



Influence of Living Conditions and Training for Health of Schoolchildren

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Authors' contributions

This work was carried out in collaboration between all authors. Authors SVM, YGK, EAB and KAV designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript and managed literature searches. Authors EVL, TVS and TAP managed the analyses of the study and literature searches. All authors read and approved the final manuscript.

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ABSTRACT

This research is devoted to the comparative analysis of Nizhny Novgorod region modern schoolchildren's health state depending on living conditions and learning environment. Health assessment has been carried out according to the schoolchildren's physical development indicators, obtained during the course of medical examinations in the Health Centre for children. The influence of the learning environment of studying has been studied in accordance with the Preventive-Oriented Health-Saving Activity Resource Center, organized on the basis of a secondary school. It has determined that the impact of territorial factors on the physical health of schoolchildren under the modern social and economic conditions begins to decline, and the value of health-saving technologies introduction into the educational process remains significant and relevant.

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1. INTRODUCTION

Children's health is a prerequisite and one of the goals of the modern concept of education, which is represented as a condition of an individual, when its organism is able to perform all its functions properly in the absence of any disease [1]. School age is an important and responsible period of childhood and youth; significant by its own and as a stage of socialization for future life, career and family formation. An educational institution, i.e. a school is a place of a child's activity for 11 years - the most intensive period of the development, all the conditions, which ensure the preservation and promotion of schoolchildren's health, must be organized [2].

Rate and other indicators of physical development are very important characteristics of health state. Individual variety of physical development rates is quite big, but if it is within normal limits, it means that life and activity of a child correspond to the abilities and needs of the organism. This is connected with the diverse rate of tissue growth [3]. According to the dynamics of the schoolchildren's growth and development, it is possible to estimate their health state, as well as physical and psychic health. Abnormalities of any kind show some problems with health and must be taken into consideration. Physical development indicators are used by modern researchers as indicators for estimating children and teenagers' health state [4].

The level of physical development of rural schoolchildren as well as quantitative and qualitative characteristics of meals in general do not differ on important factors from relevant characteristics of urban schoolchildren. Complex examination of rural schoolchildren exposed physical developmental disorder in 19,2% cases. Lower body mass with normal length (12,8%), low body mass with low height (3,2%) and mass excess of 1-2 degree (3,2%) prevailed. Developmental retardation in neuropsychic development was not noted. At the same time some data on rural schoolchildren's health cause anxiety. Among rural children specific weight of healthy children is low whereas specific weight of unhealthy children or children with different aberration is higher: in the city children of the first health group make up 36,93%, of the second health group 48,73%, of the third health group

114,34% while in the countryside the figures are 29,02%, 53,59%, 17,09% accordingly [2].

Nizhny Novgorod children's' health state and physical development is under constant control; standards are intermittently reviewed [5,6]. The results of the research prove the influence of the environment, information, domestic and physical load, sanitary-hygienic support of educational institutions and others on the level of physical development of rural and urban schoolchildren [7] The objective characteristics of children's morphological and functional status, which depends on social and economic factors, place of living and learning environment is significant from theoretical and especially practical point of view for determining the levels of health, and is also actual for creating benchmark standards of physical development statistic criteria [8].

20-40% of negative influence making children's health worse is connected with school, with uncomfortable conditions of educational process. High intensity of the educational process allows to take into consideration individual features of a child, organize partial load mode which is necessary for children with health deviations. The number of such children is increasing. According to the data of the Institute of developmental physiology, while studying at school the frequency of visual and posture disorders is five times as much increasing, psychoneurological deviation is four times as much increasing, alimentary organ pathology is three times as much increasing. High dependence of growth of deviations in a state of health from volume and intensity of an academic load is noted. Comfortable conditions of educational process mean creation at school such pedagogical conditions which effectively provide the development of intellectual, moral and individual qualities of a child identity as well as his physical and mental health [2].

In accordance with the Ministry of Education of Nizhny Novgorod region order No. 2017 from the 03.09.2013 "On the organization of the experimental network educational project Nizhny Novgorod school is a health territory: new frontiers on the educational map of the region" a new technology has been introduced - the creation of Resource centers in municipal areas of the region. One of the strategic goals of their activity is to guarantee health preservation and

promotion, ecological culture forming, healthy and safe, socially positive lifestyle among the pupils [9].

The purpose of the research is to characterize the health state of Nizhny Novgorod region modern schoolchildren.

2. MATERIALS AND METHODS

The research has been done in accordance with the results of preventive medical examinations including complex health assessment, with the use of Automated Computer Diagnostic Examination of 939 schoolchildren (508 boys and 431 girls on the basis of the Health Center for children. The parameters of physical development introduced in the curriculum of the Health Centre Automated Computer Diagnostic Examination, was estimated by centile tables [5,8]. Physical development was defined as harmonic if the difference between the indicators is not more than one centile interval, as moderately disharmonious – if the difference is two, as disharmonious – when the difference is three intervals. The sum of points (numbers) in the assessment of the indicators (body length, chest circumference and body weight) was evaluated in the following way: up to 10 points –

physical retardation, up to 15 points – normal development, 16-21 score – accelerated physical development. To identify morphological and functional peculiarities of schoolchildren, the standard indicators of Nizhny Novgorod region urban and rural schoolchildren's physical development have been used [5,8].

The level of sexual development has been determined according to the expressiveness of secondary sexual characteristics and estimated by the pediatricians of the Health Center with sexual formula and pubescence rate determination [5,8].

3. THE RESULTS OF THE RESEARCH

For revealing schoolchildren's morphological and functional peculiarities, a comparative analysis of Nizhny Novgorod schoolchildren's physical development has been carried out.

Rural boys are, according to the average indications, 2.3-4.1 cm lower than the urban ones at the age of 7,9,11 and 14 respectively; the maximum difference in body length (among the boys) is at the age of 14 (4.1 cm). Urban boys of 7, 12 and 14-15 have more body weight than the rural ones; most significant differences (6.9 kg)

Table 1. Comparing complex body indicators of urban/rural schoolchildren (M±σ)

Age	Boys				Girls			
	Rural schoolchildren	Urban schoolchildren	±Δ	P	Rural schoolchildren	Urban schoolchildren	±Δ	P
Body length, cm								
7	123,4±5,01	125,7±5,12	+2,3	0,000	123,5±5,35	124,6±5,4	+1,1	0,089
8	129,2±5,38	130,0±5,93	+0,8	0,192	128,2±6,14	129,4±5,74	+1,2	0,061
9	134,3±6,28	136,8±6,08	+2,5	0,000	134,6±6,17	134,2±6,0**	-0,4	0,534
10	139,5±6,69	140,7±5,68	+1,2	0,075	138,7±6,99	140,5±6,62	+1,8	0,017
11	144,1±6,68	146,7±6,65	+2,6	0,000	145,1±7,45	146,2±7,1	+1,1	0,167
12	150,5±8,08	151,8±7,2	+1,3	0,136	152,2±7,56*	152,7±6,93	+0,5	0,528
13	156,6±8,44	158,4±8,32	+1,8	0,058	158,4±6,28*	158,8±7,09	+0,4	0,554
14	162,2±9,20	166,3±8,86	+4,1	0,000	160,6±6,02*	161,9±5,84**	+1,3	0,041
15	170,9±9,10	171,9±6,72	+1,0	0,295	162,9±6,12**	162,5±6,72**	-0,4	0,537
16	174,5±6,75	174,1±6,98	-0,4	0,619	163,6±6,06**	163,7±5,6**	+0,1	0,869
17	176,7±6,18	175,8±6,4	-0,9	0,273	165,1±5,90**	164,5±6,42**	-0,6	0,386
Body weight, kg								
7	24,2±3,95	25,3±4,55	+1,1	0,036	24,2±4,97	24,5±4,47	+0,3	0,596
8	28,3±5,61	27,9±5,56	-0,4	0,512	27,1±5,76*	27,8±6,93	+0,7	0,304
9	31,4±7,02	32,9±7,65	+1,5	0,061	30,8±6,76	30,0±5,76**	-0,8	0,232
10	34,5±8,33	35,5±8,67	+1,0	0,274	33,0±7,02	34,5±7,43	+1,5	0,058
11	38,3±9,95	40,2±9,65	+1,9	0,088	37,0±8,50	37,6±8,45*	+0,6	0,516
12	41,5±10,25	44,8±11,82	+3,3	0,006	43,9±10,40*	44,5±11,26	+0,6	0,603
13	47,6±11,27	48,0±10,45	+0,4	0,746	49,0±10,04	49,3±10,59	+0,3	0,775
14	49,0±10,15	55,9±13,16	+6,9	0,000	51,0±8,34*	52,7±9,64*	+1,7	0,075
15	58,7±10,58	61,8±12,37	+3,1	0,020	55,1±9,85**	54,5±10,01**	-0,6	0,554
16	62,8±9,68	62,6±11,34	-0,2	0,869	56,3±8,56**	54,9±8,4**	-1,4	0,109
17	65,9±9,04	65,6±10,86	-0,3	0,817	56,8±8,77**	56,6±10,14**	-0,2	0,850

Note: ** - Differences between boys and girls are reliable for $p < 0,001$

* - Differences between boys and girls are reliable $p < 0,05$

are indicated among the boys of 14. The fact that there are no significant differences between urban and rural girls, except those of 10 and 14, where urban girls are 1.3-1.8 cm taller than rural ones is quite unexpected. As for the body weight, the girls have no significant differences. Gender differences in body length and mass are most noticeable among the children of 15-17. According to the chest circumference analysis, teenagers of Nizhny Novgorod have 2.0-3.0 bigger chest circumferences, than those who live in other parts of the region. Speaking about the rural girls of 13-17, these indicators are 1.4-2.5 cm higher. Gender differences in this indicator among rural schoolchildren are revealed almost in every age group (8-10, 12-14 and 16-17 years); among Nizhny Novgorod schoolchildren – only at the age of 15-17. Urban boys of 14 have maximal annual length, mass and chest circumference increasing (7.9 cm, 7.9 kg and 4.9 kg respectively); rural schoolchildren have such growth level at the age of 15 (8.7 cm, 9.7 kg and 5.6 cm respectively). As for the girls, both rural and urban, their maximum increasing, which is almost equal for all these indicators, has been indicated at the age of 12.

The most important characteristics of schoolchildren's growth and development are functional indicators of the body, which change in ontogenesis similarly to total body indicators - lung capacity and dynamometry of the right hand, which, as it has been indicated both among urban and rural schoolchildren, grow with the increase of years. Nizhny Novgorod boys of 12-15 have higher indicators of lung capacity than the rural ones with a maximum prevalence of 0.58 litres at the age of 14. Rural boys of 7-12 and girls of 7-11 have higher right hand strength indicators than urban students. The fact is, that urban girls of 16-17 have higher hand strength (1.2 - 2.3 kg) than rural schoolgirls.

The gender differences in lung capacity and right hand dynamometry in all age-sexual groups — boys of each age group have higher physiometric indicators than girls; the growth in physiometric indicators is more noticeable in boys.

The analysis of hemodynamic parameters revealed a decrease in the heart rate among rural schoolchildren in comparison with urban ones, in almost all age and gender groups with a maximum difference of 12 beats per minute (boys at the age of 17), and 13.3 beats / min. (girls at the age of 17). A similar tendency of lower average values has been determined from rural children on systolic blood pressure (SBP):

boys – at the age of 7-8, 14-17 and girls at the age of 7-9 and 17. An unfavorable sign among rural children was a high level of diastolic blood pressure (DBP): in all age and gender groups, it is statistically higher than among urban children. Gender differences in the SBP are more noticeable among students of the senior age group: modern boys' average values of SBR exceed girls' ones by 6.9-11.1 mm. DBP indicators have no gender differences, except for 14-year-old rural teenagers.

For revealing the impact of the learning environment on school children's health, the indicators of physical development and morbidity prevalence among secondary school No. 16 pupils (the city of Arzamas), on the basis of which the Preventive-Oriented Health-Saving Activity Resource Center has been established.

From 2011 to 2015, 939 schoolchildren underwent medical examination in the Health Center for children. Final results can be seen on the Table 2. As a result of introduction of health-saving technologies in the school educational process, during the study period there was an increase in the number of students with harmonious and moderately disharmonious physical development and, consequently, decreased the percentage of children with disharmonious development, which characterizes the activity of the Resource center from the positive side.

The study of the schoolchildren's morbidity dynamics it has been revealed that during the functioning of the Preventive-Oriented Health-Saving Activity Resource Center the number of children without chronic diseases has been increased (Table 3). The most common during this period were the diseases of the musculoskeletal system, eyes and heart with the tendency of annual decline in the number of students with such diseases. There has been a slight increase in the prevalence of endocrine, dental diseases and diseases of the respiratory system.

The study of schoolchildren's physical development rate has shown that the parameters of the physical health of 66.7% schoolchildren (61.6 % of boys and 71.1% of girls) correspond to age-gender norms. As for the children with slow level of development, 7.8% have been revealed (8.7% of boys and 6.9% girls). 25.9% of the children represent a group of children with accelerated physical development (29.7% of boys and 22.1% of girls). The majority of both

groups (with accelerated and slow physical development) are boys.

The need to determine the level of puberty is due to the fact that individual rates of puberty transformation period passage are not all the same. Puberty extreme variants diagnostics during regular medical examinations of children contributes to the early identification of disabilities in health and development. The indicators of the majority of examined children (72,8%) correspond to age norms, but in the period of pubertal growth, the number of such children gets reduced to 64.6%. Children with fast puberty development (15,7%) are more numerous than those with slow pace (11.5%).

Among children extreme variants of puberty the level of diseases, connected with endocrinology, orthopedics and neuropathology, is higher.

The impact of health-saving technologies introduction into the educational process on the health of schoolchildren has been analyzed taking into account the distribution of pupils into two groups: group 1 – schoolchildren, who study in classes with health-saving technologies group; 2 – students from ordinary regular classes (Table 4). As it has been revealed, group 1 includes 9.6% more children with harmonious and moderately disharmonious development and, accordingly, fewer boys and girls with disharmonious development.

Table 2. Subdividing the schoolchildren in accordance with the physical development harmonicity, %

Physical development groups	2011	2012	2013	2014	2015	2011/15
Harmonic development	45,5	51,7	51,0	47,7	50,3	53,4
Moderately-harmonic	22,0	22,6	28,8	30,3	25,7	25,1
Disharmonic development:						
Insufficient body mass	0,8	1,9	1,4	1,5	1,9	1,6
Overweight	14,4	9,4	8,2	6,8	10,7	9,3
Tall body with insufficient mass	6,8	5,6	5,2	9,2	8,2	5,0
Narrow chest	3,0	5,0	0,5	-	0,5	1,6
Overlength	3,0	1,3	1,9	1,5	2,7	2,2
Short length	3,8	1,9	1,5	1,5	-	1,3
Wide chest	0,7	0,6	1,5	1,5	-	0,5

Table 3. Schoolchildren's morbidity dynamics, %

Morbidity group/type	2011	2012	2013	2014	2015
Ophthalmology	38,9	45,3	54,6	36,0	34,4
Orthopedics	65,5	58,6	56,3	50,8	42,7
Cardiology	29,3	30,6	43,1	28,0	23,6
Physical development	14,8	14,0	10,3	9,8	10,6
Endocrinology	14,4	16,6	11,8	17,4	15,9
Psychiatry	3,3	2,8	4,0	3,5	3,0
Dentistry	24,4	35,4	14,4	21,1	29,6
Allergology	3,6	2,2	3,0	3,6	3,0
Neuropathology	14,2	24,4	15,0	8,8	13,4
Gastroenterology	6,3	1,8	8,1	2,1	2,1
Pulmonology	3,5	6,2	5,1	3,7	4,5
Not revealed	21,2	30,4	28,7	30,4	31,7

Table 4. Subdividing the schoolchildren in accordance with the physical development harmonicity, depending on learning environment, %

Physical development groups	All schoolchildren	The 1 st group of schoolchildren	The 2 nd group of schoolchildren
Harmonic development	50,3	29,1	21,2
Moderately-harmonic	37,7	19,7	18,0
Disharmonic development:			
Insufficient body mass	1,9	1,5	0,4
Overweight	8,7	3,1	5,6
Tall body with insufficient mass	8,2	4,1	4,1
Narrow chest	0,5	0,5	-
Overlength	2,7	0,7	2,0

4. CONCLUSION

As a result of the comparative analysis the convergence of urban and rural children's morphological and functional status indicators on total body parameters against the background of significant differences in the cardiovascular system functioning has been revealed.

The study of anthropometric data and prevalence of morbidity among the pupils of the school, on the basis of which Preventive-Oriented Health-Saving Activity Resource Center is functioning shows that the schoolchildren have a morphological status which corresponds to age-gender norms, and the teaching conditions correspond to their abilities and needs, thus contributing to harmonious development, preserving and promoting health.

Thus, the influence of the territorial factor on schoolchildren's physical health under modern social and economical conditions begins to decline, and the value of the introduction of health technologies in the educational process remains significant and relevant.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Baranov AA, Lapin Yu. E. National police in the sphere of child welfare: Issues of theory and practice: Series "Social Pediatrics. Moscow: The Union of Pediatricians of Russia. 2009;188.
2. Bezrukikh MM. Health-saving school. Moscow: Moscow State Pedagogical University. 2008;222.
3. Matveeva NA, Leonov AV, Kuzmichev Yu. G, Bogomolova ES. Ecological and hygienic problems of preservation and promotion of schoolchildren health. Nizhegorodsky Medical Journal. 2005;1: 136.
4. Leonov AV, Yu. G. Kuzmichev, Bogomolova ES, et al. Criteria assessment of sanitary and hygienic prosperity of educational institutions: Methodological instructive regulations. Nizhny Novgorod: Publishing House of Nizhegorodsky State Medical Academy. 2010;33.
5. Bogomolova Ye. S, Kuzmichev Yu. G, Matveyeva NA, et al. Children and teenagers' physical activity studying and assessment methods / edited by the Doctor of Medical Sciences, Professor Bogomolova Ye. S. Nizhny Novgorod: "Nizhny Novgorod State Medical University". 2015;92.
6. Mihajlova SV. The peculiarities of morphofunctional development of the pupils of rural area in modern conditions: extended abstract of Cand. of Biological Sci. Dissertation: 03.03.01 (Privolzhsky) Federal University of Kazan; 2014.
7. Kalyuzhniy E, Mikhailova S, Titova MN, Adol'fovich Basurov V, Zhulin NV. Influence of environmental conditions on the level of physical development of rural students Nizhny Novgorod region. Advances in Environmental Biology. 2014;T8(10):216-222.
8. Kalyuzhniy Ye. A, Kuzmichev Yu. G, Mihaylova SV, Zhulin NV, Boltacheva Ye. A. Complex assessment of schoolchildren's physical development: methodological instructive regulations. Arzamas: Arzamas State Pedagogical Institute named after A. P. Gaydar. 2012;80.
9. Lyubova Ye. V, Shesterina I. Ye, Zavyalova IN, Mihajlova SV, Oparina SA. Forming the model of "School is a Preventive-Oriented Health-Saving Activity Resource Center". Modern Pedagogic. 2015;12(37):54-58.

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