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THE INFLUENCE OF SWIMMING WITH APPLICATION OF AQUA FITNESS ELEMENTS AND INTERMEDIATE HYPOXIC TRAINING ON THE PHYSICAL PREPAREDNESS OF GIRLS 11–12 YEARS

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Abstracts

The aim is to establish the integrated influence of training sessions, which used the elements of aqua fitness and interval hypoxic training, on the special physical training of girls 11–12 years old. ***Material*:** 64 athletes aged of 11–12 years, with a sports experience of 2–3 years took place in the research. ***Results.*** During 24 weeks at the different stages of studying (after 8, 16 and 24 weeks) the efficiency of the anaerobic alactated and lactate energy supply zones, as well as in the aerobic energy supply zone was studied. It has been established that training sessions of swimming with using of elements of aqua-fitness and interval hypoxic training with the device «Endogenic-01» to improve the indicators in the area of anaerobic alactatious and anaerobic lactate energy supply, efficiency in the zone of aerobic energy supply and power of anaerobic alactat system of girls 11–12 years old. For the first time, the elements of aqua fitness and interval hypoxic training were used in the training process of young swimmers. The expediency of such an innovation is explained by minimizing the negative impact on the children's body of exercises on the development of force in conditions of the aquatic environment while improving the functional capabilities of the organism. The effectiveness of the complex application in the training process of the swimmers of the aqua fitness and the interval hypoxic training with the girls of 11–12 years is confirmed by the probable difference between the performance indicators in the aerobic energy supply zone (by 2,43 %), efficiency in the anaerobic lactate energy supply zone (6,67 %) and the power of anaerobic power supply systems (by 21,69 %) for representatives of groups of KG and BG2 and indicators of efficiency in the aerobic energy supply zone (by 2,31 %) and the capacity of anaerobic systems energy supply (to 15,00 %) in the group of representatives BG1 and BG2 in favor of the last after 24 weeks of employment for our proposed applications**.** ***Conclusions*.** The efficiency of complex application in swimming classes of aqua fitness elements and interval hypoxic training has been proved. The feasibility of such combination is proved by the growth of performance indicators in areas of aerobic, anaerobic alactatic and lactate energy supply.

Key words: anaerobic alactatic and lactate energy supply zone, aerobic energy supply zone, hypoxia, aqua fitness, swimming.

Вікторія Головкіна. Вплив занять плаванням із застосуванням елементів аквафітнесу й інтервального гіпоксичного тренування на фізичну підготовленість дівчат 11–12 років. ***Мета дослідження*** – встановити комплексний вплив тренувальних занять, у яких використано елементи аквафітнесу й інтервальне гіпоксичне тренування, на спеціальну фізичну підготовленість дівчат-плавчинь 11– 12 років. ***Матеріал.*** У дослідженні брали участь 64 спортсменки віком 11–12 років, спортивний стаж яких – 2– 3 роки. ***Результати*.** Протягом 24 тижнів на різних етапах дослідження (через 8, 16 і 24 тижні) вивчено працездатність у зонах анаеробного алактатного й лактатного енергозабезпечень, а також у зоні аеробного енергозабезпечення.

Уперше комплексно застосовано елементи аквафітнесу й інтервальне гіпоксичне тренування в тренувальному процесі юних плавців. Доцільність такого нововведення пояснюємо мінімізацією негативного впливу на організм дітей вправ із розвитку сили в умовах водного середовища з одночасним покращенням функціональних можливостей організму. Ефективність комплексного застосування в тренувальному процесі плавців елементів аквафітнесу й інтервального гіпоксичного тренування з дівчатами 11–12 років підтверджується вірогідною різницею між показниками працездатності в зоні аеробного енергозабезпечення (на 2,43 %), працездатності в зоні анаеробного лактатного енергозабезпечення (на 6,67 %) і потужності анаеробних систем енергозабезпечення (на 21,69 %) у представниць груп КГ та ОГ2 та показниками працездатності в зоні аеробного енергозабезпечення (на 2,31 %) і потужності анаеробних систем енергозабезпечення (на 15,00 %) у представниць груп ОГ1 та ОГ2 на користь останніх через 24 тижні занять за запропонованими нами програмами. Установлено, що тренувальні заняття плаванням із застосуванням елементів аквафітнесу й інтервального гіпоксичного тренування за допомогою апарату «Ендогенік-01» сприяють покращенню показників працездатності в зоні анаеробного алактатного й анаеробного лактатного енергозабезпечення, працездатності в зоні аеробного енергозабезпечення й потужності анаеробної алактатної системи дівчат 11–12 років. ***Висновки.*** Доведено ефективність комплексного застосування в заняттях плаванням елементів аквафітнесу й інтервального гіпоксичного тренування. Доцільність такого поєднання доведено зростанням показників працездатності в зонах аеробного, анаеробного алактатного й лактатного енергозабезпечення.

Ключові слова: зона анаеробного алактатного й лактатного енергозабезпечення, зона аеробного енергозабезпечення, гіпоксія, аквафітнес, плавання.

Виктория Головкина. Влияние занятий плаванием с применением элементов аквафитнеса и интервальной гипоксической тренировки на физическую подготовленность девушек 11–12 лет. ***Цель исследования*** – установить комплексное воздействие тренировочных занятий, в которых использовались элементы аквафитнеса и интервальные гипоксические тренировки, на специальную физическую подготовленность девушек-плавчих 11–12 лет. ***Материалы.*** В исследовании принимали участие 64 спортсмена в возрасте 11–12 лет, спортивный стаж которых – 2–3 года. ***Результаты.*** В течение 24 недель на разных этапах исследования (через 8, 16 и 24 недели) изучена работоспособность в зонах анаэробного алактатного и лактатного энергообеспечений, а также в зоне аэробного энергообеспечения. Впервые комплексно применены элементы аквафитнеса и интервальные гипоксические и тренировки в тренировочном процессе юных пловцов. Целесообразность такого нововведения мы объясняем минимизацией негативного воздействия на организм детей упражнений по развитию силы в условиях водной среды с одновременным улучшением функциональных возможностей организма. Эффективность комплексного применения в тренировочном процессе пловцов элементов аквафитнеса и интервальных гипоксических тренировок с девушками 11–12 лет подтверждается достоверной разницей между показателями работоспособности в зоне аэробного энергообеспечения (на 2,43 %), работоспособности в зоне анаэробного лактатного энергообеспечения (на 6,67 %) и мощности анаэробных систем энергообеспечения (на 21,69 %) у представительниц групп КГ и ОГ2 и показателями работоспособности в зоне аэробного энергообеспечения (на 2,31 %) и мощности анаэробных систем енергообезпечения (на 15,00 %) у представительниц групп ОГ1 и ОГ2 в пользу последних через 24 недели занятий по предложенным нами программам. Установлено, что тренировочные занятия плаванием с применением элементов аквафитнеса и интервальных гипоксических тренировок с помощью аппарата «Эндогеник-01» способствуют улучшению показателей работоспособности в зоне анаэробного алактатного и анаэробного лактатного энергообеспечения, работоспособности в зоне аэробного энергообеспечения и мощности анаэробной алактатной системы девушек 11–12 лет. ***Выводы.*** Доказана эффективность комплексного применения в занятиях плаванием элементов аквафитнеса и интервальных гипоксических тренировок. Целесообразность такого сочетания доказана ростом показателей работоспособности в зонах аэробного, анаэробного алактатного и лактатного энергообеспечения.

Ключевые слова: зона анаэробного алактатного и лактатного энергообеспечения, зона аэробного энергообеспечения, гипоксия, аквафитнес, плавание.

The formulation of the problem. The analysis of the protocols of the Olympic Games, the World Championships and other competitions testifies to the dynamics of the growth of results from various kinds of sport. This phenomenon is conditioned by an increase of the efficiency of training sessions by introducing new technologies into the multi-year training of athletes [4].

The improving of the strength qualities plays an essential role in the training of young swimmers [2]. Force training [17], working with swimmers is carried out in the gym of dry-swimming. However, performing force exercises under such conditions can adversely effect on the physical [13] and functional [12] preparedness of young swimmers. Therefore, we propose a part of the time allocated to the Youth Sports School for force training in the dry-swimming area to be replaced by aqua fitness [19].

The analysis of recent sources and publications. There is evidence that doing the physical exercises in water has a positive effect on various functional systems of the body [8]. Such an effect of physical exercises in water is due to the phenomenon of body discharge gravity [14], positive influence on the function of the cardiovascular [3] and respiratory systems [6], as well as the vestibular apparatus [15].

Recently, in the practice of physical education working with people of different ages, auxiliary means are used; they increase the effectiveness of physical exercisees, such as: massage [18], dietary supplements [11] et [16]. In particular, it has been proved that the using of endogenous-hypoxic breathing techniques with the Endogeneic-01 apparatus for young cyclists [10] and swimmers [9] has positively influence for the dynamics of physical training in the preparatory period of the annual macro cycle. The evidence of the effectiveness of endogenous-hypoxic respiration working with qualified hockey players on the grass is the results of the investigations by Yu. Furman and A. Sulyma [7]. The researchers conducted by Yu. Furman and S. Salnikova [6; 8] have proved the effectiveness of the complex application of aqua fitness and the method of endogenous-hypoxic respiration when working with women of mature age, which is confirmed by the improvement of their physical condition [19].

Therefore, we propose to integrate the elements of aqua fitness and the method of interval hypoxic training (IHT) in the program of training young swimmers, using the apparatus «Endogenic-01» [10].

Scientific data on the possibility of applying the IHT method in conjunction with aqua fitness in the training process of 11-12-year old girls are absent.

Hypothesis. Taking into account the experience of the previous researchers, we predicted that the integrated application of the EHB method and the elements of aqua fitness in the training process of young swimmers would enhance their functional, general and special physical training.

The purpose of the research is to establish the comprehensive impact of training sessions using the elements of aqua fitness and the method of interval hypoxic training, on the special physical training of 11–12-year old girls.

To achieve this goal, we solved the following **tasks**:

- We studied the state of the problem on the topic of research.
- We investigated the functional training of 11-12-year old girls.

The methods and organization of the research:

- the theoretical analysis and generalization of the scientific sources data;
- the pedagogical experiment;
- the testing of special physical training;
- the methods of mathematical statistics.

Participants. The experiment was attended by pupils of Children's and Youth Sports Schools, the 11–12- year old girls, sports experience of which was 2-3 years. The total number of athletes was 62. Three groups were completed before the beginning of the experiment: the control group (COG, n = 20), the first basic (BG1, n = 21) and the second main (BG2, n = 21).

The organization of the research. To study the influence of swimming exercises with elements of aqua fitness and interval hypoxic training on the special physical training of female swimmers, swimming tests were used: «swimming with free style at a distance of 25 meters», «swimming with free style at distances of 4 × 50 m at intervals of rest 15 s», «swimming with free style at a distance of 800 m». A test was also applied to record the number of twists of 25 meters in intervals with the highest possible speed in the anaerobic mode of power supply. The number of iterations was limited to an excess of heart rate that was 170 beats per minute (bpm) [9].

Studying of swimmers was carried out in stages: before the experiment, and later in 8, 16 and 24 weeks.

Frequency of trainings in all groups was 6 times a week. The content of the trainings in the main groups was different from the control. Female athletes of the first main group on each training session at the beginning of the preparatory part used interval hypoxic training (IHT) under the program of special «route maps»[10]. For this purpose the «Endogenic-01» device was used.

Strength training for female athletes of the second main group was carried out in water using elements of the aqua fitness of power direction [19]. In the process of training used such aids, such as water bands, gloves, small and large dumbbells, nudls, boots, rubber shock absorbers, swimming boards [20].

Statistical analysis. It was summing up numerical indices that reflect the position of the center of empirical distributions and their scattering: the arithmetic mean (x); arithmetic mean error (m); mean square (standard) deviation (S); dispersion (S2); coefficient of variation (V).

The values of the sample from the general population were subject to the law of normal distribution, which was verified using the Pearson criterion. Given the fact that the distribution of all the studying indicators was normal, in order to determine the validity of the difference between the mean values, the t-criterion of the Student was used [5]. The difference was considered probable with a difference of 5 % ($p < 0.05$).

The results of the research and their discussion.

There were not any of the indicators of special physical training for the girls of all groups (KG, BG1, BG2) swimming lessons for 8 weeks.

According to the following data in Table 1, the girls of the OG1 group under the influence of sixteen-week swimming exercises using interval hypoxic training had a probable improvement (4.16%) of the result of the first section swimming during the 4x50m Freestyle on 15 sec. rest interval.

Table 1

Indicators of special physical training of 11–12 year old girls at different stages of studying

Indicators		**Groups**	**Average values, x±S**			
			Before training	**After 8 weeks**	**After 16 weeks**	**After 24 weeks**
Freestyle 800m/s		CG	818,50±8,06	806,85±7,07	798,45±5,90	791,70±6,09*
		BG1	819,38±5,62	803,10±6,39	797,81±7,93*	790,67±7,75*
		BG2	821,24±7,69	802,33±6,68	794,71±7,22*	772,43±4,44*
Freestyle 4x50m with interval for a rest 15 s	1 section	CG	38,54±0,87	38,41±0,92	37,66±0,87	36,44±0,89
		BG1	38,42±0,45	38,30±0,44	36,82±0,53*	36,25±0,38*
	2 section	BG2	38,69±0,67	38,56±0,67	36,59±0,68*	35,15±0,75*
		CG	41,50±0,88	41,41±0,86	40,77±0,86	40,20±0,88
	3 section	BG1	41,54±0,44	41,49±0,44	40,76±0,45	39,99±0,54*
		BG2	41,51±0,63	41,42±0,64	39,63±0,71	39,57±0,67*
	4 section	CG	44,20±0,88	44,06±0,90	43,84±0,91	43,52±0,97
		BG1	44,37±0,43	44,26±0,44	44,15±0,45	43,37±0,40
		BG2	44,42±0,64	44,28±0,66	43,93±0,67	42,52±0,71
		CG	47,28±0,87	47,15±0,87	46,94±0,88	46,67±1,07
		BG1	47,17±0,50	47,11±0,49	47,02±0,49	46,45±0,50
		BG2	47,25±0,70	47,11±0,67	46,86±0,68	44,67±1,01*
25m/s Freestyle		CG	17,43±0,32	17,17±0,27	16,97±0,26	16,69±0,29
		BG1	17,52±0,25	17,06±0,22	16,80±0,26	15,75±0,25*
		BG2	17,50±0,30	16,99±0,28	16,70±0,26*	15,58±0,18*

End of the Table 1

Swimming at distances of 25 m under 150/170 bits per minute	CG	2,30±0,18	2,45±0,12	2,50±0,06	2,70±0,12
	BG1	2,29±0,12	2,52±0,06	2,57±0,12	2,86±0,12*
	BG2	2,29±0,18	2,71±0,12	3,05±0,12*	3,29±0,12*

The girls of the BG1 group at this stage of the study also had a probable decrease of the time to overcome the 800 m free style (2.63%), which indicates an improvement in work capacity in the aerobic energy supply zone.

As shown in Table 1, the complex application swimming and the elements of aqua fitness and the technique of interval hypoxic training during 16 weeks contributed to the decrease in the time to overcome the distance for girls of BG2 doing the tests « 800 m free style» by 3, 23% ($p<0, 05$) and «swimming distances of 4 × 50 m free style on 15 seconds of rest» (first segment) by 5.43% ($p <0.05$).

In addition, under the influence of such trainings, representatives of the BG2 group, within 16 weeks after their start, showed a probable improvement in the results of the test «25 m free style with the highest possible speed» by 4.58%, as well as the number of swimming at distances of 25 m under 150/170 bits per minute – by 33.33% (see Table 1).

The results of the researchers of special physical training of 11-12 year-old girls, 24 weeks after the beginning of trainings, showed that swimming activities in the proposed programs generally contributed to improving the efficiency in the area of aerobic energy supply, work capacity in the zone of anaerobic alactate and anaerobic lactate energy supply and the capacity of anaerobic alactate system of young female swimmers.

However, the girls who used interval hypoxic training in Swim lessons, as well as integrated elements of aqua fitness and the method of moderate hypoxia and severe hypercapnia formation in the body showed such more improvement, comparing with the representatives of the control group.

Thus, upon the forming experiment in female athletes of KG group, a significant increase of the test result of «800 m freestyle» by 3.27% was registered and was evidence of improved work capacity in the aerobic energy supply zone. Other special physical training indicators of this group swimmers remained without significant changes.

Twenty-four-week swimming classes with the technique of interval hypoxic training for the BG1 studying group facilitated the probable increasing in the results of «800 m free style», «swimming distances of 4 × 50 m free style on 15 seconds of rest» (first segment) and «25 m free style with the highest possible speed» by 3.50%, 5.63% and 10.11% tests respectively. The number of swimming at distances of 25 m under 150/170 bits per minute for the representatives of this group over 24 weeks after the beginning has been increased by 25,00% ($p <0,05$).

The results of tests` performance by female athletes of the BG2 group at the end of the molding experiment testified that under the influence of swimming exercises with the using of the elements of aqua fitness and interval hypoxic training, the results of the tests « 800 m free style» (by 5.94%), «swimming distances of 4 × 50 m free style on 15 seconds of rest» (first, second and fourth segments - by 9,16%, 4,66% and 5,46%),»25 m free style with the highest possible speed» (by 10.97%) and the number of swimming at distances of 25 m under 150/170 bits per minute (by 43.75%).

The results of control competitive testing on swimming confirm the results of research by scientists [9; 14] about limiting the ability of teenage swimmers to perform work under conditions of anaerobic metabolism.

The information of scientists [1; 7; 9; 14; 20] about the efficiency of interval hypoxic training in the systemic training of athletes has been confirmed and supplemented.

According to the results of Yu. Furman [9] and I. Hruzevych [14] there was a probable increase of work capacity in the aerobic and anaerobic lactate energy supply zone for 13-14 year-old swimmers under the influence of 16-week training sessions using the technique of interval hypoxic training.

The results of our own research have testified that the using of IHT in the training process of 11–12 year-old swimmers contributes to the improvement of work capacity in areas of aerobic, anaerobic alactate and lactic energy supply.

The increase in the capacity of anaerobic alactate energy supply system for the research girls is indicated the expediency of using our proposed program of training sessions with 11-12 year-old swimmers.

For the first time, the elements of aqua fitness and interval hypoxic training were used in the training process of young swimmers. The expediency of such an innovation is explained by minimizing the negative impact on the children's body of exercises on the development of force in conditions of the aquatic environment while improving the functional capabilities of the organism.

The effectiveness of the complex application in the training process of the swimmers of the aqua fitness and the interval hypoxic training with 11-12 year old girls is confirmed by the probable difference between the work capacity indicators in the aerobic energy supply zone (by 2.43%), work capacity in the anaerobic lactate energy supply zone (6.67%) and the power of anaerobic power supply systems (by 21.69%) for representatives of KG and BG2 groups and indicators of work capacity in the aerobic energy supply zone (by 2.31%) and the capacity of anaerobic systems energy supply (by 15.00%) for the representatives BG1 and BG2 group in favor of the last after 24 weeks of training sessions for our proposed programs.

The scientific researches of Yu. Furman, S. Salnikova [8], V. Golovkina [3], S. Fedorenko [13] and G. Zhuk [20] about the effectiveness of aqua fitness in training sessions with the purpose of improving the physical condition are supplemented by the results of control test execution by swimmers of BG2.

Conclusion. The results of the researches have testified that swimming training activities with the elements of aqua fitness and interval hypoxic training affect the improvement of swimmers` work capacity at the age of 11-12 in the zone of aerobic, anaerobic alactate and anaerobic lactate energy supply.

The effectiveness of the complex application in the training process of the swimmers of the aqua fitness and the interval hypoxic training with 11-12 year old girls is confirmed by the probable difference between the indicators of work capacity in the aerobic energy supply zone (by 2.43%), efficiency in the anaerobic lactate energy supply zone (6.67%), the capacity of anaerobic energy supply systems (by 21.69%) for representatives of KG and BG2 groups and indicators of efficiency in the aerobic energy supply zone (by 2.31%) and the capacity of anaerobic systems energy supply (by 15.00%) for representatives of BG1 and BG2 groups in favor of the last after 24 weeks of training sessions for our proposed applications.

Further research prospects. Further researches will focus on the studying of the effects of swimming activities using the elements of aqua fitness and interval hypoxic training on the function of external respiration of 11-12 year old swimmers.

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