

IMPROVEMENT OF AEROBIC ENERGY SUPPLY PROCESSES IN 37-49 YRS OLD WOMEN BY MEANS OF COMPLEX AQUA-FITNESS TRAININGS' AND METHODIC OF ENDOGENOUS - HYPOXIC BREATHING'S APPLICATION

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Abstract. *Purpose:* substantiation of purposefulness of complex aqua-fitness training and methodic of endogenous-hypoxic breathing's application for improvement of women's functional fitness. *Material:* in the research 13 women of control group and 12 women of experimental one, who had never trained aqua-fitness earlier, participated. (Their age was 37-49 years old). *Results:* during 24 weeks, at different stages of the research (after 8, 16 and 24 weeks from the beginning of trainings by the worked out program) we determined indicators of power (maximal oxygen consumption) and capacity (threshold of anaerobic metabolism), which characterize aerobic processes of energy supply. *Conclusions:* it was proved that complex application of aqua-fitness trainings in combination with methodic of endogenous-hypoxic breathing is effective. It is witnessed by acceleration of increment of absolute and relative indicators of workability, maximal oxygen consumption and threshold of anaerobic metabolism.

Key words: aqua-fitness, endogenous-hypoxic breathing, maximal oxygen consumption, threshold of anaerobic metabolism, energy supply, aerobic.

Introduction

Every age period of a person is characterized by specific re-construction of organism [1, 2, 9]. In particular, after 30 years' age in women's organism there happen substantial morphological functional changes, which manifest themselves as reduction of physical workability, functional and physical fitness, physical condition [6, 8, 9]. Under such circumstances there appears a demand in protection of women's physical health, in ability to manifest full-fledged reproductive function, providing life span increasing and creative and social functioning optimizing. That is why for women after 30 yrs old age it is purposeful to use means of physical education oriented on improvement of functional and physical fitness. It is facilitated by stimulation of aerobic energy supply processes, increasing of energy intensity of physical work, reduction of gravitation influence on body and hardening of organism [2, 5].

There is information about effective and economically profitable way of increasing of functional and physical fitness's level: implementation of innovative physical training technologies in everyday life. The determining components, in this case, are different means [5, 7, 10]. Aqua-fitness can be regarded as one of such health related means. It is characterized by wide spectrum of targeted orientation: health-related- therapeutic, recreational, conditional, teaching and, even, sport-oriented [1, 2, 5, 8, 10]. It permits to use aqua-fitness in work with different groups of population for improvement of their physical condition [1, 5, 8, 10, 11].

Recent time in practice of physical education of different age persons there have been being applied auxiliary means, which strengthen effectiveness of physical education: massage, physical-therapeutic methods, special eating adds and etc. For improvement of cardio-respiratory system's functions, perfection of motor skills as well as for therapeutic effect special techniques are introduced in physical education, sports and rehabilitation. Such techniques create hypoxia condition in organism, increase effectiveness of physical exercises [4, 7, 12, 14-17]. Regarding the above mentioned, we combined aqua-fitness program with methodic of endogenous-hypoxic breathing (EHB) with the help of Endogenic -01" device (G.I. Khodorkovskiy et al. , 2004) [13]. As on to day, there is a series of works, devoted to application of special additional means for increasing of physical exercises' effectiveness for different population strata [4, 5, 6, 8, 11, 12, 18-21]. Alongside with it, in these works there is no scientific information about possibility of application of normobaric hypercapnic hypoxia in combination with aqua-fitness trainings. Experience of previous researchers permits to stipulate that complex application of EHB and aqua-fitness training among women of 37-49 years old age will facilitate their functional and physical fitness.

Purpose, tasks of the work, material and methods

The purpose of the work is *Mema pobomu* – is to substantiate purposefulness of complex aqua-fitness training and methodic of endogenous-hypoxic breathing's application on the base of dynamic of indicators of aerobic energy supply power and capacity in women's (37-49 yrs. old age) organism.

For achievement of the set purpose we solved the following *tasks*: analysis of literature, devoted to aqua-fitness's and methodic of endogenous – hypoxic breathing's influence on organism of persons of different age and sex. We studied complex influence of aqua-fitness trainings and methodic of creation of normobaric hypercapnic hypoxia condition on indicators of aerobic energy supply and physical workability.

Methodic and organization of the research: pedagogic observation; pedagogic experiment; pedagogic testing of organism's functional fitness by indicators of aerobic energy supply systems; methods of mathematical statistic. The used methods of research permitted to determine influence of the offered program on aqua-fitness on indicators of aerobic energy supply systems.

For registration of physical workability of the tested persons we used bicycle stress test PWC₁₇₀ with bicycle stress device «BΘ-02». By its results we determined maximal oxygen consumption VO_{2 max} (V.L. Karpman et al. [3, 6, 11]. Control over heart beats rate we conducted with the help of heart beats monitor "SIGMA SPORT PS 4" and pulse-tacho-graph BEURER PM70.

For characterizing of efficiency of aerobic energy supply systems we used test for determination of threshold of anaerobic metabolism (TAM) which was offered by group of scientists under guidance of Conconi (1982) [11].

For analyzing of influence of complex aqua-fitness and endogenous-hypoxic breathing influence on indicators of aerobic energy supply systems we conducted statistic processing of the received data by t- criterion of Student [3]. Difference was regarded as confident at level of significance of p<0.05.

Results of the research

Results of study of efficiency of women organism's energy supply systems permit to affirm that aqua-fitness trainings in combination with creation in organism condition of normobaric hypercapnic hypoxia cause positive changes in power (PWC₁₇₀, VO_{2max}) and capacity (TAM) of aerobic energy supply processes.

Mean values of these indicators before trainings in control (CG) and experimental (EG) groups did not confidently differ (see table 1). During 8 weeks of trainings there did not appear any confident changes (p>0.05).

Table 1

Influence of aqua-fitness trainings with application of normobaric hypercapnic hypoxia and without it on aerobic efficiency of women's organism of 37-49 years old age (CG – n=13, EG – n=12)

Groups	Indicators	Mean value, $x \pm S$			
		Before trainings	After 8 weeks	After 16 weeks	After 24 weeks
CG	PWC ₁₇₀ ,	541.76±22.99	594.27±25.56	622.48±24.48*	629.17±24.23*
EG	kgm·min ⁻¹	549.78±38.65	627.84±26.05	667.91±28.48*	707.99±45.73*
CG	PWC ₁₇₀ ,	6.87±0.48	7.69±0.44	8.22±0.56	8.52±0.56*
EG	kgm·min ⁻¹ ·kg ⁻¹	6.99±0.45	8.18±0.42	9.06±0.48*	9.71±0.58*
CG	VO _{2 max} ,	2160.98±39.08	2250.26±43.45	2298.21±41.61*	2309.60±41.20*
EG	ml·min ⁻¹	2174.62±65.70	2307.33±44.29	2375.44±48.41*	2443.59±77.74*
CG	VO _{2 max} ,	27.52±1.59	29.26±1.53	30.41±1.60	31.32±1.76
EG	ml·min ⁻¹ ·kg ⁻¹	27.91±1.31	30.36±1.25	32.44±1.10*	33.67±1.56*
CG	TAM, W	122.31±2.59	128.46±3.46	131.54±4.32	146.15±3.46*
EG		121.67±4.62	130.00±3.70	144.17±2.77* ^Δ	150.83±3.70*
CG	TAM, W·kg ⁻¹	1.56±0.10	1.68±0.10	1.75±0.10	1.99±0.13*
EG		1.55±0.07	1.71±0.08	1.97±0.10*	2.07±0.08*
CG	Body mass, kg	81.74±3.30	79.70±2.80	77.01±2.67	76.20±2.83
EG		80.02±3.75	77.72±2.82	74.69±2.85	74.01±2.83

Notes: confident difference of values in respect to the value, registered before beginning of finalizing experiment: * – p<0.05. Confident difference in respect to indicators of control group: ^Δ – p<0.05; CG – control group; EG- experimental group.

Difference in effect of trainings became noticeable after 16 weeks from the beginning of finalizing test (see table 1). For the mentioned period in CG women only mean values of absolute physical workability increased (by 14.90%) and maximal oxygen consumption – (by 6.35%). In experimental group both absolute and relative values of these indicators confidently increased. Absolute and relative values PWC₁₇₀ increased by 21.49% (p<0.05) and 29.61% (p<0.05), VO_{2max} – by 9.24% (p<0.05) and 16.23% (p<0.05) (see table 1). Complex application of aqua-fitness and EHB facilitated confident increasing of mean values of absolute and relative indicators of anaerobic metabolism threshold – by 18.49% and 27.10% (see table 1).

It should be noted that at this stage of the experiment we registered confident difference between mean values of absolute indicators of anaerobic metabolism threshold in control and experimental groups (see table 1).

By the end of 24-weeks' training cycle we found that complex application of aqua-fitness trainings and methodic of endogenous-hypoxic breathing facilitated further increasing of indicators of aerobic energy supply of 37-49 years old women's organism. In experimental group mean values of workability absolute indicators, maximal oxygen consumption and threshold of anaerobic metabolism increased confidently by 28.78%, 12.37%, and 23.97%, comparing with initial data. Relative indicators increased by 38.91%, 20.64%, and 33.55% (see table 1). In CG aqua-fitness trainings facilitated confident increase of mean values of absolute and relative indicators of physical workability – by 16.13% and 24.02%. Absolute indicator of maximal oxygen consumption increased by 6.88% (see table 1); absolute value of TAM –19.49% ($p<0.05$) while relative – by 27.56% ($p<0.05$) (see table 1). Absolute indicator of maximal oxygen consumption in this group increased by 6.88% ($p<0.05$). Relative value remained unchanged, comparing with initial data ($p>0.05$) (see table 1).

It should be noted that 24 weeks' cycle of aqua-fitness trainings in combination with methodic of endogenous hypoxic breathing and without it facilitated improvement of organism's aerobic efficiency in 37-49 years old women (judging by criteria of Ya.P. Piarnat from "good" to "excellent").

Discussion

The obtained results of control group prove the data of previous researchers [5, 7, 10], concerning effectiveness of aqua-fitness's application for improvement of women's functional fitness. For the first time, we used methodic of endogenous hypoxic breathing in combination with aqua-fitness trainings of 37-49 years old women. Results of experimental group witnessed purposefulness of complex application of endogenous hypoxic breathing and aqua-fitness trainings for acceleration of increasing of aerobic energy supply systems' indicators.

Conclusions:

Results of the conducted researches witnessed that health related aqua-fitness trainings facilitate confident increase of physical workability indicators, maximal oxygen consumption and threshold of anaerobic metabolism. In its turn it witnesses about improvement of 37-49 years old women's functional fitness. Complex application of aqua-fitness and endogenous hypoxic breathing facilitates acceleration of the above described changes in power and capacity of aerobic energy supply processes. It proves purposefulness of their application in health related trainings of 37-49 years old women.

Further researches shall be oriented on studying of influence of complex aqua-fitness and EHB application on physical condition of 30-49 years old women.

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Conflict of interests

The authors declare that there is no conflict of interests. *інтересів.*

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