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Strengthening the physical health of preschoolers by means of fitball

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Abstract

Problem: the article highlights the problem of improving modern methods of strengthening the physical health of preschool children, the importance of using modern fitness methods to strengthen the muscles of the spine, the formation of correct posture at an early stage of development of children. One of the ways to solve the problems of children's health improvement and prevention of various disorders in the formation of the spine and skeletal muscles of young children is proposed: fitball aerobics classes, as a type of fitness aerobics 22 using large gymnastic balls - fitballs. **Objectives**: to characterize fitball-aerobics, as preschool children's innovative means of physical education, to develop a methodology for the complex effects of fitball-aerobics exercises on the development of physical abilities of preschool children's age, to determine its effectiveness. **Method**: the research was conducted in the period from 2016 to 2018 on the basis into educational organizations of preschool education in Chelyabinsk. Children of preschool age took part in the aged 5-7 years. A total of 40 children participated in the experiment (20 in the control group, 20 in the experimental group). The work done does not infringe on the rights and does not jeopardize the well-being of schoolchildren in accordance with the ethical standards of the Committee for the Rights of Experiments of the Helsinki Declaration. Parental consent to examine children was obtained. A methodology developed and tested was used for the complex effect of aerobic fitball exercises on the development of physical abilities in preschool children.

Results: the results of the study confirmed the hypothesis put forward (the developed methodology for the complex effect of fitball-aerobics exercises on the development of physical abilities preschool children will be effective). **Conclusion**: Physical Education based on the use of fitball-aerobics elements have a positive impact on the development of physical abilities of preschool children aged 5-7, motivates to engage in physical culture and sports. At the end of the pedagogical experiment, the children of the experimental group showed significantly higher results than peers from the control group.

Keywords: Physical Education, Physical abilities, Fitball aerobics, Physical fitness, Motor development, Preschool children.

Introduction

Preschool age children protection and promotion health, improving child's body functions and its full physical development are an integral part of pedagogical work in educational organizations of preschool education. Meanwhile, in preschool age, already a significant part of children (68%) experience multiple functional disorders, 17% of children acquire chronic diseases, and only one out of three children remains healthy (Kuchma, 2006; Stepanova , 2006). Preschooler's health indicators analysis over the past decade has revealed unfavorable trends: the first group of health, including healthy children with normal physical and mental development, without anatomical defects, functional and morphofunctional abnormalities, decreased by 2.7 times (from 15.6 to 5.7%), while the number of the 3rd health group, which consisting of children with chronic diseases, with physical disabilities, with an intellectual disability (Protic & Válková, 2018), the consequences of injuries and operations (from 11.8 to 26.9%), increased by 2,3 times. Most children (60-70%) in all age groups have 3-4 morphofunctional deviations, only 10-20% of children have 1-2 deviations (Lobanov et al., 2019). An alarming is increase in the number of children with five or more morphofunctional abnormalities, the leading ones being disorders of the musculoskeletal system and cardiovascular functions, digestive organs, allergic diseases (Paranicheva, 2008).

One of the ways to solve the problems of children's health and various diseases prevention is fitball aerobics –a type of fitness aerobics using large gymnastic balls (fitballs) (Saikina & Kuz'mina, 2008; Mishchenko & Badretdinova, 2019; Pesina & Mishchenko, 2019). Exercises on fitballs create a healing effect, which is confirmed by the experience of specialized correctional (Symonik et al., 2018) and rehabilitation medical centers in Europe and Russia. They make it possible to solve various problems in the complex due to the inclusion in the work of simultaneously motor, vestibular, auditory, visual, tactile and olfactory analyzers (Bedran, 2016).

Thus, they positively affect the physical and psycho-emotional state of those involved and are of great interest in children (Saikina & Kuz'mina, 2011; Veselovskaya, Sverchkova, Levchinkova, 1998).

The effectiveness gymnastic exercises with fitballs use in practice of preschool children's physical education and recovery is confirmed by numerous scientific studies of doctors, teachers and psychologists (Borisova, 2012; Denisenko, 2014; Kolesnikova, 2005; Zakharova, 2013). However, studies aimed at studying the complex effects of fitball-aerobics on the development of physical abilities, healing and improving the psycho-emotional state of preschool children's are clearly not enough.

In this regard, the relevance of the study is caused by the following contradictions:

- The request of society in a healthy harmoniously developed rising generation and preschool children's low level of health, physical development and physical abilities;
- The wide possibilities of fitball-aerobics classes impact on the body of those engaged in order to solve various problems and the lack of methodology development the complex effects of fitball-aerobics exercises on increasing the level of physical fitness, improving health status, and creating a steady interest in physical exercises;
- The practice of introducing fitballs into educational organizations of preschool education of various types and kinds, and the lack of software and methodological support for fitball-aerobics classes.

The purpose of the study is to develop and determine the effectiveness of the methodology for fitball-aerobics exercises complex effects on the development of physical abilities preschool aged children's. The object of study is the preschool aged children's process of physical education, and the subject of the study is the complex effect of fitball-aerobics exercises on the development of physical abilities of children of preschool age.

Research hypothesis: the developed methodology for the complex effect of fitball-aerobics exercises on the development of physical abilities preschool children will be effective if:

- Fitball-aerobics are used in all forms and types of work on the physical education of preschool children's, adequate to the age characteristics of children aged 5-7 and the actual state of those involved;
- The developed complexes of fitball-aerobics have a different orientation, plot, they are conducted under musical accompaniment;
- The properties of fitball (color, shape, size, elasticity, smell) are taken into account; the multifunctionality of its use (as a support, object, weighting device, simulator, obstacle, massager, landmark).

Research objectives:

1. To characterize fitball-aerobics, as preschool children's innovative means of physical education.

2. To establish factors determining the complex effect of fitball-aerobics exercises on the development of physical abilities of children of preschool age.

3. Determine the fitball aerobics used in the physical education of preschool children.

4. To develop a methodology for the complex effects of fitball-aerobics exercises on the development of physical abilities of preschool children's age, to determine its effectiveness.

Methods

The research was conducted in the period from 2016 to 2018 on the basis into educational organizations of preschool education No. 366 "Korablik (Ship)" in Chelyabinsk. Children of preschool age took part in the aged 5-7 years. A total of 40 children participated in the experiment, 20 in the control group and 20 in the experimental group. The work done does not infringe on the rights and does not jeopardize the well-being of schoolchildren in accordance with the ethical standards of the Committee for the Rights of Experiments of the 2008 Helsinki Declaration (WMA, 2013). Parental consent to examine children was obtained.

The experimental groups were engaged in the program of physical education for preschool organizations "Raduga (Rainbow)" by Grizik et al. (2005). The classes of the experimental group included fitball-aerobics exercises that contribute to the development of strength, flexibility, movements coordination and equilibrium functions. Physical exercises complexes in fitball-aerobics were developed taking into account the children's age characteristics, their motor experience, the level of motor skills formation, i.e. were focused on children aged 5-7. We spent daily assess-ment of physical activity, based on the experience of foreign researchers (Kondakov et al., 2020).

Results

The results of the study were subjected to statistical processing with the calculation of the arithmetic mean value, standard deviation, arithmetic mean error, student t-test, error probability according to the table of this coefficient (Grjibovski et al., 2003). In developing the exercises complexes, we relied on the classification of exercises proposed by Ovchinnikova & Potapchuk (2009).

The complexes included exercises:

- Using various initial positions of children on fitball balls;
- With a change in speed and pace of movement;
- Using various methods of performing exercises;
- Using coordinated movements in pairs and in a group (together, in a group, holding hands, sit down and stand up, perform turns, bends, jumps.

Table 1 presents the approximate number of classes using fitball balls.

Table 1. The approximate number of lessons per month using fitballs, organized with preschoolers 5-7 aged.

№	Forms of classes	Number of lessons per month
1	Morning hygienic gymnastics	5
2	Regular educational activity * physical education classes	2-3
3	Corrective gymnastics	8
4	Individual sessions	Of necessity
5	Independent motor activity	Of necessity
6	Sports activities, holidays, entertainment	1
7	Work “Fitball-aerobics” study group	2

Forms of using fitball with older preschool children in the process of organizing and conducting various types of physical education work are presented in Figure 1.

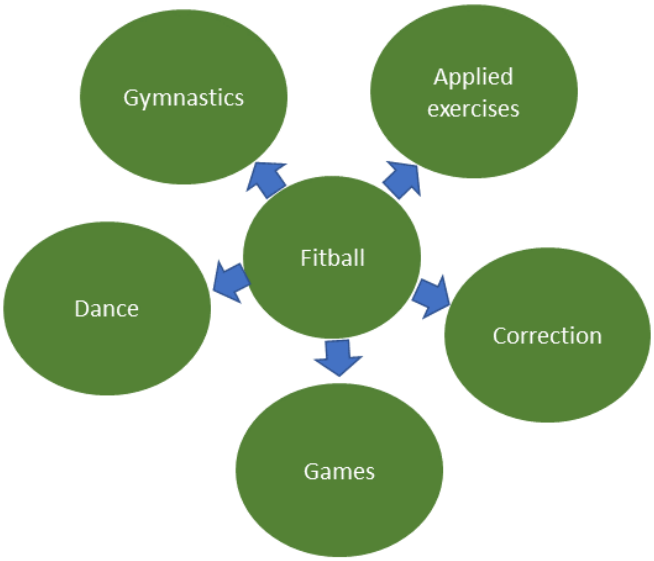

Figure 1. Forms of using fitball in the classroom with preschool aged children.

Variants for using fitballs in the preparatory part of a physical education (PE) lessons with older preschool children are presented in Figure 2.

"Loose" walking between fitballs

Walking and tossing fitballs

Figure 2. Variants for using fitballs in the preparatory physical education (PE) classes with children preschool aged.

The options for using fitballs in the main part of the physical education (PE) lesson with older preschool children are presented in figure 3.

Lying on stomach on a fitball

Lying on the back with a fitball

Figure 3. Variants of using fitballs in the main part of PE classes with preschool aged children.

Variants for using fitballs in outdoor games with older preschool children are shown in figure 4.

Figure 4. Variants for using fitball in outdoor games.

Variants for using fitball in the final part of the physical culture lesson are presented in figure 5.

The effectiveness of applying our developed methodology for the complex effects of fitball-aerobics exercises on the development of preschool children's physical abilities was evaluated based on analysis and generalization of the pedagogical experiment results.

An examination of the physical abilities children in the experimental groups carried out before the start of the experiment (September 2016) made it possible to draw a conclusion about the absence of significant differences between them (tables 2-3).

Exercises aimed at the formation proper posture

Flat feet prevention and correction exercises

Figure 5. Variants for using fitball in the final part physical education classes.

Table 2. Comparative characteristics of the level of development of physical abilities of girls 5-6 years of experimental groups before the experiment (September 2016).

Control exercises		EG (n=10) (X±m)	CG (n=10) (X±m)	t	p
Speed abilities					
Running on 30 m (s)		9,6±0,3	9,7±0,3	0,1	>0,05
Coordination abilities					
Shuttle 3x10 (s)		12,6±0,2	12,8±0,1	0,2	>0,05
Speed-power abilities					
Long jump from standstill (sm)		68,4±2,5	67,6±4,8	0,8	>0,05
Raising the torso to sitting position (number of times in 30 s)		7,9±0,8	7,4±0,9	0,5	>0,05
Power					
Dynamometry (kg)	Right hand	6,5±0,5	6,4±0,4	0,1	>0,05
	Left hand	5,9±0,6	5,7±0,8	0,2	>0,05
Flexibility					
Bend forward (sm)		1,7±1,2	1,8±1,1	0,1	>0,05

Table 3. Comparative characteristics of indicators of the level of development of physical abilities of boys of 5-6 years of experimental groups before the experiment (September 2016).

Control exercises		EG (n=10) (X±m)	CG (n=10) (X±m)	t	p
Speed abilities					
Running on 30 m (s)		9,5±0,3	9,6±0,3	0,1	>0,05
Coordination abilities					
Shuttle 3x10 (s)		12,6±0,2	12,5±0,1	0,1	>0,05
Speed-power abilities					
Long jump from standstill (sm)		68,8±3,1	68,6±3,3	0,2	>0,05
Raising the torso to sitting position (number of times in 30 s)		8,0±0,8	7,7±0,8	0,3	>0,05
Power					
Dynamometry (kg)	Right hand	6,8±0,3	6,6±0,2	0,2	>0,05
	Left hand	5,9±0,4	5,8±0,3	0,1	>0,05
Flexibility					
Bend forward (sm)		0,0±2,0	0,1±2,0	1,1	>0,05

After the first year of experimental work, significant differences were noted in the physical abilities of children engaged in experimental methods and their peers from the control group of both boys and girls (tables 4-5). At the same time, differences in the results demonstrated by boys and girls were noted. The girls of the experimental group had higher gains in running 30 m (s), long jump from the standstill (sm), abdominal muscle strength (getting up from a sitting position), right arm strength, leaning forward (sm), than their peers from the control group (table 6, figure 6). In turn, the boys of the experimental group were significantly ahead of the boys of the control group in terms of an increase in performance in running 30 m (s), shuttle running 3x10 (s), long jump from the standstill (sm), lifting the body from a sitting position (number times), dynamometry of the right hand (kg), left hand (kg), leaning forward (sm) (table 6, figure 7).

Table 4. Comparative characteristics of indicators of the level of development of physical abilities of girls of 5-6 years of experimental groups after the first year of the experiment (May 2017).

Control exercises		EG (n=10) (X±m)	CG (n=10) (X±m)	t	p
Speed abilities					
Running on 30 m (s)		7,9±0,4	8,9±0,3	2,0	<0,05
Coordination abilities					
Shuttle 3x10 (s)		10,1±0,2	11,8±0,2	2,0	<0,05
Speed-power abilities					
Long jump from standstill (sm)		96,1±1,8	79,6±4,6	2,1	<0,05
Raising the torso to sitting position (number of times in 30 s)		11,7±1,0	8,5±0,1	3,2	<0,05
Power					
Dynamometry (kg)	Right hand	8,1±0,4	6,8±0,5	2,5	<0,05
	Left hand	7,1±0,4	5,9±0,6	2,0	<0,05
Flexibility					
Bend forward (sm)		4,2±1,6	2,3±0,2	2,1	<0,05

Table 5. Comparative characteristics of indicators of the level of development of physical abilities of boys of 5-6 years of experimental groups after the first year of the experiment (May 2017).

Control exercises		EG (n=10) (X±m)	CG (n=10) (X±m)	t	p
Speed abilities					
Running on 30 m (s)		7,8±0,2	9,4±0,3	2,6	<0,05
Coordination abilities					
Shuttle 3x10 (s)		10,0±0,1	12,0±0,2	2,2	<0,05
Speed-power abilities					
Long jump from standstill (sm)		97,5±1,7	79,9±4,1	2,0	<0,05
Raising the torso to sitting position (number of times in 30 s)		12,9±0,1	8,5±0,3	2,1	<0,05
Power					
Dynamometry (kg)	Right hand	8,5±0,6	7,2±0,3	2,0	<0,05
	Left hand	8,6±0,4	6,1±0,2	2,5	<0,05
Flexibility					
Bend forward (sm)		3,4±0,9	0,3±0,1	3,1	<0,05

Table 6. The increase in physical abilities of children 5-6 years of experimental groups after the first and second years of the experiment (in %).

	After the first year of the experiment (May 2017)				After the second year of the experiment (May 2017)			
Control exercises	EG (boys) (n=10)	CG (boys) (n=10)	EG (girls) (n=10)	CG (girls) (n=10)	EG (boys) (n=10)	CG (boys) (n=10)	EG (girls) (n=10)	CG (girls) (n=10)
Running on 30 m (s)	19,6	9,1	19,4	8,6	31,7	16,9	29,9	16,2
Shuttle 3x10 (s)	23,0	14,0	11,4	8,1	28,0	22,2	25,0	16,9
Long jump from standstill (sm)	34,5	18,2	33,7	16,3	52,4	42,6	49,2	39,6
Raising the torso to sitting position (number of times in 30 s)	46,9	14,8	39,7	13,8	55,2	26,6	53,0	24,6
Dynamo-metry (kg): right	22,2	8,7	21,9	6,0	45,5	34,0	44,3	32,9
left	37,2	5,0	18,5	3,4	55,2	35,9	50,6	29,9
Bend forward (sm)	20,0	9,0	44,7	24,4	39,0	26,8	46,0	32,0

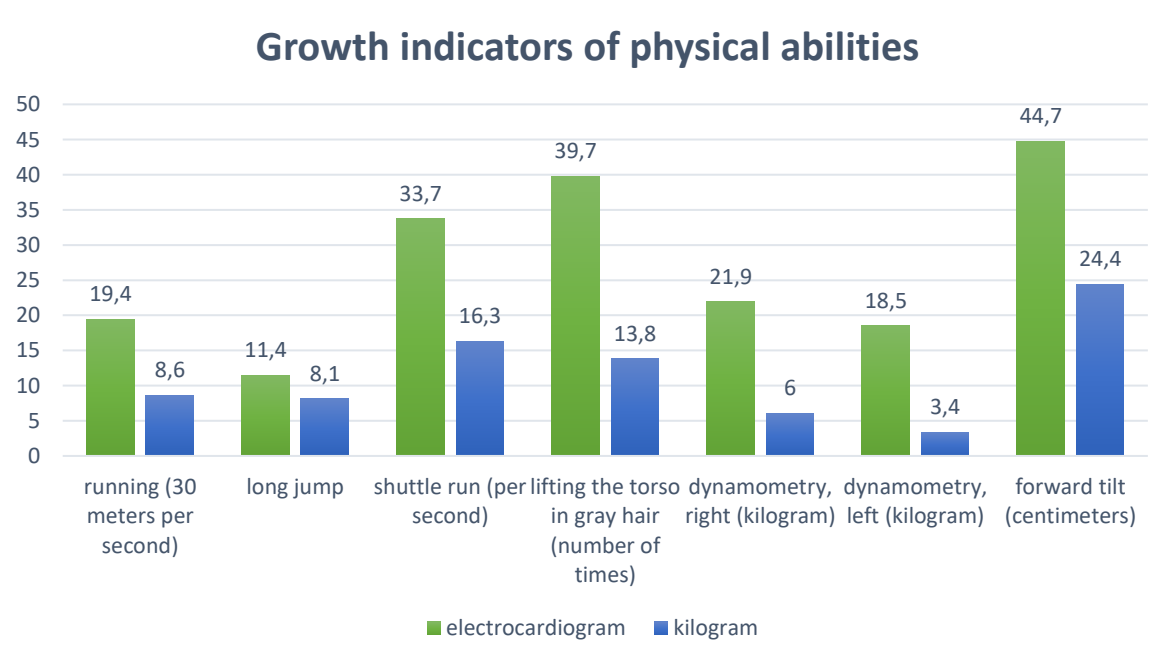

Figure 6. Growth in the indicators of physical abilities of girls' experimental groups after the first year of the experiment, in% (May 2017).

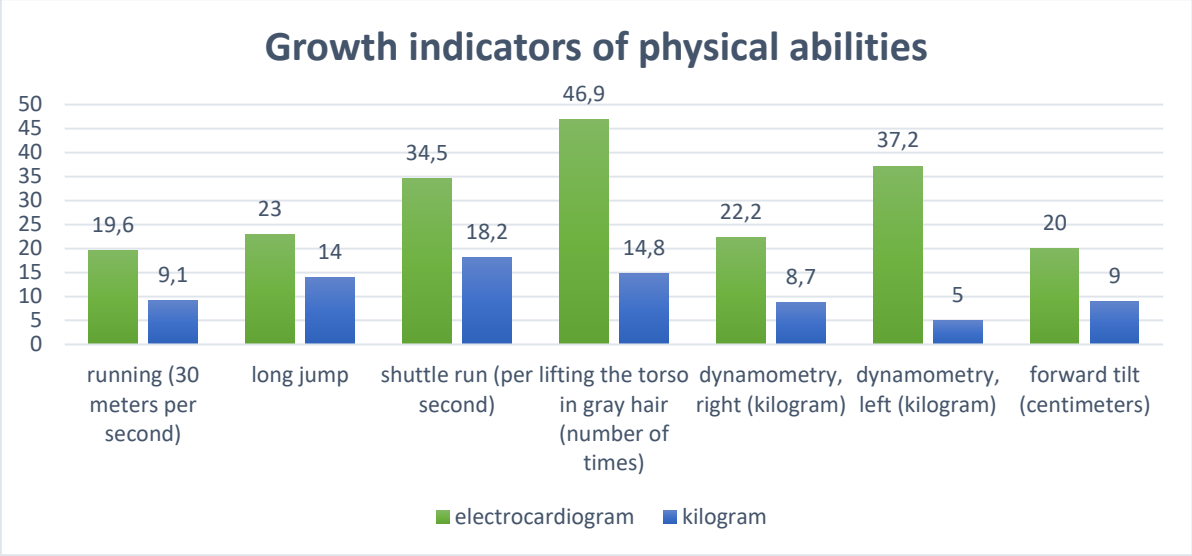

Figure 7. Growth indicators of physical abilities of boys' experimental groups after the first year of the experiment, in% (May 2017).

By the end of the second year of the experimental work, significant differences in all the studied indicators of the physical abilities of children in the control and experimental groups became more pronounced (tables 7, 8). The increase in physical abilities after the second year of the study turned out to be the most significant in the experimental group, in terms of speed, coordination, speed-strength, strength abilities and flexibility in both boys and girls (table 6, Figures 8-9).

Table 7. Comparative characteristic of girls aged 6-7 physical abilities developmental level indication at experimental groups at the end of the second year of the experiment (May 2018).

Control exercises		EG (n=10)	CG (n=10)	t	p
Speed abilities					
Running on 30 m (s)		7,1±0,3	8,0±0,6	2,5	<0,05
Coordination abilities					
Shuttle 3x10 (s)		9,8±0,1	10,8±0,3	2,3	<0,05
Speed-power abilities					
Long jump from standstill(sm)		113,0±3,5	101,0±4,0	2,4	<0,05
Raising the torso to sitting position (number of times in 30 s)		13,6±1,3	10,5±0,1	2,5	<0,05
Power					
Dynamometry (kg)	Right hand	10,2±0,2	9,5±0,9	2,2	<0,05
	Left hand	9,9±0,3	9,1±0,1	2,3	<0,05
Flexibility					
Bend forward (sm)		7,5±0,7	4,6±1,6	2,1	<0,05

Table 8. Comparative characteristic of boys aged 6-7 physical abilities developmental level indication at experimental groups at the end of the second year of the experiment (May 2018).

Control exercises		EG (n=10) (X±m)	CG (n=10) (X±m)	t	p
Speed abilities					
Running on 30 m (s)		6,9±0,4	8,1±0,4	2,6	<0,05
Coordination abilities					
Shuttle 3x10 (s)		9,5±0,2	10,0±0,3	2,1	<0,05
Speed-power abilities					
Long jump from standstill (sm)		117,6±5,8	105,7±5,1	2,5	<0,05
Raising the torso to sitting position (number of times in 30 s)		14,1±1,8	9,1±1,0	2,3	<0,05
Power					
Dynamometry (kg)	Right hand	10,8±0,8	7,6±1,0	2,3	<0,05
	Left hand	10,4±0,6	6,8±0,9	2,6	<0,05
Flexibility					
Bend forward (sm)		6,2±1,1	4,6±1,7	2,2	<0,05

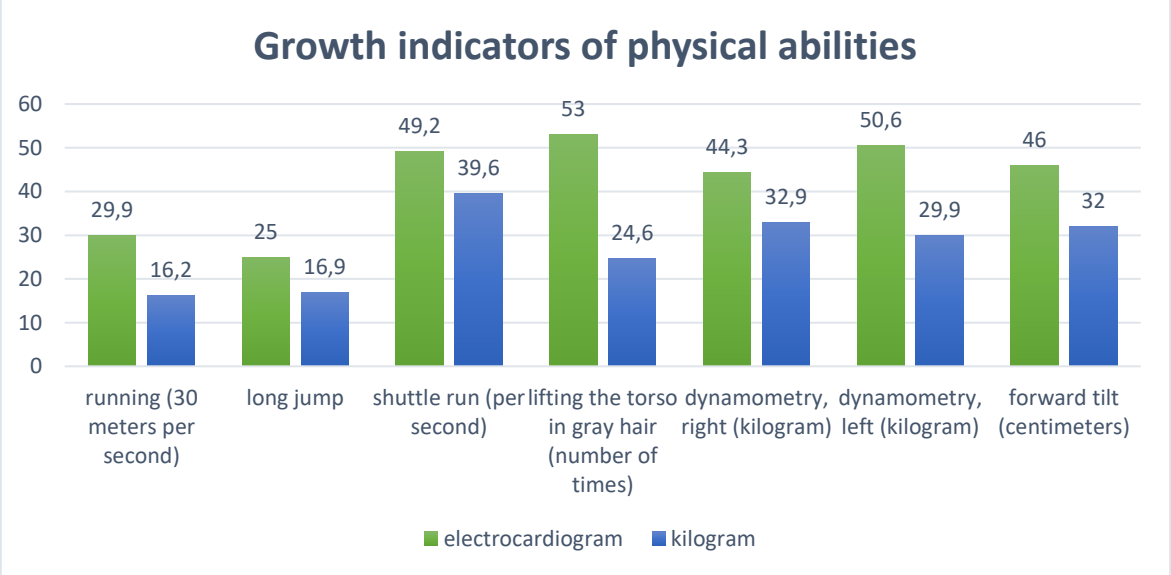

Figure 8. Growth indicators of physical abilities of girls' experimental groups after the second year of the experiment, in% (May 2018).

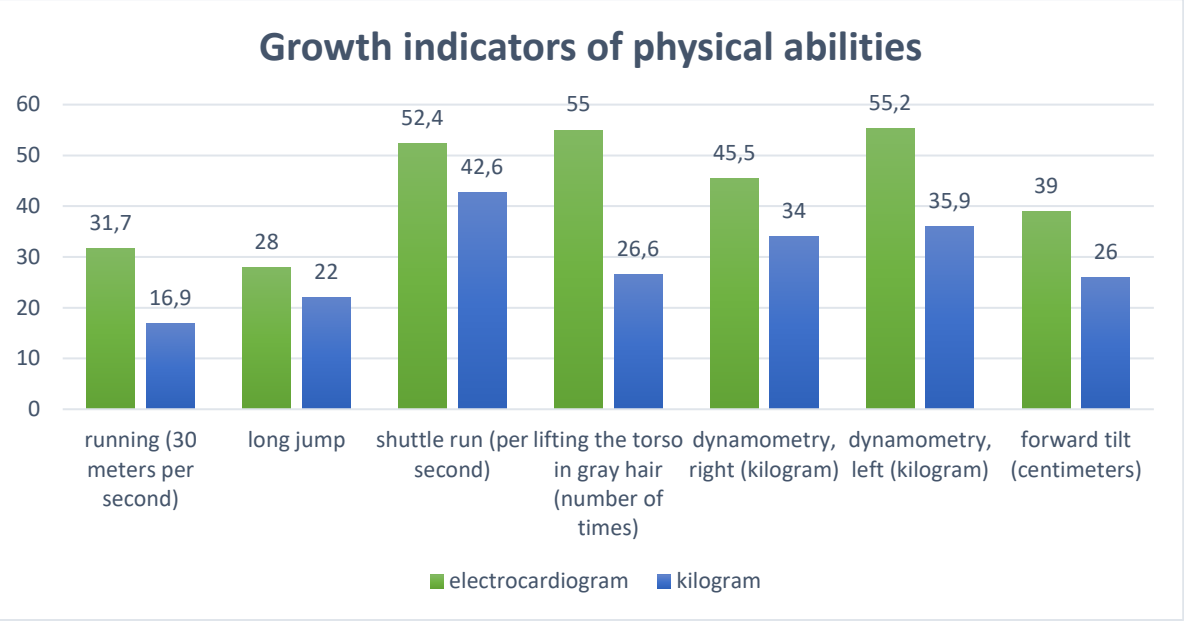

Figure 9. Growth indicators of physical abilities of boys' experimental groups after the second year of the experiment, in% (May 2018).

The pulsometry data showed that when conducting classes according to the experimental methodology, the load at all stages of the lesson corresponded to the children's abilities and the recommendations of the research institutes of the Russian Academy of Education. An analysis of the dynamics of heart rate (HR) in the classes in the experimental and control groups showed (figure 10) that physical activity in the experimental group has a more pronounced training effect on the children's body compared to the load in the classes in the control group. The motor density (30 lessons) in PE lessons in the experimental group ranged from 60-65 to 75-86% depending on the tasks and type of activity, while in the control group (30 lessons) it was lower and amounted to 50-65%. Thus, the data of pulsometry and timing to a certain extent confirm the effectiveness of physical culture classes using fitball-aerobics.

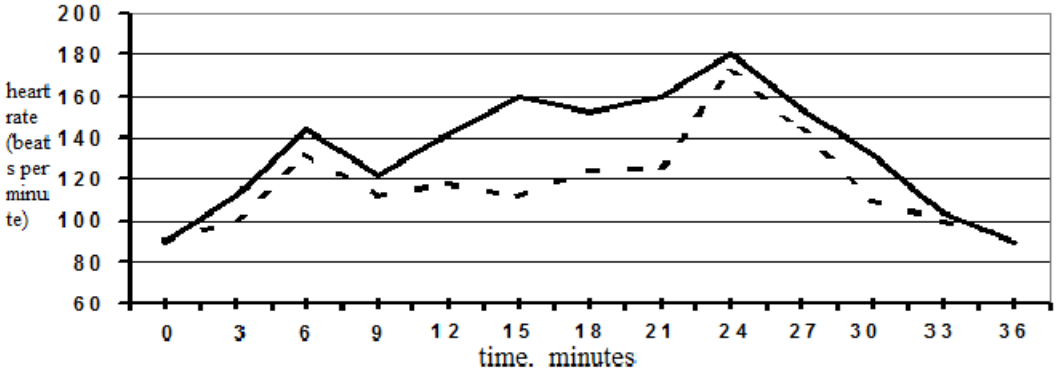

Figure 10. Dynamics of heart rate in the process physical education classes in the experimental and control groups.

Control group: – – – – – Experimental group: ————

Discussion and conclusions

The results of the study confirmed the hypothesis put forward by us. Fitball-aerobics is one of the innovative means of physical education for preschool children, which is confirmed by foreign scientific research (Pappas et al., 2013)

Fitball-aerobics has four historical stages of development:

I: Use of fitballs for medicinal purposes

II: Fit-ball gymnastics development

III: Appearance fitball- aerobics

IV: Further development of fit-ball-aerobics

It has specific features, a wide variety of means and has the ability to use them with the aim of treating the musculoskeletal system (Singh et al., 2006), the disease of vegetative-vascular dystonia of mixed type (Olchovik, 2015), respiratory, cardiovascular and nervous systems of the body in-volved.

Fitball aerobics helps to solve the following problems:

- Motor qualities development (speed, endurance, flexibility, strength, dexterity);
- Training in basic motor actions;
- Development and improvement of coordination of movements and balance;
- Strengthening the muscle corset, creating the skill of correct posture and the development of the optimal motor stereotype;
- Improving the functioning of the cardiovascular and respiratory systems;
- Normalization of the nervous system work, stimulation of neuropsychic development;
- Improving blood supply to the spine, joints and internal organs, eliminating venous stasis;
- Improving the communicative and emotional-volitional sphere;
- Stimulation of the analyzer systems development, proprioceptive sensitivity;
- Development of fine motor skills and speech; body adaptation to physical activity.

As a result of theoretical studies, it was determined that the complexity of the effects of fitball-aerobics exercises occurs due to the following factors:

- Properties of fitball (large size, round shape, bright colors, elasticity, vanilla-candy smell);
- Multifunctionality of its use (ball as: support, weight, object, simulator, landmark, obstacle, massager);
- Purposefully selected means;
- Musical accompaniment.

The performed analysis of scientific and methodological literature showed that the main means of fitball-aerobics used in the process preschool children's physical education are:

- Gymnastic exercises: drill exercises, varieties of walking, running, jumping, general developmental exercises;
- Basic aerobics exercises, connected in blocks and combinations;
- Dance exercises: elements of rhythm, choreography and modern dances;
- Preventive corrective exercises: exercises aimed at the prevention of vegetative-vascular dystonia of mixed type (Olchovik, 2015), of flat feet, posture disorders and other diseases (Singh et al., 2006);
- Active and musical games and relay races;
- Exercises from other types of physical culture (elements of athletic gymnastics, applied gymnastics, basketball, yoga, etc.).

During the study, the concept of "physical abilities" was clarified by which we mean individual qualities that determine the level of a person's motor capabilities that are associated with the success of any activity. The basis of a person's motor abilities are physical qualities, and the manifestation form is motor skills. Motive abilities include power, speed, speed-power, motor-coordination abilities, general and specific endurance (Tsaklis et al., 2015).

A methodology has been developed and tested for the complex effect of fitball-aerobics exercises on the physical abilities older preschool children development, including appropriate methods (playing, competitive); means: gymnastic exercises (drill exercises, varieties of walking, running, jumping, general developmental exercises); basic aerobics exercises (connected in blocks and combinations); abdominal muscle activity while performing trunk-flexion exercises using the fitball (Hildenbrand & Noble, 2004); dance exercises (elements of rhythm, choreography and modern dances); preventive corrective exercises (exercises aimed at the prevention of flat feet, posture disorders and other diseases); active and music games and relay races; exercises from other types of physical education (elements of athletic gymnastics, applied gymnastics, basketball, yoga, etc.).

Physical education based on the use of fitball-aerobics elements have a positive impact on the development of physical abilities of preschool children aged 5-7, motivates to engage in physical culture and sports (Stepanov, 2019). At the end of the pedagogical experiment, the children of the experimental group showed significantly higher results than peers from the control group ($p < 0.05$) in the tests: 30 m run, Shuttle run 3 × 10 m, Long jump from standstill, Bending the torso to sitting position, Dynamometry (kg), Bend forward (sm).

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Note: *some references were translated by the authors from Russian to English. For additional information, please contact them*.

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