INTENSIFYING PHYSICAL EDUCATION CLASSES THROUGH THE APPLICATION OF CONTEMPORARY AEROBICS PROGRAM

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Abstract

The goal of this research was to determine the effects and effectiveness of physical education classes when contemporary aerobics is used as the main content. The research sample included a total of 79 students, divided into control and experimental group aged 15 ± 6 months. Results showed statistically significant differences between the experimental and control group in favor of the high-low aerobics program compared to the regular physical education classes. Such programs could certainly be recommended for physical education classes as one of the approaches for intensification of existing programs.

Key words*:* aerobic and functional abilities; high school education; high-low aerobics; kinesiology; students

Introduction

Physical education (PE) strives to connect all developmental aspects of the student's personality both in the growth and development stages as well as in the prevention of disturbance of the biological-functional and health condition by using clearly defined goals and tasks (Tomporowski, P.D., et al. 2008, Devon, J.H., et al. 2016.). As a result of contemporary lifestyle physical education classes are the only form of organized kinesiology activity for most children and youth, and therefore its role is gaining ever greater significance (Yang, SL 2015). The main goal of physical education is to encourage the proper development of children and young people's morphological features as a basis for their health (Tamozhanskaya, G., V. 2015). This enables to maintain their working abilities, and to acquire and permanently adopt the habit of regular physical exercising in order to preserve physical and psycho-social health for greater quality of life and prevention of hypokinesia-related illnesses. Accordingly, teachers are required to maximize students' intellectual desire during class to influence the level of their motor information. Also, to incorporate educational effects of work and to provide such organizational forms of work, content and activities which will truly satisfy not only their interests, but also their authentic needs (Findak & Neljak, 2006).

The goals set for physical education cannot be realized without feedback on the effects of the teaching process, especially considering the fact that the interest in sporting activities among young people is decreasing from one year to another. According to the Sports and Fitness Association's (SFIA, 2016) report, in 2008 there were 30.2% of young people aged between 6 and 12 involved in various sports activities, while in 2015 this percentage decreased to 26.6%. At the age between 13 and 17, the percentage of young physically active people dropped from 42.7% to 39.3% in the same period. Therefore, it should always be kept in mind that for this purpose teachers need to show significant respect for students' needs and interests, develop their proper motives, desirable attitudes and positive emotions towards physical exercise and healthy lifestyle (Sekulić et al., 2003.). In order to stimulate students' physical exercise and active lifestyles, numerous research studies have examined the level of motivation and interest areas for different types of high school activities (Bauman Adrian et al., 2012; Butt et al., 2011; Kipp & Weiss, 2013; Pano & Markola, 2012).

According to some previous studies (Flintoff & Scraton, 2001; Shen et al., 2003), female students in comparison to male students are more motivated by the aesthetic factor, i.e. dance as structures of movement. These types of activities include contemporary aerobics programs which fit very well into the group of kinesiology activities which are in the focus of interest of today's young generation because of their connection to contemporary music with different forms of physical motion, dynamics and rhythm. Benefits of aerobics cannot be neglected, and they serve a purpose in improving the basic anthropological characteristics of individuals, such as development of functional abilities and motor skills like: coordination, flexibility, repetitive strength and balance (Viskić-Štalec et al., 2007) as well as the improvement of health status (Arazi, H. et al, 2012) that is, the impact on body mass and volume (Suksom et al., 2015) and subcutaneous fat tissue (Luglio et al., 2017). With the aim of improving and advancing physical education class process by introducing contemporary teaching models, the authors propose

the idea of applying aerobics in secondary school education.

In accordance with the above mentioned, the research goal was to determine the effects and effectiveness of physical education class which applied contemporary aerobics as the main lesson content (experimental program), and the second goal was to compare the effects of the experimental program with those of the standard physical education program.

Methods

Research sample

The research sample included a total of 79 students aged 15 ± 6 months divided into control group (N = 39) and experimental groups (N = 40). All the students included in the research were healthy at the time of conducting the experiment.

Variables sample

The variables sample included variables for the assessment of morphological characteristics: body height; body weight; upper arm circumference; upper arm skin fold; abdominal circumference; and abdominal skin fold. The tests used to evaluate flexibility were: wide legged seated forward bend – Participant leaning his shoulders against the wall arms are provided on the ground - fingers folded. Reading the zero point, and it sets a "zero" on the meter. The following is the maximum bend the reading results. Static shoulder flexibility test - Participant lays prone on the floor, forehead on the ground, and arms extended holding the 18” stick with both hands shoulder width apart. The assistant measures and records the athlete's arm length from the acromial extremity to the stick. Participant raises the stick as high as possible whilst keeping their forehead on the ground. The assistant measures and records the vertical distance from the ground to the bottom of the stick. Upper-body and neck static flexibility – The athlete lies prone on the floor with hands clasped at the side of the head. The participant raises his head and trunk as high as possible. Measured and records the vertical distance from the ground to the tip of the athlete's nose.

The variables used in assessing motor-functional abilities were: Canadian standardized test -for the evaluation of repetitive power of the trunk. Test start with the pace that gives metronome (40 strokes per minute). The task of the respondent is to raise and lower the abdomen by touching the two lines. Target line is away from starting line 8 cm. Participant doing the repetitions until can track the pace metronome. Multistage Beep test - procedure for conducting aerobic fitness, i.e. aerobic endurance. This test involves continuous running between two lines 20m apart in time to recorded beeps. The participants stand behind one of the lines facing the second line, and begin running when instructed by the recording. The subject continues running between the two lines, turning when signaled by the recorded beeps. After about one minute, a sound indicates an increase in speed, and the beeps will be closer together. This continues each minute (level). The test is stopped if the subject fails to reach the line (within 2 meters) for two consecutive ends after a warning. Wall-sit - for leg static power estimation. Characterized by the two right angles formed by the body, one at the hips and one at the knees. The person wall sitting places their back against a wall with their feet shoulder width apart and a little way out from the wall. Then, keeping their back against the wall, they lower their hips until their knees form right angles. The participant performs the test until the failure. 20 steps forward with a baton - for general coordination assessment. We measure, in seconds, the time necessary for a female subject to perform the following task in its entirety: to step forward with her right leg, drag the baton below her right leg with her left hand, and take the baton with her right hand. Then, she steps forward with her left leg, drags the baton with her right hand below her left leg and takes hold of it with her left hand.

Research implementation

The experimental program lasted for nine weeks, and the same treatment was applied in each group during two school periods of physical education classes per week. Each program comprised a total of eighteen individual trainings.

The (C) control group of respondents attended regular physical education classes twice a week, during which they mostly adopted, trained and improved perfected different teaching units related to walking and running, gymnastics, various games and dance. Both simple and complex teaching and organizational forms of work were applied.

In the experimental group (E) the standard program of physical education classes was replaced with the special program of the *high-low* aerobic exercise program. Each PE class was divided into the introductory, main and final part of the lesson. The class would start with a 5-minute warm-up consisting low power consumption steps (walking, side-steps, slides, sideways steps, climbing, etc. accompanied by music with the tempo ranging from 130 to 140 beats per minute). This was followed by a cardio section (15-20 minutes of performing prescribed aerobic exercises) where the pace of music was faster than in the introductory part of the class and ranged from 140 to 155 beats per minute. In this part of the class, choreographies which consist of arm and leg movements were applied. The choreographies included steps from the following groups of even, odd and neutral steps: walking, V-step, A-step, pulling steps, high knee march, crossovers, jumps, lift and reach, hikes, running steps, walkthroughs, and dance steps. In the final 15 minutes of the class’ exercises for the abdominal area, lower back and arms, and shoulders and chest were performed. At the very end, there were5-7 minutes of stretching exercises accompanied by soothing music for more effective relaxation.

Before the first and after the last class, initial and final measurements were performed both in the control and experimental group.

Data processing

The reliability of the instruments was determined with the Cronbach alpha coefficient and the normality of distribution was verified with the Kolmogorov-Smirnov test. The differences between measurements and groups at the initial and final testing were determined by univariate and multivariate analysis of variance (ANOVA and MANOVA). The interaction between these two programs was tested by the two-way variance analysis for dependent and independent samples. Statistica 7 software was used in analysis of data. Significance was set $p<0.001$.

Results and discussion

Data were subjected to the basic descriptive statistics as shown in Table 1. After that the normality of data distribution was determined. For all of the respondent groups (both in the initial and final measurement), the K-S test indicated normal distribution of the obtained results ($p > 0.20$). All Cronbach alpha values ranged from 0.85 to 0.99, thus establishing a good reliability of measuring instruments in all respondent groups at both measuring points.

Table 1. Basic descriptive parameters for the initial and final measurement; univariate and multivariate differences between the groups and measurements; the significance and effect size between the experimental and control program.

	initial		**final**		**Effect size**	
	E	**C**	**E**	**C**		
	M± SD	**M± SD**	**M± SD**	**M± SD**	**p**	**η^2**
AVIS	169.13 ± 4.68	168.69 ± 5.73	169.18 ± 4.67	168.69 ± 5.73	0.07	0.01
ATEZ	63.05 ± 6.59	60.43 ± 7.24	62.26 ± 6.80	59.94 ± 7.26	0.00	0.41
AONAD	22.44 ± 0.91	22.46 ± 1.07	22.80 ± 0.96	22.40 ± 1.28	0.01	0.08
AKNNDL	11.83 ± 1.10	11.88 ± 1.10	11.69 ± 1.08	11.65 ± 1.03	0.00	0.29
AOSTR	75.92 ± 4.30	75.95 ± 4.32	75.46 ± 4.43	75.51 ± 3.75	0.00	0.28
AKNTRB	12.01 ± 0.79	11.99 ± 0.87	11.61 ± 0.82 *a*	11.85 ± 0.95	0.00	0.47
MFLPRR	65.20 ± 9.54	61.21 ± 9.15	68.52 ± 9.71 *a*	62.77 ± 9.74 *#*	0.00	0.54
RFLKS	52,85 ± 13,94	57.57 ± 9.27	58.68 ± 14.78	59.61 ± 9.55	0.00	0.62
FLKS	46.30 ± 8.59	54.61 ± 8.65*****	50.76 ± 8.64 ×	56.96 ± 9.49*****	0.00	0.41
K.S.T	56.55 ± 12.36	53.21 ± 15.53	86.10 ± 12.34 ×	68.69 ± 16.54***** *a*	0.00	0.78
BEEP	353.82 ± 99.61	399.83 ± 98.89	459.61 ± 91.23 *a*	408.28 ± 97.36 *#*	0.00	0.31
MCUI	110.65 ± 64.66	90.05 ± 45.95	160.80 ± 70.96 ×	104.36 ± 59.03*****	0.00	0.35
M20IPP 20	31.46 ± 4.10	31.52 ± 4.12	28.19 ± 4.30 ×	31.04 ± 4.52*****	0.00	0.34
MANOVA I-F (F TEST)			19.11×	4.18×		
MANOVA K-E (F TEST)	4.24*****	8.19*****				

Legend: M-arithmetic mean; SD-standard deviation; η2-effect size; E-experimental group; C-control group; AVIS -body height; ATEZ-body weight; AONAD-upper arm circumference; ANNL-upper arm skin fold; AOSTR-abdominal circumference; AKNTRB-abdominal skin fold; MFLPRR-wide legged seated forward bend; RFLKS-upper-body and neck static flexibility; FLKS-and static shoulder flexibility; KST-Canadian standardized test; BEEP-multistage Beep test; MCUI-wall-sit; M20IPP20-20 in-line lunges with sliding a stick between the legs.

Note: Significance of the difference between groups *p<.001; #p<.05; significance of the difference between measurements ×p<.001, ªp<05; significance of the interaction between E and C programs;

The initial measurement before the implementation of the experimental program confirmed statistically significant difference between the groups in the test for static shoulder flexibility (FLKS) at $p<0.001$. Statistically significant difference was also found between the samples in the final flexibility assessment tests conducted after the program was implemented: the wide legged seated forward bend (MFLPRR) at $p < 0.05$ and static shoulder flexibility (FLKS) test at $p <0.001$, with the C group of respondents achieving significantly improved results. For the flexibility assessment, based on the obtained differences in the final measurement, it could be concluded that those students who did aerobics program during physical education classes significantly improved their flexibility, which was not the case with the C group of respondents. During puberty, bones grow faster than the muscles, and flexibility is the only dimension which diminishes progressively and biologically (Rodríguez et al., 2008). Nevertheless, due to systematic training,

advancement in flexibility is relatively high in view of the other motor skills (precision, coordination, balance and velocity (Sekulić & Metikoš, 2007). Research results obtained in the present research have confirmed that with quality programmed flexibility exercises it is possible to make great positive changes during a relatively short time period. Specifically, students were doing aerobics program for two school periods per week, with 5 minutes of each training targeting flexibility, thus making a total of 90 minutes over a period of 9 weeks.

After the final measurement for the assessment of abdominal skin fold (AKNTRB), a statistically significant difference was found in the E group of respondents at $p < 0.05$. The results of numerous studies have confirmed that the most suitable fat reduction intensity is in the range of 60 – 70 % of the maximum heart rate during the active period of 45 to 60 minutes. Such relatively low physical load level enables long-term continuous training, since better results in fat reduction are achieved by prolonging exercise duration rather than increasing the intensity. The *high-low* aerobics program can make some positive transformational effects in the sense of lowering subcutaneous fat tissue (Kostrzewa-Nowak et al., 2012; Mak et al., 2010) when different movement structures without interruption of activity are successively amplified and cyclically repeated more or fewer times. This has been confirmed in the E group of respondents with a statistically significantly higher progress of fat tissue transformation.

The final measurement of the Canadian standardized test for the assessment of repetitive power of the trunk (KST) has indicated that both groups of respondents significantly improved, with the difference between the measurements in the E group at $p < 0.001$ while in the C group it was at $p < 0.05$. Repetitive power is one of the motor skills which is not genetically determined and can be successfully transformed using different kinesiology content (Sekulić et al, 2008). However, the E group of participants who exercised following the specific *high-low*aerobics program, on average, have improved the repetitive power of the trunk considerably more than the C group of respondents. The reason for this should be sought in the fact that contemporary aerobics programs contain a variety of movement structures, which are repeated several times using various combinations of these structures. They are suitable for the transformation, that is, for the improvement of repetitive strength of the muscular groups which are stimulated during the exercise. In addition, it is important to mention that in the final part of the aerobics classes (15 minutes per training), different exercises for the repetitive strength were performed targeting abdominal, back, arm and shoulder muscular groups, which has certainly contributed to a significant difference between the groups in the final measurement.

For the evaluation of aerobic and functional abilities a multistage-beep test (BEEP) was used and the differences between groups were determined in the final measurement at $p < 0.05$. In the E group of respondents, the final measurement showed significant progression of aerobic and functional abilities compared to the initial measurement, i.e. there was a significant positive transformation effect. In the C group, as expected, no significant difference between the measurements was found. With the contemporary aerobics training, it is possible to develop a particularly useful motor program which enables a person who regularly trains economical exploitation of a large number of muscular groups that switch on and off in a consecutive manner (Weineck, 2007). This phenomenon is named work efficiency, and also develops in other activities which are used in the development of aerobic capacity, but then its quality is significantly lower because the number of movements and the number of involved muscles are significantly lower (Sekulić & Metikoš, 2007). This assertion has been confirmed in this particular research. However, there is possibility that these changes occurred in the E group as a result of enhancing functional capabilities, that is increasing aerobic capacity.

The final results of the general coordination assessment test - 20 in-line lunges with sliding a stick between legs (M20IPP 20) and wall-sit (MCUI) test for leg static power estimation showed clearly that the E group of respondents significantly improved their results, which, compared to the C group, has contributed to the statistically significant differences in the final measurement ($p < 0.001$). In the M20IPP 20 general coordination assessment tests, alternating and synchronizing a large number of muscular groups and movements had a vital role in the improvement of the results. Alternating different dance structures, jumps, hops and exercises in which different lunges and squats were performed have certainly influenced the statistically significant improvement of coordination and static power in general.

Based on the results of the tests, examining the value of significance level (p) and the interaction effect size ($\eta 2$) (Table 1), it may be proposed that there is noticeable difference between the effect of the *high-low* aerobics program and the classical concept of teaching physical education. Specifically, for the E and C groups there was statistically significant interaction for all the tests, apart from body height - AVIS. So, the two different forms of exercise which were applied had different developmental effect. For the measurement of upper arm circumference (AONAD) "medium effect" was determined while in all the remaining tests "large effect" of the program was determined (Levine & Hullett, 2002).

Conclusion

High-low aerobics program, which was a new form of physical activity for the participants during their PE classes, contributed to the differences between the initial and final measurements and within the groups. Due to the frontal organizational form of exercise, typical for aerobic programs, the teacher had good control over the students' workout, which enabled achievement of great intensity and work efficiency, which was not the case with the standard concept of physical education classes. Regardless the type ofthe teaching form of work/exercise, sometimes significant amount of time can be spent in organizing workstations and students during the class, thus reducing the control over the students and reducing physical load on them, too. Contemporary high-lowaerobics program includes a variety of motion structures which favour the improvement of stimulated muscular groups. Also, due to music as a compulsory and integral part of the program it is assumed that high-lowaerobic may have a positive effect on motivation and reducing fatigue, which ultimately resulted in exceptionally high work productivity and efficiency of the program implementation.

Such programs could certainly be recommended for physical education classes as one of the approaches for improving the existing programs of exercise in physical and health care area. Also, the obtained results can be encouraging for students to refer them to extracurricular organizational forms of exercise as a prevention of contemporary widespread sedentary lifestyle among young people.

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PRIMJENA PROGRAMA SUVREMENE AEROBIKE U CILJU INTENZIFIKACIJE NASTAVE TJELESNE I ZDRAVSTVENE KULTURE

Sažetak

Cilj ovog istraživanja bio je utvrditi učinke i učinkovitost nastave tjelesne i zdravstvene kulture, kada se kao glavni sadržaj u nastavi koristi suvremena aerobika. Istraživački uzorak obuhvaća ukupno 79 učenika, podijeljenih u kontrolnu i eksperimentalnu skupinu u dobi od 15 godina ± 6 mjeseci. Rezultati su pokazali statistički značajne razlike između eksperimentalne i kontrolne skupine u korist programa suvremene *hi-low* aerobike u usporedbi sa standardnim programom u nastavi tjelesne i zdravstvene kulture. Provedeni programi aerobike mogu se preporučiti kao sadržaj u nastavi tjelesne i zdravstvene kulture kao jedan od pristupa za intenziviranje postojećih programa.

Ključne riječi: aerobne i funkcionalne sposobnosti; kineziologija; srednjoškolsko obrazovanje; suvremeni hi-low aerobik; učenici

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