

EUB 2020



ECOLOGICAL  
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## **Ecology of XXI Century**

# **The European Green Deal Challenges**

8th International Multidisciplinary Academic Conference

# EUB 2020



**ECOLOGICAL  
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## Welcome

The Ecological University of Bucharest is pleased to invite you to the 8th International Multidisciplinary Academic Conference (EUB 2020), which will be held on from 13 to 15 of May 2020 as an Online event, using ZOOM platform, with the organizer from Bucharest, Romania.

Over the past 30 years, The Ecological University of Bucharest has been in the ecological and higher education service, as the first private institution of higher education in Romania, founded on the 4th of April 1990 and the only one with an ecological profile in the country.

The main purpose of the conference is to provide an international forum for researchers, professors and students from universities and research institutes to disseminate the original research findings that concentrate on both theory and practice, to exchange ideas and start new challenges. The "Ecology of XXI Century" started as an international multidisciplinary academic conference in 2013.

We wish you a fruitful conference. Welcome to EUB2020!

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## The impact of shockwave exercises on adolescents

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### Abstract

In order to increase the interest of adolescents in physical culture and increase their physical activity, empirical studies of the impact of shock wave exercises were conducted with the help of self-made simulators from plastic bottles filled with two thirds of water, pebbles and metal rods, in comparison with other physical exercises. Studies were conducted in teenagers 14 years old of two classes (n=77) in physical education lessons. One class was control, in the other, general developmental exercises with bottle simulators were carried out in the preparatory part of the lesson for 15 minutes, three times a week, for six months. At the beginning and end of the experiment, the physical development (Height, Mass, Vital capacity of the lungs, Blood pressure, Heart rate, Saturation of blood with oxygen - SpO<sub>2</sub>) and physical fitness (Flexibility, Speed, Agility, Strength, Strength endurance, High-speed strength) of all adolescents were determined. Although, almost all the physical qualities of adolescents were low before the pedagogical experiment, they had improved significantly after the six-month experiment. Almost all students in the experimental class showed good and satisfactory results, both physical development and basic physical qualities, according to state standards. Use in physical education lessons of the bottle simulators increase the interest of adolescents in physical education. Shock-wave exercises with the use of bottle simulators reduce body weight, increase the functional adaptive capacity of the cardiovascular system, developed well the flexibility, speed, endurance, speed-power and power qualities of schoolchildren. The results of the study can be useful for coaches and physical education teachers in general schools.

**Keywords:** teenagers, shockwave simulators, physical qualities.

Ключові слова: підлітки, ударно-хвильові тренажери, фізичні якості.

Ключевые слова: подростки, ударно-волновые тренажеры, физические качества.

### 1.Introduction

Positive effect of various exercises with the use of shaking and muscular vibration has been known for a long time. Muscular shaking is present in many exercises: varieties of walking, jogging, various jumps, vaulting and unsupported jumping, and skipping rope, dancing exercises. In 1927, the Katzudzo Nishi Recovery System was established. Katzudzo Nishi himself acknowledged that this system was not his invention. He has studied and tested many methods and systems for healing people, including ancient Greek, Ancient Egyptian practices, Tibetan, Chinese, Philippine medicine, yoga, including exercises to expand the human capillary through shaking. Today it is known «Agashin's simulator», with which you can perform shockwave exercises. In addition to F.K. Agashin, vibration methods and biomechanical training tools, is developed by a large group of specialists of Samara Aerospace University (Samara National Research University named after S.P. Korolev) under the guidance of professor V.S. Saveliev. According to the conclusion of the Moscow Medical Academy by name I.M. Sechenov: «training with «dynamic dumbbell» normalizes of blood pressure and heart rate, increases oxygen consumption and improves hemodynamic», (Frolov et al., 1989, p. 36). But these simulators are quite expensive and it is impossible to make them yourself. There is so-called «vibro-gymnastics», by M. Gogulan, (2002), by which, she herself cured by the Katzudzo Nishi system. In 1994, a new direction in medicine appeared - treatment using dosed microvibrational effects. Based on the effect of improving blood circulation and lymph circulation in the area of vibro-acoustic exposure, was also recommended for the recovery of people (Vasiliev et al., 2004, p. 11).

## 2 Material and Methods

We used exercises with shock-wave effects using simulators made from plastic bottles filled two-thirds full with water, gravel and metal rods. For the 500ml bottles, two metal rods, 15mm in diameter and 11 and 15cm in length, were used. For bottles 580ml - rods 15 and 17cm. When performing shaking exercises, rods of different lengths hit the bottle lid one by one: 1) longer, 2) shorter, 3) balls or pebbles, creating a fine vibration with noise effects that students liked. The noise effects were similar to the drum accompaniment. This raised the mood of the students and promoted the effectiveness of the classes. Filatov A.T. (1979) recommended such "exercises with smiling face" for "the formation of an optimal psychological climate in sports teams". We have developed a system of exercises with bottle simulators and tested their effect on physical education lessons for six months. The study involved 8th grade students aged 13,5 to 14,5 years, girls (n - 45) and boys (n - 32). We determined physical development by indicators: Height, Body weight, Vital Capacity of lungs (VCL), Blood Pressure (BP), Heart Rate (HR), Saturation of hemoglobin with blood oxygen (SpO<sup>2</sup>), and physical fitness: Flexibility, Speed: running 60 m; Strength of hand and back extensors; Agility: shuttle running (4x9 m); the Speed-power qualities: skipping rope in 1 minute and long jump from place; Strength endurance: pull up and lifting from a supine position to sitting for 1 min. schoolchildren. The studies were conducted in two classes, which did not differ significantly in terms of physical development and fitness. One class was a control, where regular lessons were taught under the State Program. The second class was experimental, where the shockwave exercises were performed in the preparatory part of the lesson for 15 minutes, three times a week for six months.

## 3. Results and Discussions

Before the experiment, the average body length of 8-th grade boys was lower than the average of the rating tables - (from M-1 $\sigma$  to M-2 $\sigma$ ) - 163,5 cm, and the girl's body lengths were average - (from M + 1 $\sigma$  to M-1 $\sigma$ ) - 162,9 cm, although no significant statistical difference between body and length indicators of boys and girls was found (Table 1). Body weight, both for boys - 59,8 kg, and for girls - 51,8 kg, according to the rating tables was higher than average (from M + 1 $\sigma$  to M + 2 $\sigma$ ). The boy's body weight was significantly greater than the girl's weight by an average of 8 kg (P<0.01). The vital capacity of the lungs, reflecting the ability of the body's regulatory ability to control external respiration, met the age standards, both in boys - 2,5 liters and in girls - 2,55 liters. It is generally accepted that a deviation of 10-15% corresponds to the norm (Herbut, 2015, p. 69). The mean VCL of boys was 0,8l greater than that of girls (P<0.05). According to the opinion of doctors, in 14-20 years of blood pressure: 100/70 - 120/80 mm Hg. - are considered normal. In experimental studies (M.V. Yoltukhivsky et al., 2017, p. 31), «it has been found that, due to hyperkinesias, which is very common in schoolchildren recently, among teenagers 14-15 years, 50% of boys and 78% of girls have low and below average levels of functional the status of the cardiovascular system». The mean heart rate in girls was slightly higher (81,1) than in boys (80,3), but this difference was not significant (P>0,05). Average figures girls and boys of SpO<sup>2</sup> were normal and with no significant difference. (P>0,05).

**Table 1** Average indicators of physical development of teenagers of 8th grades before the experiment

Sex	n	Body length (sm)	Mass (kg)	VCL (l)	BP (mmHg)	HR (number times: 1min)	SpO <sup>2</sup> (%)
M	32	163,5 $\pm$ 0,67	59,8 $\pm$ 0,58	2,5 $\pm$ 0,45	117/74 $\pm$ 3,2/4,3	80,3 $\pm$ 5,1	96,1 $\pm$ 0,34
F	45	162,9 $\pm$ 0,73	51,85 $\pm$ 0,49	2,55 $\pm$ 0,38	112/73 $\pm$ 4,7/3,5	81,1 $\pm$ 4,6	96,3 $\pm$ 0,27

The physical preparedness of adolescents before the experiment was quite low (Table 2). Average indicators of flexibility (bend sitting) of boys - 1 point, girls - 2,5 points according to the five-point system of State standards. Speed (60 m run) of boys - 2 points, of girls - 2.5 points.

Dexterity of teenagers boys and girls (shuttle running 4x9m) - 0 points. Hand strength and back extensors boys and girls have 3 points. Power endurance: (pull-up) in boys - 0 points; in girls (from hang lying) - 3 points; (lifting from a supine position to sitting) - boys and girls - 3 points. Speed-power qualities: (skipping rope jumps for 1 min) in boys and girls - 3 points; (long jump from place) the boys - 2 points, girls - 3 points according to the State standards.

Sex	Flexibility (sm)	Speed (s)	Agility (s)	Strength (kg)		Strength endurance (number of times)		Speed & strength Jumps	
	Bend sitting	60 m run	shuttle running (4x9m)	hand	back extensors	pull up	lifting from lying to sitting (in 1 min)	skipping rope (n. of times 1 min)	long jump from place (sm)
M	5,2±3,2	10,3±0,3	12,4±0,6	20,5±4,3	75,6±5,3	5,2±3,4	35,8±5,3	82,5±6,4	163,8±5,4
F	7,8±4,1	10,7±0,4	13,5±0,5	13,3±6,2	64,5±6,3	12,6±3,3	32,3±4,7	88,5±7,2	162,3±4,6

**Table 2** Average indicators of physical fitness of teenagers of 8th grades before the experiment

After the experiment the body length of schoolchildren from the experimental class increased: boys – 4sm (2,4%,  $P<0,05$ ), girls – 1.6% ( $P<0,05$ ) in the control class growth significantly increased only in boys – 2.6 cm, (1,9%,  $P<0,05$ ). The average growth of girls of the control class rate was not significantly changed ( $P>0,05$ ). The body weight of the boys of the experimental class decreased by 2.2 kg (3,7%,  $P<0,05$ ), girls - 3.6 kg (7%,  $P<0,05$ ). In the control class, body weight boys and girls was not significantly changed, although girls have a tendency to the body weight increase ( $P>0,05$ ), (Table 3). The average VCL was not significantly changed, although there is a trend towards improvement in the experimental class; the guys 0.35 l, the girls of 0.2 l ( $P>0,05$ ) in the control class, boys average has not changed, and girls have a tendency to decrease by 0.25 l ( $P>0,05$ ). The average arterial blood pressure in adolescents of the experimental class was slightly higher: 115/85 in boys and in girls -111/78 than those of the control class, respectively: 112/63 and 108/71,7. This may be due to a few large growths of pupils of experimental class after the experiment, and the best functional adaptive processes of the cardiovascular system, as a result of the training process. But the blood pressure parameters, both experimental and control classes were considered to be normal (Marushko Yu. V. & Himac T. V., 2018, p. 5). When adults and children from 13 years, the prevalence of pressure above 120/80 mm Hg., it should alert clinicians as possible hypertension. Recommendations (American Heart Association) and (American College of Cardiology) suggest new criteria for determining categories of BP in children. The term «hypertension» today, in both adults and children replaced with «high blood pressure» (P. K. Whelton, R. M. Carey, W. S. Aronow et al., 2017, p. 11; J.T. Flynn, D.C. Kaelber, C.M. Baker-Smith et al, 2017, p. 19-24). The average HR adolescents of the experimental class reduced: boys – 8%, girls – 4.4% ( $P<0,05$ ), that indicates improving the efficiency of the heart muscle. In the control class change HR metrics can only be viewed as a trend toward improvement, because they were unreliable ( $P>0,05$ ). The average SpO2 significantly improved only in adolescents of the experimental class: boys – 2.4% and girls by 2% ( $P<0,05$ ).

**Table 3** Average indicators of physical development of teenagers of 8th grades after the

Class	Sex	Height (cm)	Mass (kg)	VCL (l)	BP (mmHg)	HR (number times: 1 min)	SpO <sub>2</sub> (%)
E	M	167,7± 0,63	57,6±0,72	2,85±0,62	115/85±2,3/1,2	74±3,1	98,5±0,3
E	F	164,5±0,52	48,2±0,63	2,7±0,43	111/78±3,3/2,2	77,5±2,3	98,3±0,5
K	M	166/1±0,56	59,7±0,81	2,5±0,34	112/63±2,3/5,1	79,6±4,2	96,7±0,4
K	F	163±0,49	52,4±0,56	2,3±0,51	108,9/71,7±3,4/3,1	80,2±3,7	96,7±0,32



## *experiment*

All tested physical qualities of the experimental class were better at the end of the experiment, compared to those of the control class. The biggest difference in the average indicators of the classes was between strength and flexibility (Table 4). For example, strength endurance (pull-ups) in boys in the experimental class was better than in the control class by 52,3%, and in girls - by 29,7%. Flexibility was better for boys – 32,2% and girls – 44,6%. The strength of the hand in boys of the experimental class was better by 42,4%, and in girls - by 34,5%, ( $P<0,05$ ). Indicators of lifting from a supine position were 23% better for boys and 16.2% for girls. Agility (shuttle running 4x9m) was better for boys - by 26,2%, for girls - by 27,8%. The power of extensors teenagers back: of boys' was better by 11,5% and girls by 8,3%, ( $P<0,05$ ),

Class / Sex*	Flexibility (sm)	Speed (s)	Agility (s)	Strength (kg)		Strength endurance (number of times)		Speed-power qualities Jumps	
	Bend sitting	60 m run	shuttle running (4x9m)	hand	back extensors	pull up	from lying to sitting (in 1 min)	skipping rope (n. of times in 1 min)	long jump from place (sm)
E/M	10,5±4,2	9,7±0,2	10,3±0,4	37,5±3,4	87,3±3,5	17,4±3,7	54,2±3,5	110,9±5,6	208,5±6,4
E/F	14,8±3,1	10,3±0,5	10,4±0,35	25,2,3±5,2	70,1±4,2	20,5±2,3	49,3±2,7	120,1±4,3	195,7±4,2
K/M	6,8±2,3	10,1±0,2	13,0±0,33	21,6±2,2	77,2±2,4	8,3±2,5	41,6±3,7	99,5±5,3	192,7±4,7
K/F	8,2±3,4	10,7±0,4	13,3±0,45	16,5±3,1	64,3±3,1	14,5±4,6	41,3±2,8	112,5±4,4	187,5±3,5

**Table 4** Average indicators of physical preparedness of teenagers of 8th grades after the experiment

\* E/M – experimental class, male; E/F - experimental class, female; K/M – control class, male; K/F – control class, female;

Speed-power qualities (jumping rope in 1 min) were better for boys - by 10.3%, girls - by 6.3%; Long jump jumps were better for boys by 7.6% and girls by 4.2%. Average speeds (running 60m) were better for boys - 4.12%, girls - 3.9% than those of the control class.

### Conclusions

1. The use of shock wave simulators in physical education lessons increases the interest of adolescents in physical education.
2. Exercise shock wave action using bottle simulators stimulate weight loss, increase the functional adaptive capacity of the cardiovascular system, and normalize the saturation of arterial blood with oxygen.
3. After the experiment, the greatest difference in improvement in the fitness indicators of the adolescents of the experimental classes compared to the control was in boys: strength endurance (pulling) - by 52,3%, strength of the hand - by 42,4%, flexibility - by 32,2%, agility by 26,2%, from lying to sitting by 23%. A smaller but also significant improvements were in the figures: back muscle extensors - by 11,6%, speed-power qualities (jumping rope) - by 10,3%, long jump from place - by 7.6% and speed - by 4,12% more than in the control guys. In the girls from the largest to the smallest difference the improvements were in the indicators: flexibility - by 44,6%, strength of the hand - by 34,5%, strength endurance (pulling) - by 29,7%, agility - by 27,8%, strength endurance (from lying to sitting) – 16,2%, skipping rope – 6,3%, long jump – 4,2% and speed – 3,9% more than in the control girls.

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