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## *Development of Coordination Abilities with the Help of the Burpee Exercise*

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### ABSTRACT

This paper aims to determine the influence of the «Burpee» exercise on the indicators of endurance and coordination abilities in children aged 15-16. The pedagogical experiment was carried out based on a comprehensive school, in the city of Kirov, Russia. The study involved children 15-16 years old in the amount of 52 people. During the study period, 30 physical education lessons were held in each class. Children from the control group were engaged in the usual program, and children from the experimental group additionally performed the «Burpee» exercise. Endurance in children was determined by the test «2000 m», and the coordination abilities were determined by the test «Shuttle run 3x10m». After the pedagogical experiment, the indicators in the control group in the «2000 m» test improved by 1.9% ( $p>0.05$ ), and in the «Shuttle run 3x10m» by 3.5% ( $p>0.05$ ). In the experimental group, the performance improved significantly in the «2000 m» test by 9% ( $p<0.05$ ) and in the «Shuttle run 3x10m» by 12.4% ( $p<0.05$ ). If 15-16-year-old schoolchildren perform the «Burpee» exercise in physical education classes, then the indicators of endurance and coordination abilities will improve significantly. In this case, physical activity should be individual.

**Key words:** Coordination abilities, Schoolchildren, Endurance, Individual approach

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### INTRODUCTION

A person constantly upgrades various processes in order to reach the desired goal in a short and high-quality way. Physical culture and sports are no exception. Athletes and coaches are always in search of exercises from which the body gets its useful maximum. One of the modern and popular physical exercises all over the world is «Burpee». The author of the exercise is an American physiologist from New York, Royal Nadleston Burpee, who invented it in the early 1930s. Today, the «Burpee» exercise is so popular that online challenges are being held on the Internet in which participants compete for the maximum number of repetitions. «Burpee» is a functional exercise that accelerates the work of the heartbeat and at the same time a fairly large group of muscles is involved in it: shoulders, biceps, pectoral muscles, abdominals, back muscles, gluteal muscles, quadriceps thighs. The indisputable advantage of the «Burpee» exercise is the ability to perform it anywhere without the presence of special sports equipment and a trainer. Athletes who practice CrossFit have long appreciated the benefits and high efficiency of «Burpee», while the exercise has a lot of modifications. It can be performed both in light conditions and in complicated ones [1, 2].

The «Burpee» exercise can be effective for the safe development of the muscles of adolescents, as they work with their own weight. Strength training with barbells and dumbbells in adolescence is not recommended because it can harm a person's growth and development. However, for the correct and intensive performance of the «Burpee» exercise, a large amount of effort and a good level of physical fitness is required. At the proper level, most physical

qualities should be developed. Taking into account the sensitive periods of development of such physical qualities as strength, speed-strength abilities, and endurance, the age of 15-16 years was determined for the study, this is the 9th grade in a regular school. At this age, there is a rather intensive development of the muscle mass of schoolchildren, a favorable development of most physical qualities, especially endurance [3, 4].

If at primary school age a differentiated approach and coordination training prevail, then at senior school age an individual approach is more often used. Even though the «Burpee» exercise is quite popular all over the world, we were unable to find scientific studies that show effective components of physical activity for schoolchildren. In all likelihood, such an activity will be more effective individually for each student [5, 6].

The basis of physical culture at school is the comprehensive harmonious, physical development of each student. It was important for us to know how the modern exercise «Burpee» affects the coordination abilities indicators of schoolchildren.

**Purpose** – To determine the influence of the «Burpee» exercise on the indicators of endurance and coordination abilities in children aged 15-16.

**Research hypothesis:** it is assumed that if schoolchildren 15-16 years old use the physical exercise «Burpee» at every physical education lesson at school, then not only endurance indicators will improve, but also coordination abilities indicators.

## MATERIALS AND METHODS

### *Participants*

Schoolchildren 15-16 years old, who studied at a regular Russian school in the city of Kirov, took part in the pedagogical experiment. In total, 52 schoolchildren took part in the study, these are boys and girls who studied in grades 9a and 9b. This served as the distribution of schoolchildren into the control group (CG) and the experimental group (EG). Regardless of gender and level of physical fitness, only those schoolchildren who were admitted to physical education lessons by a doctor without any restrictions for health reasons took part in the study. In total, 32 students studied in grade 9a (CG), but 25 people (13 boys and 12 girls) were admitted to the study and were completely healthy. There were 33 students in the 9b grade (EG), but 27 students (13 boys and 14 girls) took part in the study.

### *Procedure*

The pedagogical experiment was conducted from September 1 to December 30, 2021, at a comprehensive school in the city of Kirov, Russia. All physical education lessons at the school were held 2 times a week for 45 minutes each lesson. During the period of the pedagogical experiment, 30 physical education lessons were held in each class; for 4 months, schoolchildren went to a physical education lesson at the same time. Children from grade 9a had their second lesson on Tuesday and the first lesson on Thursday. Children from grade 9b studied the first lesson on Tuesday and the second lesson on Thursday.

Schoolchildren from the CG (9a) were engaged in the usual physical education program at the school for students in grades 1-11 (7).

Schoolchildren from the EG (9b) studied according to the same program, but additionally performed the «Burpee» exercise at each lesson.

### *Execution technique*

If we decompose the whole exercise in stages, then it consists of simpler exercises: squats, planks, push-ups, and jumping out. The technique of the traditional exercise «Burpee»:

1. Starting position - stand up straight, feet shoulder-width apart.
2. Bend your knees and, in a squat position, rest your hands on the floor. Shift body weight onto hands.
3. Jump out with your feet back so that you are in a plank position with straight arms.
4. Do one push-up (flexion and extension of the arms in a lying position) and return to the plank position.
5. Jump to pull your legs to your hands and be in a squat position.
6. Jump up, raise your arms and clap above your head.

It is important to focus on the correct technique for performing the exercise, and not on the number of repetitions. However, to achieve the effect, it is necessary to maintain a sufficiently high intensity of the exercise.

### *Contraindications*

With extreme caution, the «Burpee» exercise should be performed in some cases:

- joint problems, especially with the knee and hip;
- chronic heart disease or high blood pressure;
- excessive overweight (more than 30% of the normal weight);

It is important to ensure that when performing the «Burpee» exercise, conditions such as dizziness, nausea, and chest pain do not appear. In such cases, the exercise should be stopped.

#### *Exercise stress*

The components of physical activity were individual since each student had his own level of physical fitness. The exercise was performed for time, without counting the repetitions of each student and the teacher's mental count. Over a period of time, students performed varying amounts of repetitions (approximately 15 to 25 repetitions per minute).

Depending on the objectives of the lesson, the exercise was performed either after the warm-up or at the end of the main part of the lesson. At the same time, of course, we were guided by the principle of gradualism. The physical activity components of the «Burpee» exercise are presented in **Table 1**.

**Table 1.** Components of physical activity exercise «Burpee» for children 15-16 years old

Number of series	Activity	September	October	November	December
1st series	Burpee	60 sec	90 sec	120 sec	120 sec
	Rest	60 sec	60 sec	90 sec	60 sec
2nd series	Burpee	60 sec	90 sec	120 sec	120 sec
	Rest	90 sec	90 sec	120 sec	90 sec
3rd series	Burpee	60 sec	90 sec	90 sec	120 sec
	Rest	120 sec	120 sec	120 sec	120 sec
Total time		7 min 30 sec	9 min	11 min	10 min 30 sec

It should be noted that the activity was selected according to the well-being of the majority of children in the class. So, for example, the exercise «Burpee» performed less than 60 seconds will be ineffective, however, if it is performed in the first month for more than 60 seconds, then most of the students will stop. Gradually, the activity increased, and the rest time decreased. More than three series with sufficiently high intensity, most of the students physically could not endure. At the same time, the «Burpee» exercise needed not interfere with the implementation of the main physical education curriculum at school.

Before and after the start of the study, all children took two control tests:

1. General endurance was determined according to the test «Running 2000 m» (7).

#### *Procedure*

Running 2 km on the treadmill of the athletics arena. The test was performed from a high start position. At the command «Start!» students take their places in front of the start line. After the command «March!» they start running. The result is recorded by the chronometer in minutes and seconds with an accuracy of 1 second.

2. Coordination abilities were determined according to the test «Shuttle run 3x10m» (7).

#### *Procedure*

At the command «March!» the children run to the finish line, cross it, touch it with any part of the body, return to the start line, cross it with any part of the body, and overcome the last segment finishing. The result is fixed up to 0,1 sec.

#### *Mathematical and statistical processing of results*

The indicators of all participants were recorded in a Microsoft Excel spreadsheet, and the mean value and standard deviation were determined. The change in the indicators of schoolchildren from the beginning to the end of the study was determined as a percentage, and the significance of the values was determined by Student's T-test ( $p > 0.05$ ).

## RESULTS AND DISCUSSION

Before the start of the pedagogical experiment and after its completion, all students took control tests. The results are presented in **Table 2**.

**Table 2.** The results of control tests in children aged 15-16

Test	Control group (n=25)				The experimental group (n=27)			
	Before	After	%	p	Before	After	%	p
Run 2000 m (min sec)	9.95±1.16	9.76±1.04	1.9	p>0.05	10.19±1.21	9.27±0.67	9	p<0.05
Shuttle run 3x10m (sec)	8.6±0.2	8.3±0.3	3.5	p>0.05	8.9±0.4	7.8±0.3	12.4	p<0.05

**Table 2** shows that the performance in both tests, both in grade 9a and grade 9b, improved, but the improvements were different.

In children from the CG, the indicators in the «Run 2000 m» test improved by 1.9% ( $p>0.05$ ), and the indicators in the «Shuttle run 3x10m» became higher by 3.5% ( $p>0.05$ ) than before the start of the study. Such results may indicate a fairly good impact of a regular physical education curriculum on the physical qualities and mental processes of children aged 15-16. It should also be noted the natural increase and a favorable period for the growth and development of the studied indicators.

For schoolchildren in the EG, the indicators in the «Run 2000 m» test improved by 9% ( $p<0.05$ ), and the indicators in the «Shuttle run 3x10m» became higher by 12.4% ( $p<0.05$ ) than before the start of the study. Such results indicate the unconditional effectiveness of the use of the «Burpee» exercise in physical education classes at school and its impact on the physical qualities and mental processes of 15-16-year-old schoolchildren.

Every teacher and coach should be looking for the best use of time for the development of the physical qualities of their students. The popular and uncomplicated physical exercise «Burpee» can be called unique, since it does not require special and expensive equipment, does not require a lot of space for its implementation, and at the same time, it affects a large number of muscles [1, 2]. Exercise «Burpee» requires a fairly good level of physical fitness, while the exercise itself can be in different variations. First of all, exercise develops endurance, so the most suitable age is 15-16 years. We should not forget about the natural increase in indicators at this age, this was proved by children from grade 9a, who were engaged in the usual physical education program at school [7]. Data on the sensitive period of endurance development at 15-16 years are confirmed by some other studies [3, 4].

Despite some research in the field of CrossFit, we have not found studies that focus on the popular Burpee exercise [8, 9]. Although some studies address the topic of CrossFit, there are no specific recommendations on the components of physical activity for people of different ages. Of course, such an activity should be individual, especially at senior school age [5, 6]. In our study, the approximate physical activity's for the «Burpee» exercise for children aged 15-16 were noted in physical education lessons at school. In our opinion, using less time will not be effective. If more time is used on the Burpee, then the children will be physically and psychologically tired and lose interest in the exercise, and there will not be enough time to implement the main physical education curriculum in the school [7]. It should also be noted that the relationship between physical qualities and mental abilities of people of different ages takes place [10-12].

Of course, the goal of physical education at school is to develop all the physical qualities of schoolchildren. The «Burpee» exercise is unique. In this study, we have proved that «Burpee» significantly develops at least 2 leading physical qualities in the sensitive period of development of schoolchildren. The study is promising, perhaps the «Burpee» exercise has a positive effect on other physical abilities, perhaps even on the mental processes of schoolchildren of different ages.

## CONCLUSION

If the physical exercise «Burpee» is used in every lesson in physical education at school, then the endurance indicators of children aged 15-16 will improve significantly. At the same time, indicators of coordination abilities will also improve significantly. Physical activity for the implementation of «Burpee» should be individual, depending on the level of physical fitness of the student. A new study presents an example of physical activity for students in the 9th grade of a regular school.

This study is relevant and promising for study. In the future, it is possible to determine how «Burpee» affects other physical qualities or mental processes, the search for new, optimal options for physical activity for schoolchildren of different ages.

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**ETHICS STATEMENT :** All procedures met the ethical standards of the 1964 Declaration of Helsinki. Informed consent was obtained from all parents of the children included in the study.

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