

EFFECTS OF HIGH-LOW AEROBIC PROGRAM ON TRANSFORMATION OF MOTOR SKILLS AT HIGH SCHOOL STUDENTS

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Abstract

The study was conducted to determine the value of the experimental program (high - low aerobics) and its impact on the viability of the motor skills with a high school student. The sample consisted of 80 female students of the medical schools and was divided into two groups (experimental and control). The changes that occurred in students in the course of the experimental program of 12 weeks, were followed over seven motor tests. The results were subjected to statistical methods of data processing, which involved determining the descriptive statistical parameters, and for determining statistically significant differences between the mean values of the initial and final measurement as to whether the experimental group changed significantly more than the control one, t-test was applied. The results clearly indicate that the statistically significant positive changes in the transformation of the evaluated motor skills at the final measurement are in favor of the experimental group compared to the control, which supports the effectiveness of applied programs high-low aerobics.

Key words: aerobic, high-low aerobics, fitness, motor skills, girls in secondary school

Introduction

Lack of physical activity (hypokinesia) is a major problem in the modern world, and as a reason to impose: psychic overload, static lifestyle and overeating. The population of the modern world in developed countries due to technological development is characterized by a lower degree of physical activity than ever before - even 2/3 of the population is not sufficiently physically active (Trost, Owen, Bauman, Sallis, Brown, 2002). The issue of human survival in the conditions of life imposed by reduced movement is one of the fundamental questions of modern man and the care of the child's free time founded the habits that will keep track of individual life. Creating habits for proper use of leisure time devoted to exercise and movement becomes, from the point of view of Kinesiology, a primary educational task. Particularly noteworthy is the positive attitude towards physical exercise, without which a healthy lifestyle today and even more tomorrow's human is unthinkable. (Prskalo, 2012).

Today in fitness centers various forms of aerobics are applied so the physical activity of the population can be brought on a higher level in order to reduce the risk of disease. One of the most popular types of aerobics, without which I can't imagine a modern fitness center, is for sure high-low (high-low) aerobics, which will be of interest to this study. In order for a process of programmed training to be successful, there must be a multidisciplinary approach, while the essence of training as stated by Bjelica (2006) is a constant tendency in the development of natural biomotorical size and improvement of dynamic stereotypes. The effects of transformation processes under a variety of factors that can be changed in a positive or in a negative sense, and efficient transformation processes can only be

achieved if we manage to achieve harmony in optimal volumes of activity from which we can expect a strong incentive to maximize the expression. In accordance with the previous, it can be said that this study is focused in order to determine the value of the experimental treatment (program high - low aerobics) and its impact on motor features a high school student.

Methods

The survey, which was conducted on two groups of subjects, has a longitudinal character which is applied experiment, specially designed program of high - low aerobic. The first group (N = 40), was experimental, and performed hours after the above mentioned program high - low aerobics twice a week, while the other group (N = 40), was a control one and performed regular physical education classes by the established plan and program twice a week. The study lasted 12 weeks, ie. 24 academic hours. The sample in this study consisted of 80 students of medical high school aged 16 yrs / - 6 months, regularly attending physical education. The students were divided into two equal groups: E - experimental group (N=40) forty subjects and K - control group (N=40) forty subjects.

To avoid any bias in the selection of subjects in determining the groups the application of the treatment method is applied to randomization, and a random selection procedure. The sample measurement tools applied to assess motor skills are: persistently pin running (MISTR). lifting the trunk in 30 seconds (MDIZT). squat for 30 seconds (MDUBČ). side steps (MKOUST). agility in the air (MOKRVAZ). shoulder flex stick (MISKR). deep forward bend on the bench (MDUBP).

Table 1 Basic descriptive statistical parameters - experimental group, initial measurement, motor skills.

Variable	Range	Min	Max	Mean	Std.Err	Std.Dev.	Skew	Kurt	K-S	P
MISTR1	5.80	3.00	8.80	5.16	0.24	1.50	0.58	-0.10	0.60	0.86
MDIZT1	18.00	7.00	25.00	16.48	0.66	4.19	-0.19	-0.23	0.74	0.64
MDUBČ1	18.00	15.00	33.00	24.20	0.52	3.28	-0.04	1.18	0.68	0.75
MKOUST1	5.40	8.90	14.30	11.70	0.20	1.25	-0.10	-0.41	0.71	0.69
MOKRVAZ1	5.90	4.50	10.40	7.05	0.26	1.66	0.54	-0.68	0.87	0.44
MISKR1	56.00	54.00	110.00	78.90	2.50	15.81	0.20	-0.97	0.68	0.75
MDUBP1	26.00	19.00	45.00	31.35	0.98	6.23	0.05	-0.68	0.61	0.85

Range (Range), Min (minimum value), Max (maximum value), Mean (arithmetic mean), Std. Er. Mean (standard error of the mean), Std. Dev. (Standard deviation), Skew (standardized coefficient of asymmetry, curvature), Kurt (standardized coefficient of elongation or kurtosis), K - S (Kolmogorov - Smirnov method), p (level of significance).

Table 2 Basic descriptive statistical parameters - experimental group, final measurement, motor skills.

Variable	Range	Min	Max	Mean	Std.Err	Std.Dev.	Skew	Kurt	K-S	P
MISTR2	5.60	3.30	8.90	5.62	0.24	1.51	0.46	-0.33	0.68	0.75
MDIZT2	21.00	10.00	31.00	20.55	0.69	4.35	-0.09	0.18	0.58	0.89
MDUBČ2	15.00	20.00	35.00	26.95	0.52	3.26	0.24	0.46	0.88	0.42
MKOUST2	4.90	7.70	12.60	10.32	0.17	1.10	-0.31	0.30	1.23	0.10
MOKRVAZ2	6.20	4.00	10.20	6.39	0.28	1.79	0.69	-0.57	0.94	0.34
MISKR2	55.00	45.00	100.00	69.33	2.69	17.00	0.19	-1.08	0.61	0.84
MDUBP2	30.00	19.00	49.00	37.00	0.96	6.07	-0.49	0.99	0.57	0.90

Range (Range), Min (minimum value), Max (maximum value), Mean (arithmetic mean), Std. Er. Mean (standard error of the mean), Std. Dev. (Standard deviation), Skew (standardized coefficient of asymmetry, curvature), Kurt (standardized coefficient of elongation or kurtosis), K - S (Kolmogorov - Smirnov method), p (level of significance).

Table 3 Basic descriptive statistical parameters - control group, initial measurement, motor skills.

Variable	Range	Min	Max	Mean	Std.Err	Std.Dev.	Skew	Kurt	K-S	P
MISTR1	5.10	3.20	8.30	5.26	0.22	1.36	0.62	-0.30	0.63	0.83
MDIZT1	18.00	8.00	26.00	15.58	0.72	4.56	0.48	-0.38	0.70	0.72
MDUBČ1	19.00	15.00	34.00	24.70	0.74	4.69	-0.14	-0.91	1.01	0.26
MKOUST1	6.00	8.90	14.90	11.68	0.19	1.22	0.13	0.02	0.53	0.94
MOKRVAZ1	6.90	4.50	11.40	7.02	0.27	1.70	0.62	-0.17	0.81	0.52
MISKR1	56.00	50.00	106.00	75.23	2.42	15.29	0.21	-0.66	0.51	0.96
MDUBP1	30.00	17.00	47.00	33.95	1.17	7.40	-0.51	-0.27	0.81	0.53

Range (Range), Min (minimum value), Max (maximum value), Mean (arithmetic mean), Std. Er. Mean (standard error of the mean), Std. Dev. (Standard deviation), Skew (standardized coefficient of asymmetry, curvature), Kurt (standardized coefficient of elongation or kurtosis), K - S (Kolmogorov - Smirnov method), p (level of significance).

Table 4 Basic descriptive statistical parameters - control group, final measurement, motor skills.

Variable	Range	Min	Max	Mean	Std.Err	Std.Dev.	Skew	Kurt	K-S	p
MISTR2	5.30	3.00	8.30	4.89	0.22	1.39	0.75	-0.15	0.82	0.51
MDIZT2	17.00	8.00	25.00	14.23	0.70	4.42	0.53	-0.60	0.85	0.47
MDUBČ2	23.00	10.00	33.00	22.53	0.78	4.96	-0.17	-0.17	0.91	0.37
MKOUST2	5.20	9.90	15.10	12.10	0.21	1.31	0.07	-0.81	0.67	0.76
MOKRVAZ2	7.40	4.80	12.20	7.45	0.29	1.82	0.70	0.04	0.73	0.65
MISKR2	53.00	48.00	101.00	77.23	2.29	14.51	-0.06	-0.62	0.63	0.83
MDUBP2	25.00	19.00	44.00	32.90	0.97	6.13	-0.63	-0.02	0.75	0.63

Range (Range), Min (minimum value), Max (maximum value), Mean (arithmetic mean), Std. Er. Mean (standard error of the mean), Std. Dev. (Standard deviation), Skew (standardized coefficient of asymmetry, curvature), Kurt (standardized coefficient of elongation or kurtosis), K - S (Kolmogorov - Smirnov method), p (level of significance).

Table 5 The differences between the initial and final measurements in the experimental group

	Variable	Mean	Std. Dev	Std. Error	T-Test	P
Pair 1	MISTR1	5.16	1.50	0.24	-11.89	0.00
	MISTR2	5.62	1.51	0.24		
Pair 2	MDIZT1	16.48	4.19	0.66	-8.45	0.00
	MDIZT2	20.55	4.35	0.69		
Pair 3	MDUBČ1	24.20	3.28	0.52	-6.74	0.00
	MDUBČ2	26.95	3.26	0.52		
Pair 4	MKOUST1	11.70	1.25	0.20	9.15	0.00
	MKOUST2	10.32	1.10	0.17		
Pair 5	MOKRVAZ1	7.05	1.66	0.26	8.00	0.00
	MOKRVAZ2	6.39	1.79	0.28		
Pair 6	MISKR1	78.90	15.81	2.50	8.76	0.00
	MISKR2	69.33	17.00	2.69		
Pair 7	MDUBP1	31.35	6.23	0.98	-9.97	0.00
	MDUBP2	37.00	6.07	0.96		

Mean (arithmetic mean), Std. Dev. (Standard deviation), Std. Er. Mean (standard error of the mean), T - test (T - test), p (significance level).

Table 6 The differences between the initial and final measurements in the control group.

	Variable	Mean	Std. Dev.	Std. Er.	T-Test	P
Pair 1	MISTR1	5.26	1.36	0.22	6.50	0.00
	MISTR2	4.89	1.39	0.22		
Pair 2	MDIZT1	15.58	4.56	0.72	4.89	0.00
	MDIZT2	14.23	4.42	0.70		
Pair 3	MDUBČ1	24.70	4.69	0.74	5.74	0.00
	MDUBČ2	22.53	4.96	0.78		
Pair 4	MKOUST1	11.68	1.22	0.19	-4.57	0.00
	MKOUST2	12.10	1.31	0.21		
Pair 5	MOKRVAZ1	7.02	1.70	0.27	-5.80	0.00
	MOKRVAZ2	7.45	1.82	0.29		
Pair 6	MISKR1	75.23	15.29	2.42	-2.48	0.02
	MISKR2	77.23	14.51	2.29		
Pair 7	MDUBP1	33.95	7.40	1.17	1.85	0.07
	MDUBP2	32.90	6.13	0.97		

Mean (arithmetic mean), Std. Dev. (Standard deviation), Std. Er. Mean (standard error of the mean), T - test (T - test), p (significance level).

Table 7 The differences between the experimental and control groups in the initial state of the motor skills

Variable	Mean EG1	Mean KG1	Std.Dev. EG1	Std.Dev. KG1	t-value	P
MISTR1	5.16	5.26	1.50	1.36	-0.29	0.77
MDIZT1	16.48	15.58	4.19	4.56	0.92	0.36
MDUBČ1	24.20	24.70	3.28	4.69	-0.55	0.58
MKOUST1	11.70	11.68	1.25	1.22	0.05	0.96
MOKRVAZ1	7.05	7.02	1.66	1.70	0.06	0.95
MISKR1	78.90	75.23	15.81	15.29	1.06	0.29
MDUBP1	31.35	33.95	6.23	7.40	-1.70	0.09

Mean EG 1 (arithmetic mean of the experimental group in the initial measurement), Mean KG 1 (arithmetic mean of the control group in the initial measurement), Std. Dev. EG 1 (standard deviation of the experimental group in the initial measurement), Std. Dev KG 1 (standard deviation of the control group in the initial measurement), t - value (t - value), p (significance level)

Table 8 The differences between the experimental and control groups in the final state of the motor skills

Variable	Mean EG2	Mean KG2	Std.Dev. EG2	Std.Dev. KG2	t-value	P
MISTR2	5.62	4.89	1.51	1.39	2.22	0.03
MDIZT2	20.55	14.23	4.35	4.42	6.45	0.00
MDUBČ2	26.95	22.53	3.26	4.96	4.72	0.00
MKOUST2	10.32	12.10	1.10	1.31	-6.56	0.00
MOKRVAZ2	6.39	7.45	1.79	1.82	-2.61	0.01
MISKR2	69.33	77.23	17.00	14.51	-2.24	0.03
MDUBP2	37.00	32.90	6.07	6.13	3.01	0.00

Mean EG 2 (arithmetic mean of the experimental group in the final measurement), Mean KG 2 (arithmetic mean of the control group in the final measurement), Std. Dev. EG 2 (standard deviation of the experimental group in the final measurement), Std. Dev 2 kg (standard deviation of the control group in the final measurement), t - value (t - value), p (significance level)

This leads to the normal asymmetry, with most of the results in variables: lifting the trunk in 30 seconds (MDIZT1), squat for 30 seconds (MDUBČ1), agility in the air (MOKRVAZ1) and shoulder flex stick (MISKR1) in the area of better value than the value of the arithmetic means, while the results in variables: persistent pin running (MISTR1), side steps (MKOUST1) and deep forward bend on the bench (MDUBP1) are in the zone of weaker (smaller) values of the arithmetic mean value. Kurtosis coefficient distribution results - kurtosis (Kurt), with all seven of motoric variables are in the values ± 3.00 and we treat these variables as variables that have normal flattening - mesokurtosis. Compared to normal distribution of the results that have been tested by Kolmogorov-Smirnov method, for the experimental group in the initial measurement of motor skills, it was found that the results of subjects are normally distributed. The results obtained and presented in Table 2, refer to the motor skills of the treated subjects in the experimental group in the final measurement, and

for them we can say that are within a realistic and logically expected values. All the recorded values of the coefficient skewness (Skew), for all seven of motoric tests give us the right to conclude that the results obtained are within ± 1.00 . This leads to the normal asymmetry, with most of the results in variables: lifting the trunk in 30 seconds (MDIZT2), agility in the air (MOKRVAZ2) and shoulder flex stick (MISKR2) and deep forward bend on the bench (MDUBP2) in the area of better value than the value of the arithmetic means, while the results in variables: persistent pin running (MISTR2), squat for 30 seconds (MDUBČ2), side steps (MKOUST2) are in the zone of weaker (smaller) values of the arithmetic mean value. Kurtosis coefficient distribution results - kurtosis (Kurt), with all seven of motoric variables are in the values ± 3.00 and we treat these variables as variables that have normal flattening - mesokurtosis. Compared to normal distribution of the results that have been tested by Kolmogorov-Smirnov method, for the experimental group in the final measurement of

motor skills, it was found that the results of subjects are normally distributed. The results obtained and presented in Table 3, refer to the motor skills of the treated subjects in the control group in the initial measurement, and for them we can say that are within a realistic and logically expected values. All the recorded values of the coefficient skewness (Skew), for all seven of motoric tests give us the right to conclude that the results obtained are within ± 1.00 .

This leads to the normal asymmetry, with most of the results in variables: squat for 30 seconds (MDUBČ1), side steps (MKOUST1), agility in the air (MOKRVAZ1), shoulder flex stick (MISKR1) and deep forward bend on the bench (MDUBP1) in the area of better value than the value of the arithmetic means, while the results in variables: persistent pin running (MISTR1) and lifting the trunk in 30 seconds (MDIZT1),, are in the zone of weaker (smaller) values of the arithmetic mean value. Compared to normal distribution of the results that have been tested by Kolmogorov-Smirnov method, for the control group in the initial measurement of motor skills, it was found that the results of subjects are normally distributed. The results obtained and presented in Table 4, refer to the motor skills of the treated subjects in the control group in the final measurement, and for them we can say that are within a realistic and logically expected values. All the recorded values of the coefficient skewness (Skew), for all seven of motoric tests give us the right to conclude that the results obtained are within ± 1.00 .

This leads to the normal asymmetry, with most of the results in variables: squat for 30 seconds (MDUBČ2), side steps (MKOUST2), agility in the air (MOKRVAZ2), and deep forward bend on the bench (MDUBP2) in the area of better value than the value of the arithmetic means, while the results in variables: persistent pin running (MISTR2), lifting the trunk in 30 seconds (MDIZT2), and shoulder flex stick (MISKR2) are in the zone of weaker (smaller) values of the arithmetic mean value. Kurtosis coefficient distribution results - kurtosis (Kurt), with all seven of motoric variables are in the values ± 3.00 and we treat these variables as variables that have normal flattening - mesokurtosis. Compared to normal distribution of the results that have been tested by Kolmogorov-Smirnov method, for the control group in the final measurement of motor skills, it was found that the results of subjects are normally distributed.

Differences within groups between the initial and final measurements in the area of motor skills

Based on the results obtained and compared values of arithmetic mean between the initial and final measurements of Applied seven variables in the experimental group we noticed the following changes (Table 5). With a probability of 99% (or at the level of 0.01), statistically significant changes were detected in all seven variables used.

Thus, in the experimental group who worked hours of high - low aerobics, there was a statistically significant difference in the analyzed measuring instruments in favor of the final measurement. In all the seven variable of motor space, differences were observed in favor of the final measurement. In terms of measuring instruments for the assessment of motor abilities there has been significant progress in the experimental group. So the experimental treatment, which consisted of high - low aerobics was intense enough to improve performance in all the analyzed measuring instruments. Almost the same results gave Cvetković (2007) in the study, which also applied the high - low aerobics, that was intense enough to improve performance in all the analyzed motor measuring instruments with first-year students of the Faculty of Sport and Physical Education. Sibinović (2009) also reached similar results in his study that aimed to determine the effects of programmed instruction "high-low" aerobics on morphological characteristics and motor abilities of eighth grade elementary school students. The results showed that there was a statistically significant improvement in the results of variables from initial to final measurement in motor and morphological space of the experimental group. The greatest improvement in the motor area was observed with the explosive power of the lower extremities, repeated muscle potential, flexibility, strength and coordination. Thus the results confirm definition that the aerobic is activity in which the dominant motor abilities: endurance, strength, flexibility and coordination. Based on the results obtained and compared values of arithmetic mean between the initial and final measurements of Applied seven variables in the control group we noticed the following changes (Table 6). With a probability of 99% (or at the level of 0.01), statistically significant changes were detected in next variables: persistently pin running (MISTR), lifting the trunk in 30 seconds (MDIZT), squat for 30 seconds (MDUBČ), side steps (MKOUST) and agility in the air (MOKRVAZ). With a probability of 95% (or level 0.05), statistically significant changes were detected in the variable - shoulder flex stick (MISKR). Only variables with a deep forward bend on the bench (MDUBP) showed no statistically significant changes. Cvetković (2007) and Sibinović, (2009) found similar results.

The differences between the experimental and control groups

Based on the determined mean differences between the experimental and control groups in the initial state of the variables for the assessment of motor skills (Table 7), it is evident that not a single statistically significant difference between treatment groups of respondents is detected. The variables: persistent pin running (MISTR1), lifting the trunk in 30 seconds (MDIZT1), squat for 30 seconds (MDUBČ1) and deep forward bend on the bench (MDUBP1) results better than the logical value of arithmetic means are set in the experimental group, while the results achieved as

far as comparing the arithmetic means of the variables: side steps (MKOUST1), agility in the air (MOKRVAZ1) and shoulder flex stick (MISKR1) are on the side of the control group. Based on the determined mean differences between the experimental and control groups in the final state of the variables for the assessment of motor skills (Table 8), it is noticeable that in all seven (7) variables there was statistically significant difference between the final measurement (after the experimental treatment) of treated group of subjects. All variables better results by logical value arithmetic means are set on the side of the experimental group. The experimental group was working classes as scheduled high - low aerobics program and showed significantly better results between the two measurements in all measured variables compared to the control group who did physical education classes according to the established curriculum. The effects of programmed physical activities of step and "high-low" aerobics with music on specific morphological characteristics, as well as functional and motor abilities of seventh grade female students from primary schools that reached Mandarić (2003), showed us that the programmed physical activities of step and "high-low" aerobics influenced the development of the morphological characteristics, as well as functional and motor abilities from the experimental groups, comparing to the subjects of the control group. The strongest development in both applied programmes is recognized in the maximum oxygen intake and variables from the area of general coordination as well as coordination in the rhythm. It is also important to highlight that the similar findings are reached by Stoiljković, Mandarić, Todorović & Mitić (2010); Kostić, Đurašković, Miletić & Mikalački (2006); Kostić & Zagorc (2005); Sekulić et al. (2003), the authors whose findings could confirm our hypothesis that the subjects of the experimental

groups who used aerobic reached much better results in the already specified parameters on the final testing, comparing to the subjects of the control group. On the other hand, it is widely recognized that a long-term home-based programme of aerobic physical activity improves metabolic asset and reduces systemic inflammation in sedentary people (Di Raimondo, 2013) as well as couple weeks of step aerobics was not effective in improving all of the measured anaerobic indices in men and women (Kin-Isler & Kosar, 2006). This justifies the applied experimental treatment and can be considered to be positively influenced the experimental group, ie. That is have given the positive effects.

Conclusion

Implementation of this research was conducted in order to determine the value of the experimental treatment of high - low aerobics and its impact on the transformation of motor skills a high school student, it is possible to make the following conclusion: 1) On the basis of the results it is showed that there is a statistically significant difference between the initial and final measurements of all variables related to motor abilities of women; 2) Overall, we can conclude that in this study statistically positive effect of experimental treatments on motor abilities of the respondents is demonstrated, and that aerobic is activity in which the dominant motor abilities are: endurance, strength, flexibility and coordination. Physical activity has many benefits for physical and mental health of high school student and it is necessary to provide opportunities for students in high schools for physical activity type aerobics; 3) Program activities implemented in the framework of physical education in our practice does not cause the desired transformation in the area of motor skills.

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UČINCI HIGH-LOW AEROBIK PROGRAMA NA TRANSFORMACIJE MOTORIČKIH SPOSOBNOSTI SREDNJOŠKOLKI

Sažetak

Istraživanje je provedeno kako bi se utvrdila vrijednost eksperimentalnog programa (high - low aerobik) i utjecaj na održivost motorike srednjoškolac. Uzorak se sastojao od 80 studentica medicinskih škola i bio je podijeljen u dvije skupine (eksperimentalnu i kontrolnu). Promjene koje su se događale kod studenata u okviru eksperimentalnog programa od 12 tjedana, praćene su uz pomoć sedam motoričkih testova. Rezultati su podvrgnuti statističkim metodama obrade podataka, koji je uključivao određivanje opisnih statističkih parametara, a za utvrđivanje statistički značajne razlike između srednjih vrijednosti početne i konačne mjere je li se eksperimentalna skupina promijenila znatno više od kontrole, primjenjen je t-test. Rezultati jasno ukazuju da su statistički značajne pozitivne promjene u transformaciji procijenjenih motoričkih sposobnosti na finalnom mjerenju bile u korist eksperimentalne skupine u odnosu na kontrolu, što sve zajedno podržava učinkovitost primijenjenih programa high-low aerobika.

Ključne riječi: aerobic, high-low aerobic, fitness, motoričke sposobnosti, srednjoškolke

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