

# Improving the functional capabilities of schoolchildren aged 7–11 with respiratory diseases

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PhD, Associate Professor **A.B. Sablin**<sup>1,2</sup>PhD **R.R. Aleskerov**<sup>1</sup>**E.A. Ulyanova**<sup>2</sup>**A.I. Latak**<sup>2</sup><sup>1</sup>Moscow Technical University of Communications and Informatics, Moscow<sup>2</sup>Moscow City University, Moscow

Corresponding author: a.b.sablin@mtuci.ru

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## Abstract

**Objective of the study** is to improve respiratory function in primary school-aged children with respiratory conditions through physical exercise.

**Methods and structure of the study.** The educational experiment was conducted from 13 January to 16 April 2025 in a specialised therapeutic physical education hall. Children from the experimental group attended the Moscow Centre for Kinesiotherapy three times a week and performed special sets of physical exercises for the respiratory system for 60 minutes. The pupils' overall endurance was assessed using a 6-minute run test; oxygen saturation was measured using the Stange and Genchi tests; and spirometry was used to determine lung capacity.

**Results and conclusions.** To assess the effectiveness of the experimental method with schoolchildren aged 7–11 years, functional tests and assessment tasks were used, which were conducted before and after the experiment (assessment of overall endurance, oxygen saturation and vital lung capacity). Before the start of the study, the groups were homogeneous, and the indicators showed no statistically significant differences ( $p > 0.05$ ). As a result of the study, the indicators in the control group increased, but not significantly ( $p > 0.05$ ), whilst in the experimental group, performance in the 6-minute run test improved by 11.4%, in the inspiratory and expiratory breath-holding tests the figures increased by 13.8% and 16.8% respectively, and spirometry data rose by 19.2% ( $p < 0.05$ ).

As a result of the method applied, the results in the experimental group were more than twice as high as those of the children in the control group. Thus, this method has proven its effectiveness. If schoolchildren aged 7–11 with respiratory conditions perform breathing exercises systematically, their functional capacity will improve significantly.

**Keywords:** *respiratory diseases, physical activity, younger schoolchildren, children, health.*

**Introduction.** Respiratory diseases are a widespread problem in modern medicine. They have a significant and negative impact on people's quality of life. Infections of the respiratory system carry a serious prognosis, particularly among primary school-aged children. Over recent decades, scientific research has demonstrated that the presence of a stable population of respiratory bacteria in the respiratory tract at an early age is associated with an increased risk to overall health and predicts the frequency of subsequent respiratory infections and the severity of their course in older children [6, 8].

The main causes of respiratory diseases include pathogenic organisms, environmental allergens and unhealthy habits. There are many known dis-

eases of the pulmonary system, such as acute and chronic bronchitis, pneumonia, lung abscess, lung gangrene, bronchiectasis, chronic obstructive pulmonary disease, bronchial asthma, pulmonary emphysema, lung cancer, tuberculosis, pleurisy and pulmonary haemorrhage. Diseases of the respiratory system lead to general weakness, reduced performance, fatigue, increased sweating, prolonged fever, weight loss, enlarged lymph nodes, apathy and low mood [6, 8].

It has been proven that in cases of respiratory diseases, general strengthening and specific breathing exercises should be performed, which improve the functioning of all organs and systems and stimulate the respiratory system, whilst high- and moderate-

intensity physical exercises also stimulate the respiratory system [6, 8].

When performing specific physical exercises, the respiratory muscles are strengthened and the mobility of the diaphragm and chest increases, which helps to reduce congestion in the lungs. Exercises should be selected in such a way that they correspond to clinical data. To improve ventilation in various parts of the lungs, special breathing exercises are performed: for the upper lobes, deep breathing is used with the hands resting on the waist; for the posterior lobes, enhanced diaphragmatic breathing is used. Exercises involving raising the head, spreading the arms out to the sides and upwards, and bending the torso backwards in combination with diaphragmatic breathing help to increase ventilation in the lower lobes. Special breathing exercises increase oxygen consumption and lung ventilation [3–5].

Most techniques for improving breathing are aimed at treating neurotic and other conditions, such as high blood pressure, relieving bronchial spasms and certain other ailments. It is assumed that these methods do not fully enhance the functional capabilities of the child's body, but are primarily aimed at eliminating pathologies. Based on the above, a contradiction is identified between the frequently increasing number of respiratory diseases in children and the shortcomings of modern treatment methods.

**Objective of the study** is to improve respiratory function in primary school-aged children with respiratory conditions through physical exercise.

**Methods and structure of the study.** A total of 36 boys and girls aged 7–11 took part in the study. The pupils attended mainstream schools in Moscow. The children participating in the educational experiment had been cleared to take part in physical education lessons by a doctor. All participants were diagnosed with a respiratory condition. The pupils' parents signed an informed consent form for their child's participation in the educational study.

The educational experiment was conducted from 13 January to 16 April 2025 at the Moscow Centre for

Kinesiotherapy in a specialised therapeutic physical education hall. All study participants were divided into a control group (CG) and an experimental group (EG) in such a way that, at the start of the study, there were no significant differences between the groups in any of the indicators under investigation.

Children assigned to the control group passed the standardised tests and did not perform any additional special physical exercises. Children assigned to the experimental group additionally attended the kinesiotherapy centre after school and performed special exercises for the respiratory system for 60 minutes. Sessions were held three times a week (Monday, Wednesday, Friday from 14:00 to 15:00).

Examples of exercises without equipment (6–8 repetitions):

Starting position (SP). Feet shoulder-width apart, arms hanging down.

1. Spread your arms out to the sides (palms facing up), stretch and take a deep breath, then exhale.
2. Spread your arms out to the sides and breathe in through your nose, then breathe out through your mouth – arms hanging down.
3. Lean to the right; as you breathe out, let your arms slide down your sides, then as you breathe in, return to the starting position, then repeat on the left side.
4. As you exhale, lean forwards, spread your arms out to the sides, then inhale and take a deep breath.
5. Take a maximum breath in through your nose, then exhale in short bursts through your mouth.
6. Inhale through your nose, hold your breath for 8 seconds, then exhale slowly through your mouth.
7. Exhale as fully as possible, then inhale as deeply as possible and hold your breath for 5 seconds.
8. As you inhale, push your stomach out; as you exhale, pull your stomach in.
9. Starting position + sitting on a chair. Turn your torso to the left + inhale, return to the starting position and exhale. Then repeat on the other side.
10. Starting position + lying on your back. Slowly raise your legs to a vertical position. Rest your elbows

Table 1. Comparison of indicators prior to the start of the educational study

Tests	EG (n=24)	CG (n=24)	t; p
6-minute run (m)	716,26±22,35	721,1±22,13	t=0,19; p>0,05
Stange (s)	27,7±0,42	26,31±0,77	t=0,41; p>0,05
Genchi (s)	11,81±0,85	10,73±0,92	t=0,22; p>0,05
Spirometry (ml)	1177,14±31,12	1209,5±30,01	t=1,24; p>0,05

and palms on the floor, supporting your back. Keep the back of your head and neck pressed against the floor.

Examples of exercises with equipment (6–8 repetitions):

1. As you inhale, stand up; as you exhale, squat down – lower yourself onto your knees, keeping the ball in your hands.

2. Starting position + a gymnastic stick on your shoulder blades. Arch your back (pull your shoulders back) and inhale. Lean forwards – exhale.

3. Starting position + ball on the floor. Inhale – raise your arms, exhale – bend forward and pick up the ball. Inhale – stand up straight with your arms raised, exhale and place the ball back on the floor.

4. Starting position + stick on the floor. Inhale – rise up (left foot back, on the ball of the foot), exhale – starting position, then with the right foot.

5. Starting position + stick on the floor. Inhale – lunge forward with the right foot, rise up. Exhale – starting position, then with the left foot.

6. Starting position + stick on the floor. Inhale – raise arms, exhale – pull knee towards stomach using the stick. Exhale – starting position, then repeat exercise with the other knee.

7. Starting position + stick and ball on the floor. Inhale – hold your breath for 6–8 seconds, then exhale slowly and hold your breath again for 6–8 seconds.

8. Starting position + sitting, ball on your knees. Inhale – lift the ball upwards. Exhale – lean forwards.

9. Starting position + sitting, ball held above your head. Inhale – lean to the right. Exhale – return to the starting position, then lean to the left.

10. Starting position + lying on your back, bend your leg at the knee, grasp it with a stick and press it against your chest for 12–15 seconds, then lower your leg. After that, perform the exercise with the other leg.

All schoolchildren who were cleared by a doctor before the start of the educational experiment passed the control standards and functional tests.

1. Measurement of general endurance (6-minute Cooper test). The result is the distance the pupils run in 6 minutes.

2. Measurement of oxygen saturation:

a. On inhalation (Stange test). Breathing is held on the inhale. The duration of breath-holding is calculated using a stopwatch. The test must be performed whilst seated. Result: the arithmetic mean of 3 attempts.

b. On the exhale (Genchi test). The requirements and assessment of the result are the same as in the Stange test.

3. Measurement of vital lung capacity (spirometry). Take a deep breath and exhale as fully as possible, but gradually (over 5–7 seconds), through the mouth-piece of the spirometer. The test is performed three times at intervals of 50–60 seconds. The result is the highest value of the three attempts.

Results of the study and discussion. To assess the effectiveness of the experimental methodology with schoolchildren aged 7–11, functional tests and assessment tasks were administered before and after the experiment. Prior to the start of the study, there were no statistically significant differences in the baseline indicators between the groups, indicating that the sample was homogeneous (Table 1).

Final tests and functional assessments conducted at the conclusion of the educational experiment showed that the results of the children in the experimental group were significantly higher than those of the children in the control group ( $p > 0.05$ ) (Figure 1).

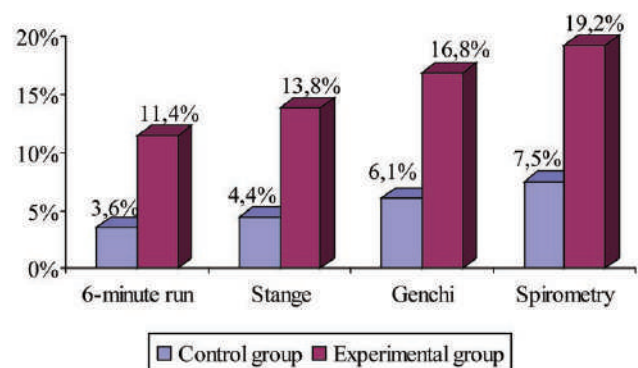


Figure 1. Changes in the indicators for both groups over the study period

The results presented in the figure show that the exercise programme, designed to improve the functional capacity of primary school-aged children with respiratory conditions, has proven to be effective.

A review of the scientific literature reveals a large number of studies devoted to human health and the normal processes of growth and development [1, 2, 7]. A review of the literature has also highlighted the importance of studying respiratory diseases [6, 8]. Particular attention should be paid to school-age children. Currently, there are several breathing techniques [1, 2], but these are designed to address various conditions (such as high blood pressure and neurotic dis-



orders). A detailed analysis of these methods showed that they have an insufficient effect on the functional capabilities of schoolchildren's bodies.

The use of a set of physical exercises aimed at improving respiratory function yielded the following results: in the 6-minute run test, the EG group improved by 11.4%; in the breath-holding test on inhalation and exhalation, the indicators increased by 13.8% and 16.8%, respectively; and in the spirometry test, the data increased by 19.2%. This is more than twice the figures for children in the CG group who did not undertake additional training. Thus, this method has demonstrated its effectiveness and can be used in educational and medical institutions to improve the functioning of the body's systems in primary school-aged children with respiratory diseases.

It is important to follow certain practical recommendations when working with children suffering from respiratory diseases. During sessions, the physical load on the body should be increased gradually by increasing the intensity of the exercises performed. If signs of overt fatigue appear, the intensity of the physical exercises should be reduced. Homework should be set for the independent performance of breathing exercises.

**Conclusions.** If schoolchildren aged 7–11 with respiratory conditions take part in therapeutic exercise on a regular basis and also perform breathing exercises for at least 60 minutes three times a week, their physical fitness will improve significantly.

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