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**TEENAGER'S RESPIRATORY SYSTEM VALUES DYNAMICS**

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**Abstract**

Features of the formation of the organism at different stages of ontogenesis under the influence of negative environmental factors. Material: Direct measurements and some number of values calculation were carried out using generally accepted methods: chest rise (CR, sm), pulmonary capacity ratio (PC), and also some functional tests: timed inspiratory capacity (Stange's test) and timed expiratory capacity (Genchi's test). 58 schoolchildren (30 girls, 28 boys), aged 15-17 took part in the research. External respiration values assessment was carried out by spirometry. When assessing external respiration, pulmonary capacity ratio (PC) was analyzed and functional tests of the respiratory system were carried out during timed inspiratory capacity (Stange's test) and timed expiratory capacity (Genchi's test), also chest rise (CR, sm) was measured. Results: The results of the respiratory system research generally indicate compliance with age norms. However, pulmonary capacity ratio (PC) values have honestly significant sex differences. The relatively large boys' pulmonary capacity ratio values are due to the physiological and metric parameters represented by the chest circumference and its rise (CR, sm). The data obtained expand the scientific image concerning the organism formation peculiarities at different ontogenesis stages under the influence



of negative environmental factors. Normal teenagers' physical development rates are accompanied by acceleration of growing respiratory organs' deviations and diseases (up to 8,9%).

### Keywords

Health – Respiratory system – Breath – Functional state

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## Introduction

At present, school education is becoming more computerized and inactive<sup>1</sup>. There is a decrease in the motivation of young people to engage in physical education<sup>2</sup>. An increase in the volume of educational, psycho-emotional stress, violation of the basics of a healthy lifestyle<sup>3</sup>, a passion for computer games and the Internet, hypokinesia<sup>4</sup> have a negative impact on the physical<sup>5</sup>, mental<sup>6</sup> and somatic<sup>7</sup> health of the student youth. Severe climatic conditions<sup>8</sup> and difficult environmental situation<sup>9</sup> have a negative impact on the health status of the population of the Ural region. Given the low health indicators of Russian schoolchildren, the negative impact of natural and environmental factors on humans, such works stimulate the scientific search for studying the morphofunctional features of the respiratory system of students studying to improve health-saving technologies in various types of educational institutions. Respiratory system is one of the leading and largely determining both growing organism's mental and physical performance<sup>10</sup>.

<sup>1</sup> N. V. Mukhanova y A. N. Savchuk, "Increase of motor activity of schoolchildren through a motivated need for physical training", *Vestnik TGPU* num 5 (2012):171-174 y S. S. Iermakov; P. I. Ivashchenko y V. V. Guzov, "Features of motivation of students to application of individual programs of physical self-preparation", *Physical Education of Students* num 4 (2012): 59–61

<sup>2</sup> M. V. Gavrilik, "Search for ways to improve the effectiveness of physical education of students", *Zdorov'e dlja vseh* num 2 (2016):21-24 (in Russian)

<sup>3</sup> D. Hortigüela-Alcalá; Á. Pérez-Pueyo y J. Moncada-Jiménez, "An analysis of the responsibility of physical education students depending on the teaching methodology received", *Journal of Physical Education and Sport* Vol: 15 num 2 (2015): 202-207 y N. Demirci y D. P. Toptaş, "The determination of physical activity, nutrition and self-sufficiency levels of sedanter individuals of fitness club member", *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports* Vol: 22 num 5 (2018): 237-245.

<sup>4</sup> B. Moy; I. Renshaw y K. Davids, "The impact of nonlinear pedagogy on physical education teacher education students' intrinsic motivation", *Physical Education and Sport Pedagogy* num 21(5) (2016): 517-538. DOI: <https://doi.org/10.1080/17408989.2015.1072506>

<sup>5</sup> B. Tolgfors y M. Ohman, "The implications of assessment for learning in physical education and health", *European Physical Education Review* Vol: 22 num 2 (2016):150-166

<sup>6</sup> C. B. Yang y M. K. Dong, "A Study of the correlation between teachers' teaching styles and students' participation motivation in the physical education", *Journal of Baltic Science Education* Vol: 16 num 2 (2017): 199-206

<sup>7</sup> A. S. Olafsdottir; J. E. Torfadottir y S. A. Arngrimsson, "Health Behavior and Metabolic Risk Factors Associated with Normal Weight Obesity in Adolescents", *PLoS ONE* Vol: 11 num 8 (2016):34-40 y T. F. Teixeira; R. D. Alves; A. P. Moreira y M. do C. Peluzio, "Main characteristics of metabolically obese normal weight and metabolically healthy obese phenotypes", *Nutr Rev* Vol: 73 num 3 (2015): 175–190

<sup>8</sup> V. G. Loginov; M. N. Ignatieva & V. V. Balashenko, "A methodological approach to assessing the comfort of living within the boundaries of the northern territories", *Regional economy* Vol: 14 num 4 (2018):1399-1410

<sup>9</sup> A. I. Semyachkov and I. A. Koch, "Ecological problems of mining regions", *Proceedings of the Ural State Mining University* num 23 (2008): 146-148.

<sup>10</sup> E. Zh. Bekmukhambetov; A. A. Mamyrbayev & T.A. Dzharkenov, "Medical and environmental aspects of transboundary cooperation in the Ural water basin", *Medical Journal of Western Kazakhstan* num 1 (33) (2012):3-5

<sup>10</sup> P. Y. Dugnist; V. A. Milhin; S. M. Golovin and E. V. Romanova, "Healthy way of life in youth's value orientations system", *Health, Physical Culture and Sports* Vol: 7 num 4 (2017): 3-25 y E. V. Romanova, "Modern interpretations of the health phenomenon: an analytical review", *Health, Physical Culture and Sports* Vol: 5 num 2 (2017):3-48.

Results of numerous studies are widely presented in scientific literature, they confirm teenagers' functional capabilities deterioration, the fact is manifested in life support systems functioning, (including respiratory), violation<sup>11</sup>.

We believe that the data obtained on the features of the manifestation and functional characteristics of the respiratory system of the body of schoolchildren will allow for the correction of the motor regime in educational institutions to increase their level of physical health.

The purpose of the work is to study the features of the functional characteristics of the respiratory system of the body of senior schoolchildren in the Ural region (Russia).

## Methods

58 schoolchildren (30 girls, 28 boys), aged 15-17 took part in the research in Chelyabinsk. When organizing the research, Helsinki Declaration<sup>12</sup> principles were observed, the schoolchildren's parents issued a voluntary consent to their children's participation in the research. We conducted anthropometric research<sup>13</sup>. The reliability of differences in the average values of the samples was assessed by parametric methods with the calculation of the Student t-test. The differences between the values of the indicators were considered statistically significant at  $p < 0,05$ <sup>14</sup>.

External respiration values assessment was carried out by spirometry. When assessing external respiration, pulmonary capacity ratio (PC) was analyzed and functional tests of the respiratory system were carried out during timed inspiratory capacity (Stange's test) and timed expiratory capacity (Genchi's test), also chest rise (CR, sm) was measured.

## Results

The children's families' social status is represented mainly by employees and about 10% are workers. Most of the children live in two-parent families. Housing and living conditions of 62% of the research participants are reported as good, 38% - satisfactory, 96% of families have a sufficient financial situation.

All this determines the families' normal social status, excluding presence of children with antisocial behavior in the research.

School-leavers' respiratory system values are presented in Table 1.

<sup>11</sup> O. A. Makunina y I. A. Jakubovskaya, "Structure and dynamics of schoolchildren's, aged 7-17 health state. On line scientific and educational bulletin", Health and educational millennium Vol: 17 num 2 (2015): 29-31

<sup>17</sup> I. A. Jakubovskaya; D. Z. Shibkova y O. A. Makunina, "Schoolchildren's anthropometric values in ten years of study dynamics (longitudinal study)", New research Vol: 1 num 50 (2017):73-77

<sup>12</sup> WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects.

<sup>13</sup> International Standards for Anthropometric Assessment. 2001.

<sup>14</sup> A. M. Grjibovski; L. O. Bygren; B. Svartbo, P. Magnus, "Social variations in fetal growth in Northwest Russia: an analysis of medical records", Annals of Epidemiology num 9 (2003):599-605

PH. D. IRINA A. JAKUBOVSKAYA / PH. D. OLGA A. MAKUNINA / DR. EUGENEY V. BYKOY / DR. VICTOR L. KRAYNIK

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Period	Values	Girls	Boys
School year (beginning)	PC (l)	3,3±0,09	3,5±0,1
	Stange's test (sec)	61,4±2,2	66,8±3,3
	Genchi's test (sec)	33,7±1,4	31,8±1,7
	CR (sm)	7,3±0,8	9,1±1,7
School year (finishing)	PC (l)	2,9±0,1***	4,0±0,1*** ●●●
	Stange's test, (sec)	60,4±2,5	70,2±2,3
	Genchi's test (sec)	35,1±1,9	33,2±1,7
	CR (sm)	8,7±0,9	11,6±1,6●●

Note: \* - the school year beginning and end values; ● – statistical significance between the boys' and girls' values. ●● -  $p < 0,01$ ; ●●●, \*\*\* -  $p < 0,001$ .

Table 1

School-leavers' respiratory system values within the school year dynamics ( $M \pm m$ )

There are no significant differences between schoolchildren aged 16 and 17, it allows combining the values into one group. Significant differences within the school year dynamics were revealed by the pulmonary capacity ratio (PC): for girls this value decreased by 12,1 %, and for boys - increased by 14,3%.

In mass examinations, samples with timed inspiratory capacity (Stange's test) and timed expiratory capacity (Genchi's test), are widely used. Since these tests results depend on respiratory and cardiovascular systems functional state, they are called cardiorespiratory ones. Female organism is more sensitive to the lack of oxygen than male one so, the functional breathing tests standards for girls are lower than for boys.

The respiratory apparatus development can be proved by the chest rise (CR) size, which is determined by the trunk intercostal muscles, involved in the act of breathing, state. It turned out that the girls' chest rise (CR) values increased by 1,4 cm (11,5%) over the year, and the boys' one – by 2,5 cm (26,7%).

Figure 1 presents the dynamics of the pulmonary capacity ratio (PC) school-leavers and its comparison with the literature data for different regions of the Russian Federation.

The girls' pulmonary capacity ratio (PC) values have no significant differences from their peers' ones, which live in the Northern and Southern Urals.

But it should be noted that in comparison with schoolgirls in the Southern regions of the Russian Federation the pulmonary capacity ratio (PC) values are higher by 10,3-21,2 per cent ( $p < 0,05$ ), as compared to Central Russia schoolgirls – lower by 15,2 31,0% ( $p < 0,01$ ).



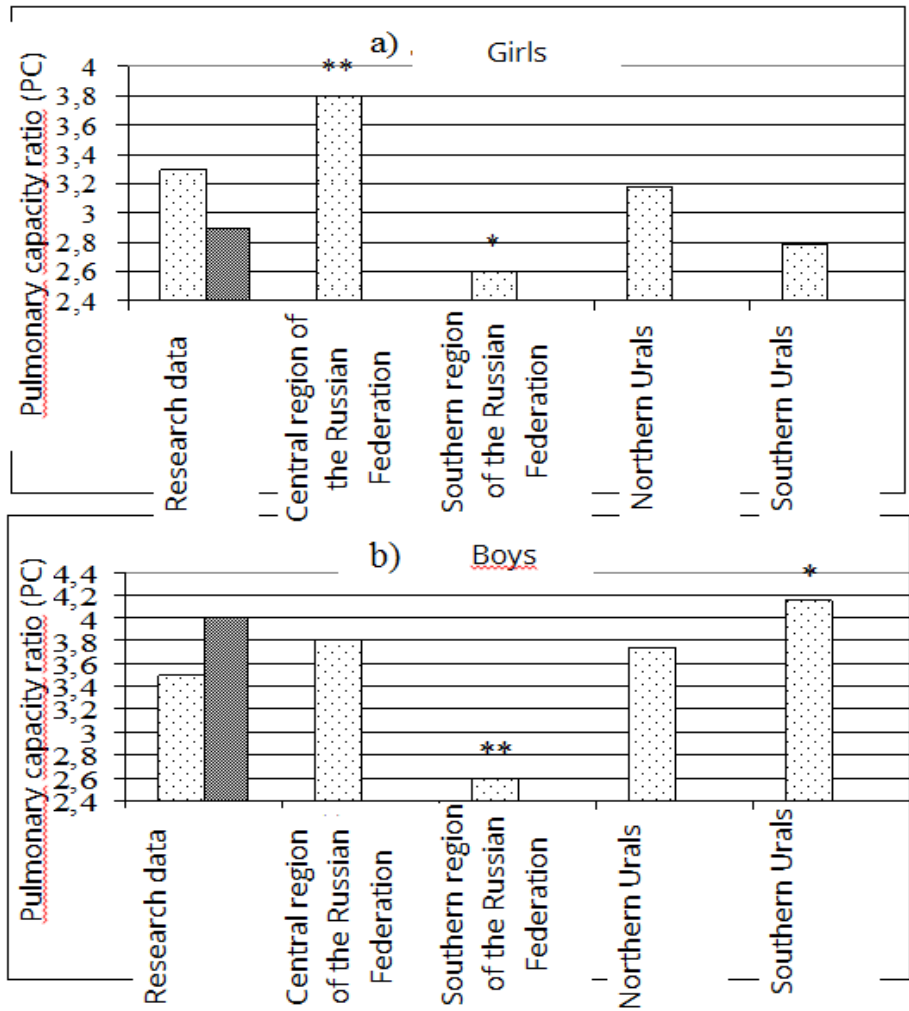


Figure 1

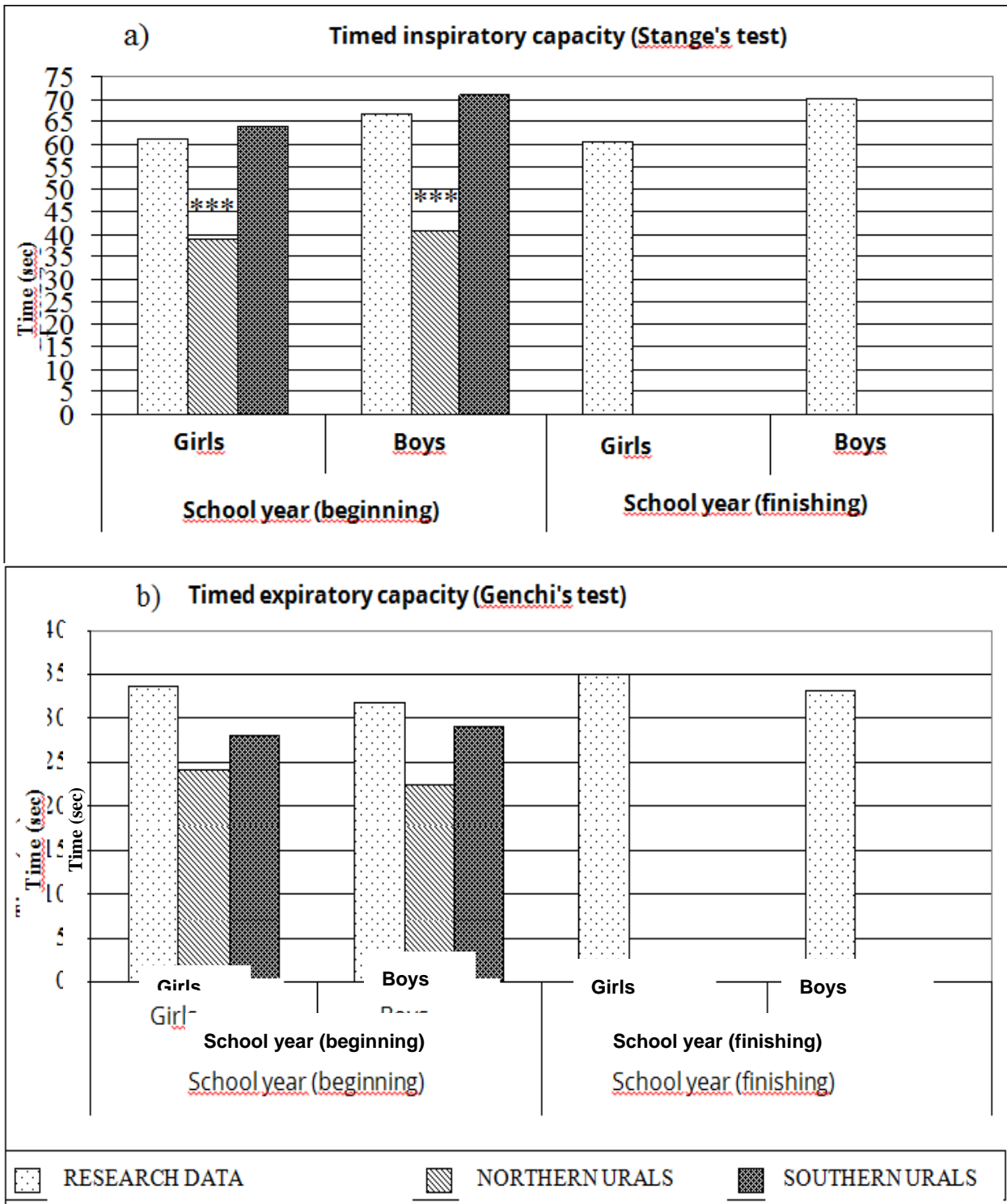
The school-leavers' pulmonary capacity ratio (PC) values within the studying year dynamics, and compared with the literature data for different regions of the Russian Federation.

a – girls; b - boys

□ School year (beginning)      ■ School year (finishing)

The boys we examined, showed the pulmonary capacity ratio (PC) values higher by 25,7-35,0% compared to the boys, living in the Southern region of the Russian Federation and lower by 20% compared to the boys, living in the Southern Urals.

The data presented in Figure 2 reflect the boys' and girls' functional respiratory samples values: breath holding during the inhale (Stange) (Fig. a) and breath holding during the exhale (Genchi) (Fig. b) within the studying year dynamics and also in comparison with research data from other regions. Analyzed functional samples are rarely used in physiological studies of this kind. We compared our results with research data from the Northern Urals (Sverdlovsk region) and the Southern Urals (Chelyabinsk).



Note: \*\*\* - statistical significance compared with schoolchildren from other regions (p>0,001).

Figure 2  
 Functional respiratory tests (sec) within the studying year dynamics and compared with the literature data

The above presented figures analysis allowed us to determine that the schoolchildren's Stange's and Genchi's values did not change within the school year dynamics, and the average values did not differ from the data, received from Chelyabinsk schoolchildren. Comparing with Sverdlovsk region schoolchildren, timed inspiratory capacity (Stange's test) values were higher by 33-35%, and timed expiratory capacity (Genchi's test) values were also higher by 25-28%. Comparison of the values obtained by them with the norms of the Ministry of Health of the Russian Federation revealed that children, living in Sverdlovsk region lag behind the given norms by Stange's test results. Boys' Stange's test results are 54-72% of the norm, and girls' ones - 62-82% of it. Differences between the surveyed boys and girls in terms of Stange's and Genchi's tests range from 8-10%. The distribution of schoolchildren by the pulmonary capacity ratio (PC) values within the school year dynamics is shown in figure 3.

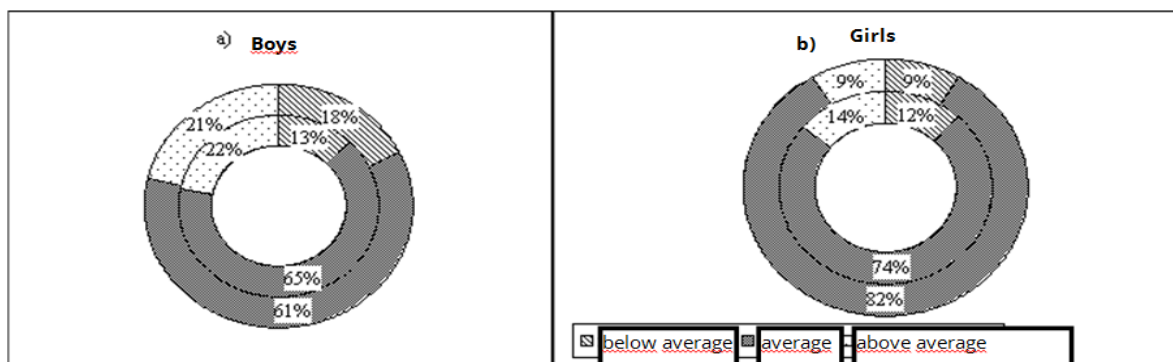


Figure 3

Schoolchildren distribution by pulmonary capacity ratio (PC) values within the school year dynamics inner circle – the studying year beginning; outer circle – the studying year finishing

The figure analysis allowed us to establish that the number of girls with an average level of PC values index is more than one of boys by 9% at the beginning and 21% at the end of the school year (statistically, the differences are not reliable). The number of girls with an average level of PC values increases from the beginning to the end of the school year by 8%. As a result, the number of girls with a level below the average and above the average level of PC values decreases by 3% and 5%, respectively. In the group of boys the number of students with a level of PC values below the average increases by 5% during the studying year.

## Discussions

Respiratory system values are important criteria for health status and reflect the influence of household, on the type of family<sup>15</sup> environmental<sup>16</sup>, hygienic and psychological factors<sup>17</sup>. Respiratory system functional state is the leading component that ensures the efficiency and quality of a growing organism's life.

<sup>15</sup> N. V. Pats; D. A. Redkin y O. V. Pats, "Some aspects of medical and social portrait of adolescents and youth from single-parent families". Health, Physical Culture and Sports Vol: 1 num 17 (2020):60-5.

<sup>16</sup> D. O. Lastkov y A. V. Dubovaya, Health condition: environmental aspects. Health, Physical Culture and Sports Vol: 1 num 17 (2020): 46-9

<sup>17</sup> S. B. Kukharenok y D. G. Miroshkin, "Analysis of adolescents' living in different environmental conditions in the cities of the Altai Territory external respiratory function values", Natural and technical sciences Vol:6 num 44 (2009): 154-159

Changes in adolescents' respiratory system values in school year dynamics reflect risk factors influence for oxygen deficiency (smoking<sup>18</sup>, the presence of chronic respiratory diseases, hypodynamia)<sup>19</sup>.

Respiratory functional tests allow us to assess a person's adaptation to hypoxia and hypoxemia, i. e. characterize organism's ability to resist oxygen lack. Individuals with high rates of hypoxemic tests have better exercise capacity. According to foreign studies, Hypoxemia is difficult to treat. Hypoxemia may be treated causally by correcting the position of the double-lumen tube, clearing the main bronchi of the ventilated lung from secretions, and improving the ventilation strategy<sup>20</sup>.

There is abundant evidence that students' adaptation to study loads in different educational environments has its own peculiarities, indicating that each model in studying needs a physiological assessment of its "price". Research conducted in the school year dynamics indicate low proper values of the most adolescents' lungs vital capacity, regardless of gender, which fact demonstrates low functional reserves of the respiratory system and the bioenergy potential of the organism as a whole<sup>21</sup>.

Research works conducted to assess adolescents' respiratory system dynamics during summer holidays in different regions show multidirectional results. A survey of adolescents, aged 13-14, vacationing in camps in the Moscow and Rostov regions did not reveal changes in respiratory system values during summer holidays<sup>22</sup>. However, the opposite results of adolescents' external respiration values dynamics during summer holidays were obtained in the course of research conducted in the Yaroslavl region<sup>23</sup>.

Regional features of adolescents' respiratory system values are confirmed by the results of research<sup>24</sup>. A decrease in the adolescents' respiratory system parameters in Primorye territory was revealed: hidden bronchial obstruction and hyperventilation,

<sup>18</sup> P. Y. Dugnist; T. M. Peregudova; E. V. Novichikhina; E. V. Romanova; V. A. Milkhin y J. R. Pirozhenko, "Youth addictions to harmful habits", Health, Physical Culture and Sports Vol: 15 num 4 (2019):86-0. Available from: <http://journal.asu.ru/zosh/article/view/7077> (in Russia)

<sup>19</sup> M. A. Skachkova; V. Abubakirova; G. Karpova y O. A. Kharchenko, "Modern approaches to children's and adolescents' health status screening assessment in the orenburg region", Orenburg Medical Bulletin Vol: 3 num 19 (2017): 41-44.

<sup>20</sup> Karzai Waheedullah, Schwarzkopf Konrad. "Hypoxemia during One-lung Ventilation Prediction, Prevention, and Treatment", Anesthesiology Vol: 6 num 110 (2019):1402-1411

<sup>21</sup> O. I. Shkvirina; L. F. Trokhimchuk; N. N. Khasanova; Y. V. Mesheryuk y T. A. Lineva, "Dynamics of a functional condition of an organism of 12-13 year-old juveniles as a criterion for adaptation to the educational environment", The Bulletin of Adyghe State University Vol: 1 num 133 (2014):59-66

<sup>22</sup> N. B. Pankova; I. Z. Mustafina; E. V. Afanaseva; M. Yu. Karganov y V. R. Kuchma, "Functional changes in the cardiopulmonary system, psychomotor coordination, and psychoemotional status in adolescents on summer holiday", Russian Pediatric Journal num 2 (2006): 8-15

<sup>23</sup> T. V. Soboleva y I. N. Nikolaeva, "Dynamic of functional indicators of cardiorespiratory system during the time children spent in the summer country facility of rest and recovery", Remedial gymnastics and sport medicine Vol: 6 num 90 (2011): 39-44

<sup>24</sup> E. V. Krukovitch; V. N. Luchaninova y M. M. Tsvetkova, "Peculiarities of respiration function in teenagers in Prymorye". Bulletin of respiratory physiology and pathology num 19 (2004):55-59; S. B. Kukharenok y D. G. Miroshkin, "Analysis of adolescents' living in different environmental conditions in the cities of the Altai Territory external respiratory function values", Natural and technical sciences Vol:6 num 44 (2009): 154-159 y L. V. Pronina, "Indicators of physical fitness and condition of a respiratory system of the teenagers living in the city of Kaspiysk", Modern scientific research and development, Vol: 28 num 11( 2018):580-581



restrictive type of breathing and detreniated respiratory system<sup>25</sup>. The authors found that adolescents' lungs vital capacity values in Kaspiysk on average were less than the average values for Russia<sup>26</sup>. Research of adolescents' respiratory system values in the Altai territory<sup>27</sup> revealed a downward trend. The authors explain the respiratory system values' decrease by the growth of musculoskeletal system pathologies, hypodynamia, negative bad habits influence, regional environmental features, etc. As a result of breathing mechanics violation, it is possible that part of the alveoli may fall and stick together during exhalation. It is possible that the decrease in values is due to respiratory tract development heterochrony, intensive growth processes in these age intervals and is short-term in nature. This is confirmed by the results of research by Sokolov E. V.<sup>28</sup>. The author found that the airways' and lung tissue's functional state values change in close connection with anthropometric characteristics variability of the organism, children with a high Quetelet index have normal, age - appropriate values of lung volumes and capacities, schoolchildren with a low index are slightly behind their physically developed peers in terms of airway patency at all levels.

There are research results confirming that negative trends in adolescents' health standardformation in the Orenburg region are caused by active and passive tobacco smoking. A research of adolescents' respiratory system functional state in Orenburg and the Orenburg region was conducted. When analyzing spirometry data, deviations of various degrees of restriction and obstruction were noted. However, in the group of adolescents who actively and passively smoke, spirometry abnormalities were diagnosed more often than in non-smoking adolescents<sup>29</sup>.

In the ten-year period of research dynamics, the analysis of adolescents' respiratory system values in Nizhniy Novgorod was carried out. A decrease in high school students', studying at an innovative educational organization, organism's functional systems' activity level, functional values deterioration were found. The authors note a decrease in the proportion of children with high vital lung capacity parameters over the study period by more than two times: 32.2% in 2007 and 14.82% in 2017<sup>30</sup>.

Taking into account that some of the considered values depend on the degree of such a biomechanics factor development as lungs and chest extensibility, as well as respiratory muscles development, we can speak about children's motor activity and their

<sup>25</sup> E. V. Krukovitch; V. N. Luchaninova y M. M. Tsvetkova, "Peculiarities of respiration function in teenagers in Prymorye", Bulletin of respiratory physiology and pathology num 19 (2004): 55-59

<sup>26</sup> L. V. Pronina, "Indicators of physical fitness and condition of a respiratory system of the teenagers living in the city of Kaspiysk". Modern scientific research and development, Vol: 28 num 11 ( 2018): 580-581

<sup>27</sup> S. B. Kukharenok y D. G. Miroshkin, "Analysis of adolescents' living in different environmental conditions in the cities of the Altai Territory external respiratory function values", Natural and technical sciences Vol:6 num 44 (2009): 154-159

<sup>28</sup> E. V. Sokolov, "Functional state of breathing system in 12-year-old teens", New research Vol: 3 num 40 (2014): 47-55

<sup>29</sup> M. A. Skachkova; A. V. Abubakirova; E. G. Karpova y O. A. Kharchenko, "Modern approaches to children's and adolescents' health status screening assessment in the orenburg region", Orenburg Medical Bulletin Vol: 3 num 19 (2017): 41-44

<sup>30</sup> E. S. Bogomolova; N. V. Kotova; E. O. Maksimenko; S. N. Kovalchuk; M. V. Shaposhnikova; A. S. Kiseleva; E. A. Olyushina y A. N. Pisareva, "Dynamics of the morphofunctional development of senior pupils of the innovative educational organization of Nizhny Novgorod (2007-2017)", Medical almanac Vol: 4 num 55 (2018): 143-146.

physical development level. Literature data and our works indicate that in recent years, research on children's and adolescents' physical development assessment, their reserve capabilities and adaptive abilities have become the subject of increased attention for physiologists, pediatricians, hygienists and representatives of other medical specialties, as an important tool for children's health primary control. In adolescence, respiratory system reaction is characterized by the values' instability and variability. However, large hormonal changes during adolescents' puberty still require a fairly high supply of energy resources, which supports their relatively high lungs hyperventilation level. At this age, there are large reserve capabilities of the respiratory system.

The increase in VC (vital capacity) by the end of the school year is more pronounced in boys compared to girls. Indicators of resistance to hypoxia (timed inspiratory capacity, Stange's test) do not change reliably by the end of the school year in boys and girls.

Our research results differ multidirectional from adolescents' respiratory system values in other regions. Chelyabinsk teenagers' respiratory system age-sexual development in corresponds to the age standards in Russia.

It is important that the results obtained for assessing adolescents' respiratory system are informative criteria for health status and should be used for the development of health improving measures.

## Conclusions

The data obtained expand the scientific image concerning the organism formation peculiarities at different ontogenesis stages under the influence of negative environmental factors. Normal teenagers' physical development rates are accompanied by acceleration of growing respiratory organs' deviations and diseases (up to 8,9%). Pulmonary capacity ratio (PC) values have honestly significant sex differences. The relatively large boys' pulmonary capacity ratio (PC) values are due to the physiological and metric parameters represented by the chest circumference and its rise (CR, sm). The teenagers' respiratory system sex – age development is adequate to age standards.

## References

Bekmukhambetov, E. Zh.; Mamyrbayev A. A. & Dzharkenov, T. A. "Medical and environmental aspects of transboundary cooperation in the Ural water basin". Medical Journal of Western Kazakhstan num 1 (33) (2012):3-5.

Bogomolova, E. S.; Kotova, N. V.; Maksimenko, E. O.; Kovalchuk, S. N.; Shaposhnikova, M. V.; Kiseleva, A. S.; Olyushina, E. A. y Pisareva, A. N. "Dynamics of the morphofunctional development of senior pupils of the innovative educational organization of Nizhny Novgorod (2007-2017)". Medical almanac Vol: 4 num 55 (2018): 143-146.

Demirci, N. y Toptaş D. P. "The determination of physical activity, nutrition and self-sufficiency levels of sedanter individuals of fitness club member". Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports num 22(5) (2018): 237-245. DOI: <https://doi.org/10.15561/18189172.2018.050340>.

Dugnist, P. Y.; Milhin, V. A.; Golovin, S. M. and Romanova, E. V. "Healthy way of life in youth's value orientations system". *Health, Physical Culture and Sports* Vol: 7 num 4 (2017): 3-25. Available from: <http://journal.asu.ru/zosh/article/view/3463> (in Russia)

Dugnist, P. Y.; Peregudova, T. M.; Novichikhina, E. V.; Romanova, E. V.; Milkhin, V. A. y Pirozhenko J. R. "Youth addictions to harmful habits". *Health, Physical Culture and Sports* Vol: 15 num 4 (2019): 86-0. Available from: <http://journal.asu.ru/zosh/article/view/7077> (in Russia)

Gavriliuk, M. V. "Search for ways to improve the effectiveness of physical education of students". *Zdorov'e dlja vseh* num 2 (2016): 21-24 (in Russian).

Grijbovski, A. M.; Bygren, L. O.; Svartbo, B. y Magnus P. "Social variations in fetal growth in Northwest Russia: an analysis of medical records". *Annals of Epidemiology* num 9 (2003): 599–605. Available from: [https://doi.org/10.1016/S1047-2797\(03\)00052-8](https://doi.org/10.1016/S1047-2797(03)00052-8).

Hortigüela-Alcalá, D.; Pérez-Pueyo Á. y Moncada-Jiménez, J. "An analysis of the responsibility of physical education students depending on the teaching methodology received". *Journal of Physical Education and Sport* num 15(2) (2015): 202-207. DOI:10.7752/jpes.2015.02031.

Iermakov, S. S.; Ivashchenko, P. I. y Guzov, V. V. "Features of motivation of students to application of individual programs of physical self-preparation". *Physical Education of Students* num 4 (2012): 59–61

International Standards for Anthropometric Assessment. 2001. Available from: <http://www.ceap.br/material/MAT17032011184632.pdf>

Jakubovskaya, I. A.; Shibkova, D. Z. y Makunina O. A. "Schoolchildren's anthropometric values in ten years of study dynamics (longitudinal study)". *New research* Vol: 1 num 50 (2017): 73-77. Available from: <https://elibrary.ru/item.asp?id=32323255> (in Russia)

Karzai Waheedullah, Schwarzkopf Konrad. "Hypoxemia during One-lung Ventilation Prediction, Prevention, and Treatment". *Anesthesiology* Vol: 6 num 110 (2019): 1402-1411.

Krukovitch, E. V.; Luchaninova, V. N. y Tsvetkova, M. M. "Peculiarities of respiration function in teenagers in Prymorye". *Bulletin of respiratory physiology and pathology* num 19 (2004): 55-59.

Kukharenok, S. B. y Miroshkin, D. G. "Analysis of adolescents' living in different environmental conditions in the cities of the Altai Territory external respiratory function values". *Natural and technical sciences* Vol:6 num 44 (2009): 154-159. (in Russia)

Lastkov, D. O. y Dubovaya, A. V. Health condition: environmental aspects. *Health, Physical Culture and Sports* Vol: 1 num 17 (2020): 46-9. Available from: <http://journal.asu.ru/zosh/article/view/7455> (in Russia)

Loginov, V. G.; Ignatieva, M. N. & Balashenko, V. V. "A methodological approach to assessing the comfort of living within the boundaries of the northern territories". *Regional economy* Vol: 14 num 4 (2018): 1399-1410

Makunina, O. A. y Jakubovskaya, I. A. Structure and dynamics of schoolchildren's, aged 7-17 health state. On line scientific and educational bulletin. Health and educational millennium Vol: 17 num 2 (2015): 29-31. Available from: <https://elibrary.ru/item.asp?id=22885244> (in Russia)

Moy, B.; Renshaw, I. y Davids, K. "The impact of nonlinear pedagogy on physical education teacher education students' intrinsic motivation". Physical Education and Sport Pedagogy num 21(5) (2016): 517-538. DOI: <https://doi.org/10.1080/17408989.2015.1072506>

Mukhanova, N. V. y Savchuk, A. N. "Increase of motor activity of schoolchildren through a motivated need for physical training". Vestnik TGPU num 5 (2012):171-174 (in Russian).

Novichikhina, E. V.; Frolov, M. I.; Romanova, E. V.; Kesler, A. V. y Dylkina, T. V. "On the question of the compatibility of the concepts «sport» and «nicotine». Health, Physical Culture and Sports Vol:4 num 15 (2019): 109-113. Available from: <http://journal.asu.ru/zosh/article/view/7084>

Olafsdottir, A. S.; Torfadottir, J. E. y Arngrimsson, S. A. "Health Behavior and Metabolic Risk Factors Associated with Normal Weight Obesity in Adolescents". PLoS ONE Vol: 11 num 8 (2016): 34-40. DOI:<https://doi.org/10.1371/journal.pone.0161451>

Pankova, N. B.; Mustafina, I. Z.; Afanaseva, E. V.; Karganov, M. Yu. y Kuchma, V. R. "Functional changes in the cardiopulmonary system, psychomotor coordination, and psychoemotional status in adolescents on summer holiday". Russian Pediatric Journal num 2 (2006): 8-15.

Pats, N. V.; Redkin, D. A. y Pats, O. V. "Some aspects of medical and social portrait of adolescents and youth from single-parent families". Health, Physical Culture and Sports Vol:1 num 17 (2020): 60-5. Available from: <http://journal.asu.ru/zosh/article/view/7461> (in Russia)

Pogonysheva I. A. y Pogonyshv D. A. "Risk factors for reducing resistance to oxygen deficiency in students in the middle of river region". Nizhnevartovsk State University Bulletin num 3 (2015): 78-84.

Pronina, L. V. "Indicators of physical fitness and condition of a respiratory system of the teenagers living in the city of Kaspiysk". Modern scientific research and development, Vol: 28 num 11( 2018): 580-581.

Romanova, E. V. "Modern interpretations of the health phenomenon: an analytical review". Health, Physical Culture and Sports Vol: 5 num 2 (2017):3-48. Available from: <http://journal.asu.ru/zosh/article/view/2199> (in Russia)

Semyachkov, A. I. and Koch, I. A. "Ecological problems of mining regions". Proceedings of the Ural State Mining University num 23 (2008): 146-148.

Shkvirina, O. I.; Trokhimchuk, L. F.; Khasanova N. N.; Mesheryuk, Y. V. y Lineva, T. A. "Dynamics of a functional condition of an organism of 12-13 year-old juveniles as a criterion for adaptation to the educational environment". The Bulletin of Adyghe State University Vol: 1 num 133 (2014): 59-66.



Skachkova, M. A.; Abubakirova, A. V.; Karpova, E. G. y Kharchenko, O. A. "Modern approaches to children's and adolescents' health status screening assessment in the orenburg region". Orenburg Medical Bulletin Vol:3 num 19 (2017): 41-44.

Soboleva, T. V. y Nikolaeva, I. N. "Dinamic of functional indicators of cardiorespiratory system during the time children spent in the summer country facility of rest and recovery". Remedial gymnastics and sport medicine Vol: 6 num 90 (2011): 39-44.

Sokolov, E. V. "Functional state of breathing system in 12-year-old teens". New research Vol: 3 num 40 (2014): 47-55.

Teixeira, T. F.; Alves, R. D.; Moreira, A. P. y Peluzio, M. do C. "Main characteristics of metabolically obese normal weight and metabolically healthy obese phenotypes". Nutr Rev Vol: 73 num 3 (2015): 175–190. DOI: <http://dx.doi.org/10.1093/nutrit>.

Tolgfors, B. y Ohman M. "The implications of assessment for learning in physical education and health". European Physical Education Review Vol: 22 num 2 (2016): 150-166. DOI: <https://doi.org/10.1177/1356336X1559500649>.

WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects. Available from: [http://www.ub.edu/recerca/Bioetica/doc/Declaracio\\_Helsinki\\_2013.pdf](http://www.ub.edu/recerca/Bioetica/doc/Declaracio_Helsinki_2013.pdf).

Yang, C. B. y Dong, M. K. "A Study of the correlation between teachers' teaching styles and students' participation motivation in the physical education". Journal of Baltic Science Education Vol: 16 num 2 (2017): 199-206.

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