO_{2max}. So, if we turn to the qualitative assessment of the results, the median data for both groups of women was in the middle range of the SHL, EG_1 at the lower limit, but EG_2 – on top. At the same time, between of the crossing values of points the reliable differences of groups (p<0,01) are marked.

We have to remind, that concordantly with G. L. Apanasenko middle SHL answer value of VO_{2max} 29±4 ml/min · kg, higher of the middle – 41±3 ml/min · kg, which are on verge of tolerance [1]. The last allows asserting, that the women of EG_2 had of value VO_{2max} higher. It's with consideration of the training orientation also enough expected.

Data of calculation of Pirogova's LFS are complement information about physical state and witnessed about higher LFS of women of EG_2, which with consideration of differences from men, what lies in the calculation formula, can be described as above average, while of EG_1 – average. According to a calculation by R.M. Baevsky's AP studied groups of women are not different, but their majority on the level of satisfactory adaptation: AP of EG_1 – 2,25 (1,96; 2,43), of EG_2 – 2,14 (1,77; 2,32).

Substantial, from the position of interpreting the physical state of the women were calculation of the KVI, which characterizing the prevalence and impact of sympathetic or parasympathetic branches of regulation of the vegetative involuntary nervous system, although in recent years there were publications that insist on other maintenance of this index [3,10].

At the same time, we received reliable (p<0,05) differences between the study groups of the KVI, which allow to assert, that state of vegetative regulation in EG_1 is unbalanced and, to some extent, there is predominance of parasympathetic influences, while in EG_2 – it is optimized in a sufficiently narrow range of normative values that demonstrate state of the balance of vegetative regulation.

The smallest difference between the groups EG_1 and EG_2 were in data of the functional state of the respiratory system. Recall, that we weren't registered reliable differences in data of VCL and VCI (table 1).

Analogical results we were got at the analysis of data of tests of hypoxia's firmness – Shtange and Genchi. The last found a reflection in absence of reliable differences between the calculation of data of IS, which between of the investigated groups didn't differ and for the qualitative characteristic proved satisfactory and well state of cardio-respiratory system in both groups of women (table 2).

Conclusions

1. The study of literary sources shows appropriateness and effectiveness of physical activity of aerobic orientation for middle-aged women, but some aspects concerning their se-

Table 2

Differences of conservative data of cardio respiratory systems of women of EG_1 and EG_2

Indicator	EG_1	EG_2
HR, min^{-1}	79,4 (71,3; 89,2)	73,9 (72,6; 78,5)*
SBP, mmHg	110,0 (108,0; 120,0)	100,0 (98,0; 104,0)*
DBP, mmHg	70,0 (60,0; 80,0)	70,0 (66,0; 72,0)
Robinson's index, min^{-1}· mmHg/100	78,0 (72,0; 84,0)	66,0 (60,0; 72,0)**
Time of the restitution, s	105 (60; 120)	85 (60; 90)*
A sum of marks by system of estimation SHL	7 (6; 9)	11 (7; 13)**
KVI	0,06 (-0,33; 0,17)	-0,03 (-0,06; 0,03)*
Baevsky's AP	2,25 (1,96; 2,43)	2,14 (1,77; 2,32)
Pirogova's LFS	0,443 (0,356; 0,478)	0,526 (0,394; 0,673)*
KECB	3120,0 (2640,0; 3600,0)	2100,0 (1980,0; 2160,0)**
SI	1820,4 (1208,3; 2497,2)	1589,7 (1454,5; 3091,7)
Shtange's test, s	40,5 (25,0; 57,0)	40,0 (32,0; 53,0)
Genche's test, s	25,0 (20,0; 40,0)	30,0 (24,0; 32,0)

Note. ** – data probable differences, p<0,05; ** p < 0,01*

lection and impact, combining with other types of exercise has not been studied and require clarification. There are no publications, which study of the impact of long-term experience training of aerobic- orientation on middle-aged women.

2. Research of physical development using of data of the basic anthropometric measuring showed, that women with experience of training over 10 years compared to women with experience of 3–5 years, marked characteristic of the reliable changes that can be connected with influence of training of aerobic orientation. Namely, lower body weight, body fat percentage, circumference of waist and limbs, as well as higher values of absolute and relative strength of hands and neck circumference, which, in our opinion, show the development of the trunk and neck muscles specifically. Absence of differences in data of VCL and chest's amplitude appeared enough informing. The shown differences of physical development give possibility to assume reduction of risks of origin of cardiovascular diseases, among the basic factors of development of that increase of masses of body and percentage of body fat. Complementing this assumption is no difference parameters of VCL and VCI, which reduced in women with more old age, according to other researchers.

3. Fully logical were differences at activity of the cardiovascular system with consideration of the training orientation. Women with experience of training more than 10 years had in the state of calmness less indicators of HR and SBP, thus last on the lower limit of age-old normative values and also more rapid renewal of organism after standard physical loading that allowed witness economization functions of systemic hemodynamic. Similarly, changing all indexes, that includes of heart rate and blood pressure in the formulas of calculating. Analysis of SHL by system of G. L. Apanasenko allowed assuming a higher aerobic capacity of women with longer experience of training. There was also informing absence of differences in the results of tests of hypoxia's firmness of organism and Skybinskaya's index, what witnessed age-old firmness of performance of the respiratory system of women indicators with longer training experience of aerobic orientation.

4. On the whole results, which we are received, showed a positive effect of long-term training of aerobic orientation on the physical state of middle-aged women, however, for a more complete analysis of changes in the women's body, necessary to make a number of additional instrumental, biochemical, immunological, genetic research, which would allow to characterize changes in vegetative, endocrine, immune and other systems of women under influence of long-term of exercise aerobic orientation, which determines the issue for further research in this area.

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