ORIGINAL ARTICLES. PHYSICAL EDUCATION

Functional fitness of women of the first period of adulthood under the influence of aqua fitness

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DOI: https://doi.org/10.34142/HSR.2021.07.01.02

How to Cite
Miroshnichenko VM, Brezdenyuk OY, Golovkina VV, Romanenko OI, Chekhovskaya YS Functional fitness of women of the first period of adulthood under the influence of aqua fitness. *Health, Sport, Rehabilitation*. 2021;*7*(1):19-27. https://doi.org/10.34142/HSR.2021.07.01.02

Abstract

Purpose: to identify the features of the impact of aqua fitness on aerobic and anaerobic performance of women 25-35 years.
Material and methods: The study involved women aged 25-35 in the number of 41 people. For 24 weeks, the subjects were engaged in an aqua fitness program. Aqua fitness classes were aerobic and strength. The anaerobic lactate productivity of the organism was determined by the Wingat anaerobic test WAT 10. The anaerobic lactate productivity of the organism was determined by the Wingat anaerobic test WAT 30 and the bicycle ergometric test according to the method of A. Shogy, G. Cherebetin. The threshold of anaerobic metabolism was determined by cycling ergometric test F. Conconi et al. Aerobic productivity of the body was studied by Vo2 max. Absolute and relative indicators were determined for all tests.
Results. Under the influence of classes in the aqua fitness program, growth was found in all indicators of functional readiness. The power of anaerobic lactate energy supply processes relative to WAT 10 increased with a statistically significant difference in level ($t = 5.07$; $p = 0.000$). The power of anaerobic lactate energy supply processes relative to WAT 30 increased with a statistically significant difference in level ($t = 4.68$; $p = 0.000$). The power of aerobic energy supply processes relative to Vo2 max increased with a statistically significant difference at the level ($t = 2.77$; $p = 0.007$).
Conclusions: Aqua fitness is an effective means of correcting indicators of functional fitness. The combination of strength and aerobic classes in the aqua fitness program provides an increase in aerobic, anaerobic lactate and anaerobic lactate productivity of the body. A slight decrease in body weight studied under the influence of aqua fitness causes a greater degree of growth of relative indicators of WAT 10, WAT 30, MCPM, AMT, VO_{2max}, compared with absolute.
Key words: aerobic productivity, anaerobic productivity, health training

Анотація

Мірошніченко В.М., Брезденюк О.Ю., Головкіна В.В., Романенко О.І., Чехівська Ю.С. Функціональна підготовленість жінок першого періоду зрілого віку під впливом занять аквафітнесом

Мета: виявити особливості впливу занять аквафітнесом на аеробну та анаеробну продуктивність організму жінок 25-35 років.

Матеріал і методи: У дослідженні взяли участь жінки 25-35 років у кількості 41 особи. Протягом 24 тижнів досліджувані займалися за програмою аквафітнесу. Заняття аквафітнесом мали аеробне і силове спрямування. Анаеробну алактатну продуктивність організму визначали за Вінгатським анаеробним тестом WAT 10. Анаеробну лактатну продуктивність організму визначали за Вінгатським анаеробним тестом WAT 30 та велоергометричним тестом за методикою A. Shogy, G. Cherebetin. Поріг анаеробного обміну визначали за велоергометричним тестом F. Conconi et al. Аеробну продуктивність організму досліджували за показником $Vo_{2\ max}$. За усіма тестами визначали абсолютні та відносні показники.

Результати. Під впливом занять за програмою аквафітнесу виявлено зростання за усіма показниками функціональної підготовленості. Потужність анаеробних алактатних процесів енергозабезпечення за відносним показником WAT 10 зросла із статистично значущою відмінністю на рівні (t=5,07; p=0,000). Потужність анаеробних лактатних процесів енергозабезпечення за відносним показником WAT 30 зросла із статистично значущою відмінністю на рівні (t=4,68; p=0,000). Потужність аеробних процесів енергозабезпечення за відносним показником $Vo_{2\ max}$ зросла із статистично значущою відмінністю на рівні (t=2,77; p=0,007).

Висновки: Заняття аквафітнесом є дієвим засобом корекції показників функціональної підготовленості. Поєднання у програмі аквафітнесу занять силового та аеробного спрямування забезпечує зростання показників аеробної, анаеробної лактатної та анаеробної алактатної продуктивності організму. Незначне зниження маси тіла досліджуваних під впливом занять аквафітнесом обумовлює більший ступінь зростання відносних показників WAT 10, WAT 30, MAEMW, AMT, $VO_{2\ max}$, у порівнянні з абсолютними.

Ключові слова: аеробна продуктивність, анаеробна продуктивність, оздоровчі тренування

Аннотация

Мирошниченко В.Н., Брезденюк А.Ю., Головкина В.В., Романенко А.И., Чеховская Ю.С. Функциональная подготовленность женщин первого периода зрелого возраста под действиемм занятий аквафитнесом

Цель: выявить особенности влияния занятий водным фитнесом на аэробную и анаэробную работоспособность женщин 25-35 лет.

Материал и методы. В исследовании приняли участие женщины 25-35 лет в количестве 41 человека. В течение 24 недель испытуемые занимались по программе аквафитнеса. Занятия по аквафитнесу были аэробными и силовыми. Анаэробная лактатная продуктивность организма определялась с помощью анаэробного теста Wingat WAT 10. Анаэробная лактатная продуктивность организма определялась с помощью анаэробного теста Wingat WAT 30 и велоэргометрического теста по методике A. Shogy, G. Cherebetin. Порог анаэробного метаболизма определяли с помощью велосипедно-эргометрического теста F. Conconi et al. Аэробную продуктивность организма изучали по Vo2 max. По всем тестам определялись абсолютные и относительные показатели.

Результаты. Под влиянием занятий по программе аквафитнеса обнаружен рост по всем показателям функциональной подготовленности. Мощность анаэробных процессов энергообеспечения лактата относительно WAT 10 увеличивалась со статистически значимой разницей в уровне (t = 5,07; p = 0,000). Мощность анаэробных процессов энергообеспечения лактата относительно WAT 30 увеличивалась со статистически значимой разницей в уровне (t = 4,68; p = 0,000). Мощность процессов аэробного энергообеспечения относительно Vo2 max увеличивалась со статистически значимой разницей на уровне (t = 2,77; p = 0,007).

Выводы: Аквафитнес - эффективное средство коррекции показателей функциональной подготовленности. Сочетание силовых и аэробных занятий в программе аквафитнеса обеспечивает повышение аэробной, анаэробной лактатной и анаэробной лактатной продуктивности организма. Небольшое снижение массы тела, исследованное под влиянием аквафитнеса, вызывает большую степень роста относительных показателей WAT 10, WAT 30, MCPM, AMT, VO2max по сравнению с абсолютными.

Ключевые слова: аэробная продуктивность, анаэробная продуктивность, оздоровительная тренировка

Introduction

Aquafitness, as a type of physical activity in recent years is gaining popularity. Women aged 25-35 predominate among the visitors of aqua fitness classes. This age period MF Ivanytsky is characterized as homeostasis [1]. Physiologists refer the age category of 25-35 years to the first period of adulthood. A.S. Солодков, E.Б. Sologub [2] note that up to 22 years have passed all the critical and sensitive periods for the development of physical qualities. For healthy people of the first period of adulthood, all age warnings regarding physical activity have been removed [2, 3]. This opens up opportunities to apply the whole arsenal of tools and methods in the process of aqua fitness.

The uniqueness of training in the aquatic environment is due to a number of factors. The high density of water allows the use of the aquatic environment as a natural simulator, as indicated by Yu Briskin [4], N. Goglyuvat [5], S. Salnikov [6]. In the aquatic environment, the effects of exercise can be directed to the development of strength, strength endurance and general endurance. Accordingly, the various energy supply systems of muscular activity are activated.

S. Salnykova studied the effect of aqua fitness using the technique of endogenous-hypoxic respiration on Vo2 max and AMT in women 30-49 years [7]. V. Golovkina introduced aqua fitness classes in the process of training athletes-swimmers aged 11-12 [8]. M. Vécseyné Kovách et al. [9], Raquel Leirós-Rodríguez et al. [10] studied the impact of aqua fitness on the physical qualities, self-esteem and health of older people. K. Vochna et al. [11] found an increase in the bone strength index in women 54-65 years under the influence of aqua fitness programs. Fernanda de Mattos et al. [12] found a positive effect of sets of aerobic, strength, coordination exercises performed in water on muscle strength and physical function of the subjects. Henrique Pereira Neiva et al. [13] found a positive effect of exercise in the aquatic environment on physical fitness and health indicators in women 59 ± 12.3 years. Eva Ryzkova et al. [14] proved the effectiveness of aqua fitness using high-intensity exercises to reduce heart rate and improve physical fitness in students 21.1 ± 3.2 years. Rachel E. Williams et al. [15] found an increase in muscle strength and muscular endurance under the influence of 15 weeks of aqua fitness. We have not found data on the possibility of improving the aerobic, anaerobic lactate, anaerobic lactate processes of energy supply of muscular activity in women of the first period of adulthood by means of aqua fitness.

We have suggested that due to the wide arsenal of tools and methods used in aqua fitness classes, it is possible to influence all energy supply systems of muscular activity: aerobic, anaerobic lactate and anaerobic lactate.

Purpose: to identify the features of the impact of aqua fitness on aerobic and anaerobic performance of women 25-35 years

Material and methods

Participants

The study involved 41 females aged 25-35 years (the first period of adulthood). Prior to the start of classes on the experimental program, the subjects had experience of aqua fitness for no more than 1 month. All subjects in the past had no experience in sports. Each subject gave written consent to participate in the experiment.

Procedure

The subjects were engaged in the author's program on aqua fitness. The frequency of classes was 3 times a week. In the preparatory period (1-4 weeks) twice a week was dominated by strength training and once a week - aerobic. In the preparatory period, the tasks of women's adaptation to the conditions of the aquatic environment, the formation of skills and abilities of the basic elements of aqua fitness, to ensure the growth of functionality were solved. In the main period (5-20 weeks) the ratio of aerobic and strength exercises changed in favor of aerobic. Emphasis was placed on increasing the motor density of classes and increasing the coordination complexity of exercises. As the functional capacity of women increased, the pace of exercise, their coordination complexity and the number of repetitions gradually increased. To ensure a gradual increase in the intensity of the load alternately included aids that complicate the performance of exercises (dumbbells of various sizes, noodles, boots, rubber shock absorbers and others). During the maintenance period, aerobic work was also preferred. The task of the maintenance period was to maintain functional indicators at the achieved level. In the second half of the main period and in the maintenance period, the method of circuit training was used in strength training. When dosing loads, the features of the female body were taken into account. Also took into account the characteristics of the aquatic environment on the body [18].

Functional readiness was determined by indicators of aerobic lactate, anaerobic lactate and

aerobic productivity. The power of aerobic energy supply of muscular activity was studied by the indicator of maximum oxygen consumption (Vo2 max). Determined Vo2 max according to the method of VL Karpman and co-authors [16]. Used bicycle ergometric version of the test PWC 170. Based on the data obtained, Vo2 max was calculated. Expressed Vo2 max in ml • min-1. The technology of the test is described in the publication Yu.M. Furman et al. [17, p. 30-33].

Anaerobic metabolism threshold (AMT) was determined by the test of F. Conconi et al. [17] in a modification of Yu.M. Furman. The subjects performed a stepwise increasing load on the ergometer. At the end of each stage, heart rate was recorded. The AMT level corresponded to the inflection point on the heart rate chart. Impressed by the value of AMT in W. The technology of the test is described in detail in the work of Yu.M. Furman. [17, p. 37-38].

To determine the capacity of anaerobic lactate energy processes used a method developed by Shogy A., Cherebetin G. This method involves determining the maximum amount of external mechanical work for 1 min (MAEMW). The technology of the test is described in detail in the work of Yu.M. Furman et al. [17, p. 42].

The power of anaerobic lactate energy supply processes was determined using the Wingat anaerobic test WAT 10. This test is to perform a bicycle ergometric load lasting 10 s with the maximum possible pedaling frequency. The number of full pedal revolutions was counted. By mathematical calculations, the result was expressed in kgm • min-1.

The power of anaerobic lactate energy supply processes was determined using the Wingat anaerobic test WAT 30. The conditions of this test are similar to the test WAT 10. The difference is in the duration of the load which is 30s. Expressed results in kgm • min-1. The technology of performing tests WAT 10 and WAT 30 is described in the publication Yu.M. Furman et al. [17, p. 40-42]

To increase the informativeness of all indicators, absolute and relative values were studied. All tests were performed on a Christopeit Sport AX-1 bicycle ergometer.

Statistical analysis

The duration of the experimental part of the study was 24 weeks. Control measurements were performed before the start of classes, 12 weeks after the start of classes and after their completion. Related kgm • min samples were compared, where the series showed changes in traits depending on the stage of the study. Initially, the data series were checked using the STATISTICA 13 program for compliance with the normal distribution law. Data that corresponded to the normal distribution law were compared according to Student's t-test. Determined: X - arithmetic mean, S - standard deviation, t - value of Student's t-test, p - level of significance. The difference was considered significant at a significance level of $p < 0.05$.

Results

After 12 weeks of training, an increase in the relative values of anaerobic lactate productivity of the body (according to WAT 10) and anaerobic lactate productivity of the body (according to WAT 30, MAEMW) (Table 1).

Table 1

Dynamics of indicators of functional readiness of women 25-35 years under the influence of aqua fitness at the second control stage of the study (n = 41)

Indicators	Before classes	In 12 weeks	Significance of differences	
	$\bar{x}$ ± S	$\bar{x}$ ± S	t	p
WAT 10 (kgm·min^{-1})	2441,1±534,57	2580,9±512,83	-1,20846	0,230
WAT 10 (kgm·min^{-1}·kg^{-1})	38,0±5,04	40,9±4,83	-2,61869	0,011*
WAT 30 (kgm·min^{-1})	2214,5±485,70	2333,1±459,44	-1,13572	0,259
WAT 30 (kgm·min^{-1}·kg^{-1})	34,5±4,71	37,0±4,41	-2,44469	0,017*
MAEMW (kgm·min^{-1})	1558,2±248,84	1615,4±237,01	-1,06446	0,290
MAEMW (kgm·min^{-1}·kg^{-1})	24,5±2,54	25,8±2,32	-2,33926	0,022*
AMT (W)	137,1±14,53	141,2±14,70	-1,28453	0,203
AMT (W· kg^{-1})	2,2±0,27	2,3±0,25	-1,65152	0,102
$Vo_{2\ max}$ (мл·хв$^{-1}$)	2567,4±168,83	2606,6±171,94	-1,04157	0,301
$Vo_{2\ max}$ (мл·хв$^{-1}$·kg^{-1})	40,9±4,90	42,0±4,55	-1,08529	0,281

Note: * - significance level $p < 0.05$.

At the end of the program, the subjects found a statistically significant increase in most indicators of functional readiness (table 2). According to the absolute indicators of WAT 30 and MAEMW, only a tendency to increase the mean group values (p> 0.05). It should be noted a smaller degree of growth of absolute values for all indicators. This is indicated by the values of the t-test, which in absolute terms are in the range of 1,862-2,352, and in relative terms in the range of 2,765-5,074.

Table 2

Dynamics of indicators of functional readiness among women 25-35 years old under the influence of aquafitness classes at the third control stage of the study (n = 41)

Indicators	Before classes	In 12 weeks	Significance of differences	
	$\bar{x} \pm S$	$\bar{x} \pm S$	t	p
WAT 10 (kgm·min^{-1})	2441,1±534,57	2680,4±476,36	-2,140	0,035*
WAT 10 (kgm·min^{-1}·kg^{-1})	38,0±5,04	43,5±4,75	-5,074	0,000*
WAT 30 (kgm·min^{-1})	2214,5±485,70	2412,7±424,95	-1,966	0,052
WAT 30 (kgm·min^{-1}·kg^{-1})	34,5±4,71	39,2±4,29	-4,684	0,000*
MAEMW(kgm·min^{-1})	1558,2±248,84	1654,4±217,50	-1,863	0,066
MAEMW(kgm·min^{-1}·kg^{-1})	24,5±2,54	27,0±2,32	-4,650	0,000*
AMT (W)	137,1±14,53	143,7±15,12	-2,010	0,048*
AMT (W· kg^{-1})	2,2±0,27	2,4±0,26	-3,137	0,002*
$Vo_{2\ max}$ (мл·хв$^{-1}$)	2567,4±168,83	2657,3±177,28	-2,352	0,021*
$Vo_{2\ max}$ (мл·хв$^{-1}$·kg^{-1})	40,9±4,90	43,7±4,30	-2,766	0,007*

Note: * - significance level p <0.05

The fact that we found a greater increase in the relative indicators of functional fitness prompted us to study the dynamics of body weight of the subjects. The data in table 3 indicate an existing tendency to decrease the body weight of the subjects, but we did not find a statistically significant difference (p> 0.05).

Table 3

Dynamics of body weight in women 25-35 years under the influence of aqua fitness at different stages of the study (n=41)

Indicator	Before classes	In 12 weeks	Significance of differences		In 24 weeks	Significance of differences	
	$\bar{x} \pm S$	$\bar{x} \pm S$	t	p	$\bar{x} \pm S$	t	p
Маса тіла (kg)	63,7±8,62	62,7±7,78	0,520	0,604	61,3±6,75	1,376	0,172

Discussion

The influence of aquafitness training was manifested by a statistically significant increase in indicators of the entire spectrum of energy supply of muscle activity: aerobic, anaerobic lactate and anaerobic alactate. Such data indicate the possibility of versatile influence by means of aquafitness on the functional readiness of women 25-35 years old. The growth of the anaerobic alactate performance of the body (according to the WAT 10 indicator) was caused by the exercises of strength nature, provided by the program at all periods of training. We did not find data on the influence of aquafitness classes on the absolute and relative indicators of WAT 10 in women of 25-35 years old in the literature available to us. Furman YM et al. [19] found an increase in the anaerobic alactate performance of athletes-swimmers 11-12 years old as a result of introducing exercise complexes from the aquafitness arsenal into the training process. S. Salnikova [6] established the growth of explosive strength in women 30-49 years old under the influence of aquafitness classes. The ability to exhibit explosive strength depends on the anaerobic alactic capabilities of the organism [2, 17, 20]. Therefore, it can be argued that the growth in the indices of anaerobic alactate productivity that we found to a certain extent confirms the data of the aforementioned authors. Raquel Leirós-Rodríguez et al. Found a low efficiency of aquafitness classes in terms of increasing the strength abilities of women aged 65.5 ± 5.6 years. [ten]. Such data indicate that the ability to influence anaerobic alactate performance and strength abilities by aquafitness training depends on the means used and the age group of the subjects.

The increase in the relative indices of anaerobic lactic performance of the body (according to the indications of WAT 30 and MAEMW) was caused by the use of exercises of submaximal intensity (at a heart rate of 170-180 beats • min-1) and strength exercises performed by the method of circular training. Since the growth occurred only in relative terms, this was influenced by the decrease in body weight of the subjects. In the literature available to us, there is no data on the impact of aquafitness classes on WAT 30 and MAEMW indicators. There are data on which conclusions can be drawn indirectly. So V. Kovách et al. [9] found an increase in the result of the test "squatting on a chair from a standing position for 30 s" and "flexion and extension of the arm with a dumbbell for 30 s" in women 66.4 ± 6.2 years old, engaged in the aquafitness program.

The growth of AMT indicators was facilitated by the aerobic training provided by the program. Also, the AMT indicator is influenced by exercises that are performed with submaximal intensity. This is indicated by a very high degree of correlation between anaerobic lactate performance of the body and aerobic [17]. The influence of aquafitness classes on the AMT indicator of persons of different age groups has been studied fragmentarily. Thus, Yu. Furman and S. Salnikova [20] found an increase in AMT in women aged 37-49 under the influence of aquafitness classes in combination with endogenous hypoxic respiration.

Among the indicators of aerobic performance, a statistically significant increase occurred both in terms of the relative indicator Vo2 max, and in absolute terms. The data obtained by us are confirmed by the researches of S. Salnikova [6], who established an increase in the absolute and relative indicator Vo2 max in women aged 30-49 years under the influence of aquafitness classes in combination with endogenous hypoxic respiration. V.V. Golovkina [8] found an increase in Vo2 max in athletes-swimmers 11-12 years old as a result of the introduction of aquafitness into the training process. ON. Goglyuvat [5] found an increase in the functional parameters of the oxygen transport system in women of the first period of adulthood under the influence of aquafitness. It should be noted that it is the capabilities of the oxygen-transport system that is the limiting factor of the aerobic energy supply system for muscular activity [21].

Aqua fitness did not cause a statistically confirmed decrease in body weight ($p > 0.05$). At the same time, the average group value of the body weight of the subjects decreased from 63.7 kg to 61.3 kg (see Table 3). It was this factor that caused a large increase in the relative indicators WAT 10 WAT 30 MAEMW, AMT, VO2 max, compared with the absolute. Since the relative indicators of functional readiness are more informative, this fact must be taken into account when conducting classes with women of the first period of adulthood.

Conclusions

Aquafitness classes are an effective means of correcting indicators of functional readiness. The combination of strength and aerobic training in the aquafitness program provides an increase in the indicators of aerobic, anaerobic lactate and anaerobic alactate performance of the body. An insignificant decrease in the body weight of the subjects under the influence of aquafitness exercises determines a significantly greater degree of growth in the relative indicators of the cardiovascular system in comparison with the absolute ones.

Conflict of interest

The authors declare that there is no conflict of interest.

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Received: 2021-01-18 Accepted: 2021-02-16 Published: 2021-03-20