THE EFFECT OF AEROBICS EXERCISES ON THE CHANGE OF SENIOR GIRLS' PHYSICAL AND FUNCTIONAL FITNESS

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Introduction

Aerobics is one of the most usually practiced forms of physical training which is especially suitable for senior girls, women (Shimamoto, et.al., 1998; Kviklienė, 2001; Abraham, 2003; Baublienė, 2003; Poteliūnienė, 2003; Kviklienė, et.al., 2007).

The content of aerobics exercises as well as musical background is favourable to development of girls' functional powers, experiencing of positive emotions during physical activities. By applying diversity of aerobics exercises, wide opportunities for regulation of physical load of those performing exercises are disclosed. Moreover, A. Vitartaitė et.al., (2004), research show that the impact of aerobics on the heart and blood vessel systems as well as the sympathetic nervous system, aerobic fitness is similar to that of jogging exercises or riding a bicycle (Garber, et.al., 1992). The exceptional feature of aerobics, emotional, rhythmic music provide positive emotions for the exercising girls and women encourage occurrence of active motivation for motor activities.

J. M. Bell, E. J. Bassey, (1996), H. H., Williford, ir kt. (1989) research show that the abundance of aerobics kinds and interaction of their characteristics, the physiological impact of aerobics exercises ought to be further investigated because different variations of load, the pace of moves and the content of exercises make a different effect on one's organism.

The aim of the research was to reveal the effect of aerobic exercises on senior girls' functional fitness and physical efficiency.

The research objectives: To work out the model of aerobics exercises and to apply it in practice; to evaluate the effect of aerobics lessons on the change of girls' physical and functional condition.

Research methods

The pedagogical experiment of duration of 8 months took place with Šiauliai J. Janonis Gymnasium female pupils of the 11th form. On the voluntary basis, the experimental group (E, n=22) was formed. For girls of this group, during regulated lessons of physical training, aerobics exercises were conducted twice a week, 45 minutes each, according to differentiated aerobics programmes based on classical, combined and step, high intensity aerobics (see Table 1). Teaching the kinds of aerobics and correct performance of basic exercises, the ways of linking steps, the pace of music, the initial positions was underlined during first lessons of regulated physical training and, if needed, in further proceeding of the experiment.

The control group (K) (n = 22) consisted of female pupils of the 11th form of Radviliškis Vaižgantas Gymnasium whose lessons of physical training proceeded according to regular methods.

We measured the indices of physical fitness by the "EUROFITO" tests for physical fitness (Volbekienė, 1993): bending of arms and hanging (mls); sitting and reaching (cm); long jump from a standing position (cm); sitting and lying (N/30s); endurance of abdominal press force; 20 m endurance shuttle run (min.); 10 x 5 m shuttle run (sec.); flamingo balance (n/min.)

We measured the functional fitness of the blood circulation and respiratory systems by the following tests: Pulse rate in rest (pants/min.); Pulse rate after a standard physical load (pants/min.); Rufje test; for measurement of functional fitness (Skernevičius, et al., 2004).

During the pedagogical experiment, the girls of E group were being tested regularly in order to observe and evaluate the physical condition of the investigated; and the results of testing allowed to correcting the content of the educational programme as well as physical load and its change (Table 1).

Table 1. ***Kinds of aerobics and physical load in the E impact group***

Months	**Kinds of aerobics**		
	Classical aerobics		
September -October	Amount of lessons	Average pace of music, d/min	The pulse rate to be achieved beats/min.
	16	130-132	135
November-December	Combined aerobics		
	Amount of lessons	Average pace of music, d/min	The pulse rate to be achieved beats/min.
	12	132-137	135-138

Continued Table 1

January-April	Step, high intensity		
	Amount of lessons	Average pace of music, d/min	The pulse rate to be achieved beats/min.
	25	132-140	140-146

Results of Research

Analysis of the change of results of physical fitness shows that in the E group indices of flexibility ($p<0.001$), sudden force ($p<0.05$), waist force ($p<0.05$), functional force ($p<0.05$), endurance of heart and respiratory systems ($p<0.05$) of the investigated have increased statistically reliably during the experimental period (Table 2). In the control group, the indices of physical fitness have slightly increased during the experimental period and one of them has not increased up to a statistically reliable point (Table 2).

We estimated that the change of results of the "flamingo" test was higher of the E effect group girls if to compare it with those of the K effect group during the experimental period; it did not reach the statistically reliable value ($p>0.05$) (see table 2). While evaluating according to the EUROFIT standards for girls of this age, the average result of the balance test of both groups is evaluated as "higher than average" (Volbekienė, 2002, EUROFITAS).

Table 2. ***The changes of physical condition of the experimental group's pupils (x±Sx)***

Tests	Research stages, Statistical data	E group (n=22)	K group (n=22)	p E-K groups
Flamingo balance (n/min.)	I	5.72±1.98	4.90± 2.43	
	II	4.5±1.65	4.59±2.44	>0.05
	d	1.22	0.31	
	t	0.47	0.13	
	p	>0.05	>0.05	
Sitting and reaching (cm)	I	23.27±4.31	24.40±3.91	
	II	31.75±4.85	25.02±4.49	<0.001
	d	8.48	0.62	
	t	4.10	0,10	
	p	<0.001	>0.05	
Long jump from standing position (cm)	I	173.45±8.71	172.0±13.94	
	II	178.95±10.5	174.63±14.7	<0.025
	d	5.50	2.63	
	t	2.38	0.27	
	p	<0.05	>0.05	
Sitting and lying (N/30s)	I	24.09± 3.46	23.50±1.94	
	II	28.86± 3.69	24.31±2.25	<0.05
	d	4.77	0.81	
	t	2.35	0.62	
	p	<0.05	>0.05	
Hanging with bent arms (s)	I	10.53±5.26	10.64±9.11	
	II	16.35±1.65	11.91±9.24	<0.05
	d	5.82	1.27	
	t	2.28	0.02	
	p	<0.05	>0.05	
10x5 m shuttle run(s)	I	20.23±1.62	22,53±1,43	
	II	19.33±1.19	21.86±1.34	>0.05
	d	0.90	0.67	
	t	0.45	0.34	
	p	>0.05	>0.05	
Endurance shuttle run (min.)	I	3.5±1.22	3.86±1.42	
	II	6.97±1.48	4.27±1.35	<0.05
	d	3.40	0.41	
	t	2.40	0.11	
	p	<0.05	>0.05	

Flexibility of girls of the investigated groups was evaluated by the test of "sitting and reaching". During the first testing, flexibility of girls from both effect groups was evaluated as "average' which was in E effect group 23.3 ±4.31 cm; in K group – 24.40±3.91 cm (Table 2). During the experimental period, average results of flexibility of E group's girls increased statistically reliably (t = 4, 10; p<0.001) and reached 31.75±4.85; d=8.48 cm in the final research stage. The result of flexibility of E group's girls was evaluated as "high" in the final research stage. Flexibility of K group's girls almost did not change – the average difference between results was d=0.62 in the final research stage (Table 2).

We researched sudden force of the investigated by the test of a long jump from a standing position. Obtained data is provided in Tables 2. During the experimental period, average results of E group increased statistically reliably (d=5.50; t= 2.38; p<0.05) and reached 178.95±10.5 cm in the final research stage. Average results of K group's girls had a tendency of increase, and they reached 174.63±14.68 (d=2.63; t=0.27; p>0.05) at the end of the pedagogical experiment. The average result of sudden force of E group's girls in the final research stage was evaluated as "average", the one of K group – "below the average level".

For evaluation of dynamic force of abdominal press muscles, we applied the test of "sitting and lying" N/30 s. (Table 2). During the experimental period, the average results of E group's girls increased statistically reliably (d=4.77 times; t= 2.35; p<0.05) and reached 28.86±3.69 times in the final research stage. The average results of K group's girls changed slightly and reached 24.31±2.25 times; (d=0.81 times; p >0.05) at the end of the pedagogical experiment.

For evaluation of functional muscle static force and endurance, we employed the test of hanging with bent arms. The results obtained are presented in Tables 2. During the first testing, results of both groups of girls did not differ statistically reliably and were evaluated as "average". During the experimental period, average results of E group's girls increased statistically reliably (d=4.40 s; t=2.28; p<0.05) and they reached 16.35±1.65 s in the final stage. Average results of K group's girls almost did not change and they reached 11.91±9.24 s; (d=1.27 s; p>0.05) at the end of the pedagogical experiment.

Average results of E group's girls' static force endurance in the final stage of the research were evaluated as "above than average", those of K group – as "below the average" level.

For evaluation of dexterity of the investigated groups, we employed the test of shuttle run of 10x5 m. (Table 2). During the experimental period, average results of dexterity of E and K effect groups' girls had a tendency of increase; however, a statistically reliable difference in the final stage of the research was not estimated. In the final research stage, the average result of E effect group reached 19.33±1.19 s (d=0.90 s; t=0.45; p>0.05), of K group – the average result was 21.86±1.34 s, (d=0.67 s; t=0.34; p>0.05).

Average results of dexterity of E group's girls were evaluated as "above the average" in the final research stage, whereas those of K group – as "below the average" level.

For evaluation of the heart and respiratory systems, we used the test of endurance shuttle run of 20 m. (Table 2). During the experimental period, average results of E group's girls increased statistically reliably (d=3.40 min.; t=2.40; p<0.05) and they reached 6.97±1.48 min. in the final research stage. Average results of K group's girls changed slightly and they reached 4.27±1.35 min.; (d=0.41 min. t=0.11; >0.05) at the end of the pedagogical experiment.

Average results of E group's girls' endurance run were evaluated as "above the average" in the final research stage, those of K group – "below the average" level.

Analysis of EUROFIT test results during the experimental period shows that the change of the experimental E group's girls' results increased faster during the experimental period in comparison with those of K group's girls.

Analysis of the change of results of functional fitness

Rufje test is a functional sample where indices of the pulse rate at rest are taken for total evaluation as well as the indices recorded as a reaction to standard physical load and proceeding of recovery during one minute (Bell, J.M., Bassey, E. J., 1996; Skernevičius, et.al., 2004). Heart rate at rest shows functional fitness of the blood circulation and respiratory systems. Decrease of pulse rate is evaluated as a positive change of adaptive blood circulation and respiratory systems (Skernevičius, et.al., 2004). Rufje test of the investigated took place in the end of the experimental period in order to evaluate functional fitness of the blood circulation and respiratory systems of E and K effect groups (Table 3).

Table 3. ***Changes of functional indices of the impact groups*** (X±Sx)

Testing stages	Group	Pulse rate in rest (pants/min.)	Pulse rate after a standard physical load (pants/min.)	Rufje index (cond. units.)
I	E	81.67±1.81	128.12±3.15	11.46±0.69
	K	80.23±2.56	125.34±3.24	10.59±0.63
	p	-	-	-
II	E	66.21±0.96	106.16±2.58	5.89±0.75
	K	75.26±1.32	122.52±1.56	9,53±0.62
	p	<0.001	<0.001	<0.001

We evaluated that the average Rufje index result of E effect group in the end of the experimental period reached 5.98 cond. units, whereas in K group it was 9.53 cond. units, which shows poor training; E group's Rufje index (5.98 cond. units) meens the satisfactory level of training.

Physiological curves of lessons of different aerobics kinds

The data of our research show that during aerobics training physical load was of an educable character and reached approximately 70 per cent or recommended pulse rate which according to the authors (Blauzdys, 2002, Ivaškienė, 2002, Poteliūnienė, 2003), are to be achieved and evaluated positively in lessons of physical education for senior forms (Table 4). Analysis of a physiological curve shows that physical load of an educable character during the lesson of aerobics is being maintained for a sufficiently long time – approximately 15-20 minutes. That is why it becomes obvious that training in classical, combined and especially step aerobics suits well to development of common endurance of senior forms' girls. Step aerobics training make the highest effect on the blood circulation and respiratory systems and work of skeletal muscles (Williford, et. al., 1989; Poteliūnienė, 2003; Vitartaitė et.,al., 2004). The research shows that average aerobic intensity is the most useful for health for the beginners, when PI is 50-70 per cent of the maximum.

Table 4. ***Physiological curves of different kinds of aerobics lessons***

Tipe of aerobics	Preparatory part, min		Main part, min					Final part , min	
	5	10	15	20	25	30	35	40	45
	Pulse rate (pants/min.)								
Classical aerobics	120	132	150	156	156	120	114	108	102
Combined aerobics	120	136	156	162	162	126	114	102	102
Step aerobics	114	126	144	174	180	144	126	114	108
	Main aerobics steps, exercises on breathing, stretching		Main combinations of dance steps, non-stop moves, jogging, jumps, swings, work on a platform		Exercises for development of force and force endurance			Relaxation, exercises on stretching	

Analysis of evaluation of cohesion of physical education lessons

Common and motor cohesion of physical education lessons for the investigated girls was evaluated by the method of observation. We registered activities of the investigated and calculated that the common cohesion (CC) of an aerobics lesson was the following: CC=44.5/45*100%=98.8%. Motor cohesion (MC) of an aerobics lesson was the following: MC=43/45*100%=95.5%.Common cohesion of a basketball lesson was the following: CC=35/45*100%=77.7%. Motor cohesion: MC= 23/45 * 100%=51.1%.

The research shows that aerobics training during lessons are more effective. The common and motor cohesion of an aerobics lesson is higher, pupils move in an average pace for a longer time; this improves work of the respiratory and blood circulation systems, increases efficiency of pupils, and develops common endurance.

Conclusions

1. The endurance indices (Rufje test index) of flexibility, sudden force, waist force, functional force, the heart and respiratory systems of E ef-

fect group have increased statistically reliably ($p<0.05$) during the experimental period, whereas the indices of K group had a tendency for increase.
2. Analysis of observation of lessons revealed that aerobics training was more effective and bore an educable character in comparison with basketball lessons.
3. Lessons of physical education made impact on development of psycho-motor reaction speed which was more pronounced in E group than in K group of effect.
4. The effect of aerobics training on physical activity of girls is more effective than of a basketball lesson – common cohesion of an aerobics lesson reached 98.8 per cent, motor cohesion – 95.5 per cent, of basketball lessons – 77.7 per cent, and 51.1 per cent.
5. The obtained research results prove the hypothetical assumption that aerobics training predetermines higher physical activity of senior forms' girls and better development of physical powers.

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Summary

The aim of the research was to reveal the effect of aerobic exercises on senior girls' functional fitness and physical efficiency. The research objectives vas to work out the model of aerobics exercises and to apply it in practice; to evaluate the effect of aerobics lessons on the change of girls' physical and functional condition.

The results of the research showed that aerobic exercises had positive effect on the change of participants' physical fitness: the parameters of flexibility, speed-strength, waist strength, functional strength of E group participants improved (statistical significance $p<0,05$) during the experimental period. The results showed that the parameters of the cardiac and respiratory system endurance of E group improved statistical significance, the parameters of K group made an improvement but they did not reach the significance level. The results revealed that the effect of aerobic exercises are more effective than basketball training. During the basketball training the endurance training level is not reached when PI is 70 per cent. The anaerobic exercises approach the border of training filfulment70 – 90 per cent of maximum PD level. The physical culture classes had an impact on the development of psychomotor reaction, the impact was more significant on E group than K group. The outcomes of the research showed that the aerobic exercises impact on physical activity is more effective than basketball training. Aerobics general closeness reached 98,8%, motor cohesion.- 95,5%, basketball training general closeness reached 77,7% , and motor – 51,1%.The results of the research confirms the hypothesis that aerobic exercises intensify physical activity and improve physical fitness training during physical culture classes.

Keywords: aaerobics, physical condition, functional fitness, motor cohesion.

AEROBIKOS PRATIMŲ VEIKSMINGUMAS VYRESNIŲJŲ KLASIŲ MERGINŲ FIZINIŲ IR FUNKCINIŲ GALIŲ KAITAI

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Santrauka

Tyrimo tikslas – nustatyti aerobikos pratybų poveikį aukštesniųjų klasių merginų fizinės būklės kaitai.

Suformuluota hipotezė, kad kryptingos aerobikos pratybos kūno kultūros pamokose lemia didesnį aukštesniųjų klasių merginų motorinį glaudumą bei efektyvesnį fizinių galių ugdymą.

Tyrimo duomenys parodė, kad aerobikos pratybos darė teigiamą įtaką tiriamųjų fizinio pajėgumo rodiklių kaitai: per eksperimentinį laikotarpį E grupės tiriamųjų lankstumo, staigiosios jėgos, liemens jėgos, funkcinės jėgos rodikliai pagerėjo statistiškai patikimai ($p < 0,05$).

Nustatyta, kad E grupės dalyvių širdies ir kvėpavimo sistemos ištvermės rodikliai pakito statistiškai patikimai, o K grupėje šie rodikliai turėjo tendenciją gerėti, tačiau nė vienas jų nepakito iki statistiškai patikimos ribos.

Tyrimo rezultatų analizė parodė, kad aerobikos pratybos yra efektyvesnės ir turėjo lavinamąjį poveikį, lyginant su krepšinio pamoka. Krepšinio pamokos metu bendrosios ištvermės lavinimo riba PI 70 proc. – nepasiekiama. Aerobikos pratybose priartėjama prie anaerobinio pratimų atlikimo slenksčio 70–90 proc. nuo maksimalios PD ribos. Kūno kultūros pamokos turėjo įtakos psichomotorinės reakcijos greičiui, kuris E grupėje buvo ryškesnis nei K poveikio grupėje, lavėti.

Aerobikos pratybų poveikis fiziniam aktyvumui yra efektyvesnis nei krepšinio pamokos. Aerobikos bendrasis glaudumas siekė 98,8 %, motorinis – 95,5 %. Tuo tarpu krepšinio pamokos bendrasis glaudumas siekė 77,7 %, o motorinis – 51,1 %. Rezultatų analizė patvirtina hipotezę, kad aerobikos pratybos kūno kultūros pamokose sąlygoja didesnį fizinį aktyvumą bei geresnį fizinių galių ugdymą.

Prasminiai žodžiai: aerobika, fizinės ir funkcinės galios, motorinis glaudumas.

Įteikta 2011-09-13