Original Article

Characteristics of physical conditions of 7-9-year-old schoolchildren within the process of physical education

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Abstract:
Introduction: Child's body is a complex self-regulating system, the formation of which is influenced both by the genetic factor and the environmental factors. The younger school age is characterized by an active process of formation of morpho-functional structures of the body. The objective of this study is to monitor the physical condition in seven-to-nine-year-old children in the process of physical education. *Material and methods*: The study was carried out on the basis of secondary schools No. 6, No. 30, No. 27, No. 33 and No. 22 during 2016-2017 school year. Altogether 595 pupils of primary school age (n = 595) were involved in the study, including 210 schoolchildren of 7 years, 200 schoolchildren of 8 years old, and 185 schoolchildren of 9 years. For the samples that corresponded to the normal distribution law, the parametric Student's t-test was used; for the samples that did not correspond to the normal distribution law, the nonparametric Kruskal-Wallis criterion was used. *Results*: it has been found out that the results of monitoring of the physical condition of the schoolchildren aged 7-9 years indicate the regular processes of biological development of the body. The results of physical fitness indicate a high variability in the parameters of flexibility and coordination of movements. The incidence rate among schoolchildren was high; according to the class of diseases, the respiratory diseases, which are seasonal, are in the first place. *Conclusion:* the results of monitoring of the physical condition of schoolchildren indicate positive dynamics in all sex-age groups of indicators of physical development, functional status, physical performance and physical fitness. The results of monitoring of the 2016-2017 school year enabled effective implementation of the corrections in the educational process.
Keywords: characteristics, physical condition, schoolchildren, physical education.

Introduction

The processes of modernization of Ukrainian education system concern all educational institutions. Changes that occur in the modern school require the new approaches to the organization of a modern lesson. The intensity of the learning process, computerization and preference for knowledge leaves the schoolchildren health out of consideration. In recent years, the results of monitoring of the physical health of schoolchildren have negative dynamics. According to the study data of (Antipkin, 2007; Baranov, 2009; Kovalenko, 2011; Biletska, 2016; Bolotin, 2016; 2017; Galan, 2017;Butenko, 2017; Paliichuk, 2018) schoolchildren of the primary grades have low indicators of the functional state. According to (Hrabar, 2013; Andrieieva, 2014; Tomenko, 2017; Yarmak, 2017), the results of a study of the adaptive-reserve capabilities of primary school students indicate the tension of adaptation mechanisms.

As (Khrypko, 2016) point out, the monitoring of the cardiovascular system of schoolchildren has become especially urgent in recent years. Adaptive-adjustment activities of the body of some children are in such a disorder that even minor physical exertion can lead to undesirable consequences. The long-term studies by (Kashuba, 2010; 2013) show an increase in the number of children of primary school age who have deviations in the state of posture in the sagittal and frontal planes. (Baranov et al.) have pointed to a significant increase in the incidence rate of the main categories of diseases and disability due to diseases among the children population.

Materials and Methods

Altogether 595 (n = 595) pupils of primary school age were involved in the scientific study, including 108 boys and 102 girls aged 7 years; 96 boys and 104 girls aged 8 years; 92 boys and 93 girls aged. The methods of study applied were as follows: theoretical methods of study, containing analysis and systematization of scientific and methodological publications and the Internet information resources, anthropometric methods, educational methods, physiological methods. The processing of the obtained data was carried out with the help of the package "Statistika 6.0" (Stat Soft, USA) and spreadsheets "Excel 2016" (Microsoft, USA), which enabled conducting the analysis of measurements and calculations of base values. To determine the reliability of the

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differences between the samples, it was used the reliability level p = 95 % (significance level 0.05). Some hypotheses were tested at a higher level of reliability p = 99 % (significance level 0.01). The Shapiro-Wilk test was used to verify that the sample was consistent with the law of normal distribution. Dispersion analysis was used to determine the dynamics of indicators of the physical state of schoolchildren aging from 7 to 9 years. For those samples that do not correspond to the law of normal distribution, parametric analysis of variance was performed. For samples that do not correspond to the normal distribution law, a nonparametric dispersion analysis of Kruskal-Wallis was performed.

Anthropometric methods included measurements of body length, body weight, and girths of various body parts. The anthropometric examination of children aging from 7 to 9 years was carried out by standard equipment according to generally accepted and unified techniques.

To assess the state of the cardiovascular system, the following measurements were made: heart rate at rest (HR_{rest}) – by palpatory method; systolic blood pressure (SBP) and diastolic blood pressure (DBP) using a mechanical tonometer "Omron-M-1" (Japan).

The functional state of the respiratory system was studied by determining the vital capacity of the lungs (VC) with the aid of a dry portable Spirograph according to the generally accepted technique. Functional tests were also used: the Shtange test - after 5 minutes of rest, the recipient takes a maximum breath, then exhalation, incomplete inhalation (75 % of maximum), holds his breath with a closed nose and mouth; the Genchi test is performed similarly, only holding of the breath is made after a full exhalation.

Physical performance was determined by a value of the Ruffier index. During assessment of the physical performance according to the Ruffier index, the patient was in the sitting position, then after 5 minutes' rest, the heart rate was recorded for 15 sec (HR_{rest}), then the exercise was performed - 30 squats during 45 sec, after which the heart rate was again recorded for the first 15 sec after the load (HR_2) and for the last 15 seconds from the first minute of the recovery period (HR_3). The Ruffier index was calculated according to the formula:
IR = 4 (HR_{rest} + HR_2+ HR_3) -200/10

Control tests of physical fitness were carried out by the estimation of level of development of certain motor qualities: strength, speed, endurance, flexibility, agility and coordination of movements based on the results of various motor tests of Sergienko L.P. (Sergienko, 2001).

The rate of strength was determined by the results of the hands grip strength dynamometry of the right and left hand, with the help of a dynamometer, standing in the initial position with a hand extended downwards. Speed characteristics were determined by the results of running 30 m sprint run.

Speed-strength qualities were determined by the results of a standing long jump. The starting position - standing position, legs are abducted on the width of the shoulders, the result was measured in centimetres with an accuracy of 1 cm. Agility was determined by the results of the test "shuttle run 4x9 m". To assess the flexibility of the spine, the test was performed from the initial sitting position, the distance between the feet is 10-15 cm. The patient performs the maximum bending of the trunk forward without bending the knees and holds at least 2 seconds.

To determine the static coordination, we used the E. Bondarevskyi test. (The patient is standing on one leg, touching the knee joint of the supporting leg by the heel of the other leg, hands on waist, the head directly) We recorded not only visual signs of impaired coordination, but also the time elapsed before the appearance of these signs. To study the morbidity, a method of content analysis was used.

Medical cards were analysed. The incidence was estimated according to the frequency (the number of diseases per year), the severity (the number of days missed due to illness for the year), and the class of diseases. Both the overall morbidity and morbidity for each specific class of diseases was estimated according to the nosological scheme proposed by the World Health Organization (International Statistical Classification of Diseases and Related Health Problems).

Results

During 2016-2017 school year, we conducted a comprehensive study of indicators of physical condition of primary school children aging from 7 to 9 years, all of them for health reasons are referred to the main and preparatory medical groups.

Evaluation of physical development of the children of primary school age is important for determining physical health, as it enables the analysis of the dynamics of changes in anthropometric data, which in turn enables regulating the nature, volume and intensity of physical activity. The average statistical results are presented in Table 1.

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Table 1. Average statistical indicators of physical development of schoolchildren aging from 7 to 9 during the school year (n = 595)

Indicators	Age	Boys (n=296)				±Δ.%	Girls (n=299)				±Δ.%
		The beginning of the year		The end of the year			The beginning of the year		The end of the year		
		$\overline{x}$	S	$\overline{x}$	S		$\overline{x}$	S	$\overline{x}$	S	
Body length, cm	7	126.4	4.62	128.4*	4.87	1.6	127.2	6.31	129.4*	4.61	1.7
	8	130.2	3.31	132.4*	5.32	1.7	131.9	5.16	133.6	4.89	1.3
	9	138.4	4.75	139.9	6.18	1.1	139.5	4.32	142.1*	5.23	1.8
Body weight, kg	7	27.3	4.32	28.8	6.45	5.2	26.5	4.33	27.9	6.56	5.0
	8	29.5	4.65	31.1*	7.97	5.1	28.6	4.16	30.7*	7.27	6.8
	9	32.2	5.16	34.1*	7.44	5.9	32.5	5.22	35.1**	7.49	7.4
Chest girth, cm	7	59.4	3.23	60.9	3.41	2.5	58.4	3.12	59.6	3.38	2.0
	8	62.5	4.45	64.2	3.11	2.6	61.3	5.69	62.4	3.75	1.8
	9	65.7	4.67	66.8	3.87	1.6	64.9	5.98	65.7	4.12	1.2
Dynamometry right, kg	7	5.7	2.32	6.5*	1.08	12.3	4.1	1.34	4.6*	1.05	10.9
	8	9.3	2.17	10.5*	1.16	11.4	7.5	2.87	8.1*	0.87	7.4
	9	11.5	3.37	12.6*	1.25	8.7	9.3	3.56	10.1*	0.83	7.9
Dynamometry left, kg	7	4.9	2.34	5.4	2.72	9.3	3.6	1.88	3.9	2.52	7.7
	8	7.7	2.43	8.3	2.83	7.2	5.7	2.45	6.1	2.61	6.6
	9	9.6	2.87	10.4	3.36	7.7	7.4	2.74	7.9	3.92	6.3

Note: statistically significant difference at the level * p <0.05; ** p <0.01 compared to the beginning of the school year.

In the course of our study, we found out that during the school year, in boys of 7 years, the body length increases by 2.0 cm, that is 1.6 % (p <0.05). The greatest increase in body length is observed in children of 8 years, by 2.2 cm that is 1.7 % (p <0.05). In children of 9 years, the body length increased only by 1.1 cm, that is 1.1 % (p <0.05). So, on average, during the school year, the total amount of the body length increase in boys from 7 to 9 years is 5.3 cm. During the school year, in girls of 7 years the increase of body length made 2.2 cm, i.e. 1.7 % (p <0.05), in 8-year-old girls this indicator increased only by 1.7 cm, that is 1.3 % (p <0.05). The greatest increase in body length is observed in 9-year-old girls – by 2.6 cm, that is 1.8 % (p <0.05). The total increase in body length in girls from 7 to 9 years is 6.5 cm. The body weight of pupils from 7 to 9 years increases by 5.0 kg in boys and 6.1 kg in girls. On average, the body weight in boys of 7 years increased by 1.5 kg, i.e. by 5.2 % (p <0.05), in girls of 7 years - by 1.4 kg, that is 5.0 % (p <0.05). In 8-year-old boys the body weight increased by 1.6 kg, that is 5.1 % (p <0.05), and in 8-year-old girls – by 2.1 kg, that is 6.8 % (p <0.05). In boys of 9 years, the body weight increased by 1.9 kg, that is 5.9 % (p <0.05), in girls of 9 years - by 2.6 kg, that is 7.4 % (p <0.01). So girls have a more significant increase in body weight, especially at the age of 8 and 9 years; in boys the largest annual increase in body weight is observed only in 9-year-old students. Analysing the individual body mass index of schoolchildren aging from 7 to 9 years, we found out that the number of children with overweight increases year by year, especially this fact concerns girls. Thus, among boys of 7 years, 22.2 % (n = 24) have an overweight, and 17.6 % of 7-year-old girls (n = 18) have an overweight too 30.2 % of 8-year-old boys (n = 29) and 26.9 % of 8-year-old girls (n = 28) have an overweight. It is worthwhile to mention that in 9-year-old girls, 33.3 % (n = 31) have an overweight, and in boys aging 9 years, there are 28.2 % (n = 26) with this parameter. Deficiency of body weight was observed in 19.4 % of 7-year-old-boys (n = 21) and in 14.7 % (n = 15) in 7-year-old girls; in boys of 8 years 23.9 % (n = 23) have a body mass deficit, in girls of 8 years - 20.2 % (n = 21). In boys of 9 years there are 1.7 % (n = 20) with a deficiency of body weight, in girls of 9 years – there are 17.2 % (n = 16). The average group indices of chest girth in schoolchildren aging from 7 to 9 years increase in boys by 4.9 cm, and in girls by 3.5 cm. It should be noted that in children of 7 years during the school year, a larger increase of chest girth is observed in boys - by 1.9 cm that is 2.5 % (p> 0.05), in girls only 1.2 cm, that is 2.0 % (p <0.05); in boys of 8 and 9 years the growth rate was the same - 1.5 cm that is 2.6 % (p <0.05) and 1.6 % (p <0.05), and in girls of 8 and 9 years this parameter is 1.1 cm that is 1.8 % (p <0.05) and 1.2 cm that is 1.2 % (p <0.05), respectively.

Analysing the average group changes of the right-hand grip strength of the schoolchildren during the school year, we found out that there is a decrease in positive dynamics in boys aging from 7 to 9 years. In 7-year-old boys, during the school year, the right hand grip strength increased by 0.8 kg that is 12.3 % (p <0.05), in 8-year-old boys - by 1.2 kg, i.e. 11.4 % (p <0.05), and in boys of 9 years 1.1 kg, that is 8.7 % (p <0.05). In girls, on the contrary, there is some positive dynamics in improving the dynamometry index of the right hand grip

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strength, in 7-year-old girls, the indicator improved during the school year by 0.5 kg, that is 10.9 % (p <0.05), in girls aging 8 years by 0.6 kg, that is 7.4 % (p <0.05), and in girls aging 9 years by 0.8 kg, that is 7.9 % (p <0.05). In the course of our study, we found out that the indicators of the left hand grip strength both in boys and girls have received positive changes during the school year. In boys aging 7 years, this indicator improved by 0.5 kg, that is 9.3 % (p <0.05), in girls aging 7 years, the improvement was by 0.3 kg, that is 7.7 % (p <0.05). In 8-year-old boys this indicator improved by 0.6 kg, that is 7.2 % (p <0.05), in 8-year-old girls - by 0.4 kg, that is 6.6 % (p <0.05). In boys aging 9 years the dynamometry of the left hand increased by 0.8 kg, that is 7.7 % (p <0.05), in girls aging 9 years old - by 0.5 kg that is 6.3 % (p <0.05).

The presented data testify about the presence of a general positive age-related dynamics of all the studied indicators, characterizing physical development in schoolchildren aging from 7 to 9 years. As a result of the study, we found that between boys and girls 7-9 years, there are no reliable differences between the main anthropometric indicators.

In the course of our study, we found out that high variability is observed in the body mass and the dynamometry of the right and left hand, both in boys and girls aging from 7 to 9 years. The coefficients of variation were in the range from 15.7 % to 64.6 %, which indicates the heterogeneity of the samples.

The next stage of monitoring was the study of the functional state of children aging from 7 to 9 years during the school year. The results of the study are presented in Table 2.

Table 2. The average statistical indicators of the functional state of children aging from 7 to 9 years during the school year (n = 595)

Indicators	Age	Boys (n=296)				±Δ.%	Girls (n=299)				±Δ.%
		The beginning of the year		The end of the year			The beginning of the year		The end of the year		
		$\overline{x}$	S	$\overline{x}$	S		$\overline{x}$	S	$\overline{x}$	S	
HR, beats /min-1	7	94.2	2.21	93.5	2.87	0.7	94.8	1.87	93.6	3.82	1.3
	8	91.3	2.65	92.4	3.43	1.2	92.0	2.18	92.4	3.66	0.4
	9	90.4	1.86	90.1	2.58	0.3	91.6	1.38	92.1	2.18	0.5
SBP, mmHg	7	94.3	7.12	94.1	8.45	0.2	101.8	8.23	101.2	9.55	0.6
	8	102.4	9.33	103.4	9.33	1.0	104.3	9.45	104.8	9.83	0.5
	9	103.8	9.26	104.1	9.91	0.3	106.8	9.21	107.2	9.79	0.4
DBP, mmHg	7	64.2	6.22	64.6	7.15	0.6	57.5	5.78	59.5	6.18	3.4
	8	63.5	5.17	63.9	6.48	0.6	60.9	4.37	61.4	5.44	0.8
	9	65.8	6.45	65.9	7.33	0.2	62.7	5.75	63.8	6.19	1.7
VC, l	7	1.3	0.44	1.4*	0.77	7.1	1.2	0.15	1.3*	0.24	7.7
	8	1.4	0.12	1.5*	0.43	6.7	1.3	0.12	1.4*	0.17	7.1
	9	1,5	0.32	1.7*	0.45	11.8	1.4	0.28	1.5*	0.34	6.7
Genchi test, sec	7	16.6	0.32	16.8	0.74	1.2	15.8	0.76	15.9	0.49	0.6
	8	17.4	0.45	17.9	0.98	2.8	16.7	0.97	17.4	0.87	4.0
	9	19.7	0.78	22.9*	0.65	14.0	19.1	0.17	21.7*	0.43	12.0
Shtange test, sec	7	12.4	0.97	12.6	1.56	1.6	12.9	0.18	13.4	0.34	3.7
	8	14.7	0.81	15.2	1.93	3.3	14.2	0.93	16.1*	0.04	11.8
	9	16.1	0.22	16.9*	1.83	4.7	16.2	0.64	16.7	0.82	3.0
Ruffier index, nominal units.	7	13.6	2.82	13.5	2.07	0.7	13.8	2.16	13.3	2.11	3.8
	8	12.6	2.45	12.4	2.14	1.6	12.9	2.41	12.2	2.09	5.7
	9	11.8	2.04	10.4**	2.18	18.1	12.1	2.35	11.3*	2.13	7.1

Note: statistically significant difference at the level * p <0.05; ** p <0.01 compared to the beginning of the school year.

The results of the study of the cardiovascular parameters of children aging from 7 to 9 years indicate a decrease in the heart rate at rest (HRrest) with age. Only in boys and girls of 8 years at the end of the school year, this indicator increased by 1.2 % (p <0.05) and 0.4 % (p <0.05), respectively. We did not reveal any significant changes in readings of systolic and diastolic blood pressure during the school year. The mean group values of blood pressure readings in all sex-age groups were within the limits of age norms.

Perfection of the respiratory apparatus in children occurs as it grows and develops. During the training in boys, the total increase in vital capacity of lungs (VC) increased by 0.4 l, in girls by 0.3 l. On average, the annual increase in boys aged 7-8 years was 0.1 l (7.1 % p <0.05) and (6.7 % p <0.05), and in boys aging 9 years was 0.2 l (11.8 % p <0.05). In girls of 7-9 years, the annual increase in the VC was the same by 0.1 l. (7.7 % p

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<0.05, 7.1 % p <0.05, 6.7 % p <0.05). The analysis of the average group results of respiratory samples in children aging from 7 to 9 years indicates positive dynamics during the training in all sex-age groups. Significant changes in the Genchi test parameters were observed only in boys of 9 years (14.0 % p <0.05) and in girls of 9 years (12.0 % p <0.05). The greatest increase in the results in the performance of the Shtange test during the year is observed in girls aging 8 years (11.8 % p <0.05), whereas in boys the greatest increase in this test (4.7 % p <0.05) took place at the age of 9 years.

In boys aging 7 years, 45.4 % (n = 49) have a low level of physical performance, in girls of 7 years - 43.1 % (n = 44); in boys aging 8 years a low level is observed in 37.5 % (n = 36), in girls aging 8 years - 38.5 % (n = 40). In boys aging 9 years 34.8 % (n = 32) have a low level, and in girls of 9 years - 35.5 % (n = 33). At the beginning of the school year, a high level of physical working capacity was not found among children of 7-9 years at all. In the annual cycle there is positive dynamics in all sex-age groups. Reliable changes in the Ruffier index took place only in schoolchildren aging 9 years. So in boys of 9 years the indicator improved by 18.1 % (p <0.01), in girls of 9 years - by 7.1 % (p <0.05).

In boys aging 7 years, 45.4 % (n = 49) have a low level of physical performance, in girls of 7 years - 43.1 % (n = 44); in boys aging 8 years a low level is observed in 37.5 % (n = 36), in girls aging 8 years - 38.5 % (n = 40). In boys aging 9 years 34.8 % (n = 32) have a low level, and in girls of 9 years - 35.5 % (n = 33). At the beginning of the school year, a high level of physical working capacity was not found among children of 7-9 years at all. In the annual cycle there is positive dynamics in all sex-age groups. Reliable changes in the Ruffier index took place only in schoolchildren aging 9 years. So in boys of 9 years the indicator improved by 18.1 % (p <0.01), in girls of 9 years - by 7.1 % (p <0.05).

The next stage of monitoring was the study of the physical fitness of children aging from 7 to 9 years. The average statistical results are presented in Table 3. The analysis of the results obtained for physical fitness indicates positive dynamics of all motor qualities during training. In the annual cycle, the speed characteristics did not change significantly. The result in the 30 m race in all sex-age groups improved by 1.6 % (p <0.05), in girls of 7 years - by 1.5 % (p <0.05). Indicators of the flexibility have not changed in boys aging 7 years in the course of the school year.

Table 3. Average statistical indicators of physical fitness of children aging from 7 to 9 years old during the school year (n = 595)

Indicators	Age	Boys (n=296)				±Δ.%	Girls (n=299)				±Δ.%
		The beginning of the year		The end of the year			The beginning of the year		The end of the year		
		$\overline{x}$	S	$\overline{x}$	S		$\overline{x}$	S	$\overline{x}$	S	
Running 30 m, sec	7	6.5	0.23	6.4	0.78	1.6	6.6	0.67	6.5	0.85	1.5
	8	6.3	0.34	6.2	0.93	1.6	6.4	0.98	6.3	0.94	1.6
	9	6.2	0.55	6.1	1.04	1.6	6.3	0.49	6.2	1.13	1.6
Sit-up from the back-lying position, times /1 min	7	21.3	4.26	21.9	4.41	2.7	20.8	4.47	21.3	4.97	2.3
	8	24.1	4.82	25.6	4.83	5.9	23.6	4.92	23.8	5.16	0.8
	9	26.8	4.12	27.1	4.33	1.1	25.9	4.58	26.4	5.22	1.9
Shuttle running 4 × 9 m, sec	7	12.9	0.77	12.8	0.59	0.8	12.8	0.32	12.7	0.58	0.8
	8	12.6	0.84	12.5	0.78	0.8	12.5	0.91	12.5	0.47	0.0
	9	12.1	0.56	11.9	1.17	1.7	12.2	0.62	12.0	0.95	1.7
Bending forward from the sitting position, cm	7	1.4	1.11	1.4	1.24	0.0	2.6	1.21	2.7	1.68	3.7
	8	1.6	1.31	1.7	1.61	5.9	3.1	1.98	3.3	1.31	6.1
	9	2.2	1.79	2.3	1.11	4.3	3.7	1.87	3.8	1.72	2.6
Standing long jump, cm	7	117.4	21.03	119.8	20.12	2.0	116.2	22.13	118.4	21.32	1.9
	8	128.6	18.21	129.6	17.43	0.8	127.5	19.54	129.1	15.41	1.2
	9	132.0	15.26	135.4	18.32	2.5	131.8	19.26	132.8	13.86	0.8
Bondarevskyi test, sec	7	9.4	4.09	9.3	4.76	1.1	10.2	3.16	10.3	3.42	1.0
	8	9.6	4.33	9.7	4.89	1.0	10.4	4.54	10.6	4.76	1.9
	9	11.1	5.78	11.2	5.97	0.9	11.7	4.87	11.9	4.62	1.7

The analysis of the average statistical results of boys aging from 7 to 9 years in tests characterizing the strength and speed-strength characteristics are slightly higher than those of girls. In girls aging from 7 to 9 years, the average results of flexibility, coordination of movements and agility are better than in boys, only at the age of 9 boys have higher results in agility. It should be pointed out that there were no significant changes in motor tests during the school year in all sex-age groups. We also found high variability in the indicators characterizing the development of flexibility and static coordination. In boys aging from 7 to 9 years, the variation coefficients

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ranged from 43.5 % to 81.9 %, in girls aging from 7 to 9 years - from 31.0 % to 63.9 %. This feature indicates the heterogeneity of the sample and the process of formation of these motor qualities.

Our next stage of the study was the study of the morbidity of schoolchildren aging from 7 to 9 years during the school year. Analysis of medical records indicated a high percentage of children who suffered from a disease in the course of the year: in the boys of 7 years - 87.0 % (n = 94), in the boys of 8 years - 89.6 % (n = 86), in the boys of 9 years - 95.6 % (n = 88) were ill. In the girls of 7 years 96.1 % (n = 98) were ill, in the girls of 8 years - 91.3 % (n = 95) and in the girls of 9 years - 95.7 % (n = 89) got sick in the course of the year. Such a high incidence rate of children aging from 7 to 9 years can be explained by the presence of stress factors, environmental conditions and social living standards.

Analysing the medical records of 7-year-old boys, we found that 55.8 % (n = 58) were ill 2 times a year, and 34.6 % (n = 36) were ill more than 3 times a year. In 8-year-old boys 63.5 % (n = 61) were sick 2 times a year and 30.2 % (n = 29) - more than 3 times a year. In boys of 9 years 53.3 % (n = 49) got sick more than 2 times a year and 22.8 % (n = 21) - more than 3 times a year. Among the boys aging from 7 to 9 years there were those who were ill with two classes of diseases: 43.5 % of 7-year-old boys (n = 47), 30.2 % of 8-year-old boys (n = 29) and 33.7 % of 9-year-old boys (n = 31). There were boys who got sick with three classes of diseases: 8.3 % of 7-year-old boys (n = 9), 11.4 % of 8-yearold boys (n = 11) and 7.6 % of 9-year-old boys (n = 7). Altogether 61.7 % of 7-year-old girls (n = 63) got sick 2 times a year, in girls of 8 years - 56.8 % (n = 58) and in girls of 9 years - 40.8 % (n = 38), 28.4% of 7-year-old girls (n = 29) got sick more than 3 times a year, 29.8 % of 8-year-old girls (n = 31) and 25.8 % of 9-year-old girls (n = 24) were ill more than 3 times a year. Number of girls who were sick for two classes of diseases: 36.2 % of the 7-year-old girls (n = 37), 26.0 % of 8-year-old girls (n = 27) and 20.4 % of 9-year-old girls (n = 19) in the course of the school year. Number of girls who were sick for the three classes of diseases: 8.8 % of 7-year-old-girls (n = 9), 8.6 % of 8-year-old-girls (n = 9) and 8.6 % of 9-year-old girls (n = 8). There was no particular difference in the incidence of diseases of boys and girls aging from 7 to 9 years. We found that, on average, children from 7 to 9 years have missed 12-17 days of schooling.

The results of our studies indicate that in the nosology of the incidence rate for the period 2016-2017 school year, respiratory diseases are in the first place in boys and girls aging years, 79.6 % and 82.3 % respectively; in boys of 8 years - 85.4 %, in girls of 8 years - 82.7 %; in boys of 9 years - 82.6 %, in girls of 9 years - 83.9 %. Mostly these are acute respiratory diseases of the upper respiratory tract, influenza and pneumonia, and other acute respiratory infections of the lower respiratory tract.

Most diseases of the respiratory organs are seasonal, the maximum incidence was recorded in the autumn-winter and winter-spring seasons. The structure of respiratory diseases includes: rhinitis, pharyngitis, laryngitis, laryngotracheitis, bronchitis, diseases of the tonsils and adenoids. It should be noted that the structure of morbidity, especially respiratory pathology, is due to the conditions of schooling, the move by public transport, contact with sick viral infections in the classrooms, inappropriate nutrition, psycho-emotional loads and so on.

Diseases of the musculoskeletal system are in the second place, both in boys and girls aging from 7 to 9 years. The violation of posture is observed in 43.5 % (n = 47) of 7-year-old boys, 48.9 % of 8-year-old-boys (n = 47) and 53.3 % of 9-year-old girls (n = 49). According to the study, 42.2 % of 7-year-old girls (n = 43) have got posture disorders, 49.0 % of 8-year-old girls (n = 51) and 50.5 % of 9-year-old girls (n = 47). There is a negative tendency to increase the number of children with a violation of posture in all age and sex groups. Modern scientists (Kashuba, 2017; Galan, 2018;) regard the status of the locomotor system as a general indicator of health as a whole. After all, this pathology affects the status of virtually all functional systems of the body. Further among the diseases are infectious and parasitic diseases. Mental disorders, endocrine and allergic diseases, diseases of the nervous system and sensory organs are quite common among children of 7-9 years.

In the opinion of (Moiseenko, 2017) the reform of schooling without taking into account the state of health and psychological readiness for the study of the primary school children significantly increased their morbidity. Information overloads, stressful situations, modernization of the educational process require a lot of exertion from the child's body, which, along with other negative factors (physical activity restriction, subject education system, insufficient natural lighting, total computerization, etc.) leads first to functional disorders, and subsequently to the formation of organic pathology.

Discussion

Monitoring of the physical state in the modern educational process, one of the important elements of the management of the pedagogical process. In the scientific literature, the physical state is defined as a complex evaluation of morpho-functional status, health status, physical fitness and performance. In the study of indicators of physical development, we found that in the younger school age, the high variability of the body mass index, which indicates the process of forming of the basic anthropometric characteristics. The results of our studies are confirmed in the works of (Biletska, 2006; Nakonechnyi, 2017; Kozhokar, 2018; Yarmak, 2018), who points out that the primary school age in terms of changing somatotypes, the rate of increase of body length and body weight is heterogeneous. In the age range from 7 to 9 years, deep and extremely ambiguous rearrangements take place.

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The results of our studies confirm the data of (Goncharova, 2007) about the lack of a reliable difference between indicators of physical development of boys and girls aging from 7 to 9 years. In this age range, the tissue structure continues to form and grow. The development of muscle strength is mainly due to the growth of muscle mass (hypertrophy) and by increasing the efficiency of muscle control and has a heterochronic character. The growth rate of body length slows down while the body weight increases by 2.0-2.5 kg per year. The circumference of the chest increases, thanks to which the vital capacity of the lungs increases. On average, the annual increase in the VC in boys was 0.1-0.2 l and in girls - 0.1 l.

The results of the examination of the state of the cardiovascular and respiratory systems confirmed and supplemented the results of the studies of (Dmytruk, 2011; 2016). Analysis of the average statistical heart rate at rest in boys and girls aging from 7 to 9 years indicates a positive trend during the school year. In all sex-age groups there is a wave-like increase in blood pressure. The analysis of the data of the functional breath holding tests on inhalation and exhalation shows that with age in boys and girls aging from 7 to 9 years, the resistance to hypoxia increases. However, the function of breathing remains not perfect. That is, the breathing apparatus is less productive.

The breath holding in children during physical exertion causes a rapid decrease in the saturation of the blood with oxygen. Therefore, when teaching children physical exercises, it is necessary to coordinate their breathing strictly with the movements of the body. Teaching proper breathing during exercise is an important task when conducting classes with students aging from 7 to 9 years.

The results of the reaction of the cardiovascular system to the dynamic load (Ruffier's test) allowed us to assess the level of physical performance of schoolchildren aging from 7 to 9 years. The results of our studies are confirmed by the data of (Biletska, 2006; 2016). By the value of the Ruffier index, the overwhelming majority of the surveyed primary school age children had a satisfactory response to the dynamic load and corresponded to a low level of physical performance. Although with age there is a positive trend, indicating an increase in the reserve capabilities of the cardiovascular system. Positive dynamics also testifies to the processes of the formation of mechanisms responsible for the adaptive capabilities of the body to physical loads.

Analysis of the development of the basic motor qualities of schoolchildren aging from 7 to 9 years indicates that boys have higher rates in all motor tests, except for the test "bending forward from the sitting position" and the Bondarevskyi test, characterizing the static coordination of movements. This is explained by the heterochronism of the development of the motor qualities of a person.

There was no significant difference (p> 0.05) during the study of physical fitness between boys and girls aging from 7 to 9 years. It should also be pointed out the influence of the genetic factor on which the process of formation of motor functions directly depends. Structural reorganization is determined by the basic biological regularity - the heterochronism of the formation of the basic anatomical and physiological systems of the body. The development of the basic motor qualities repeats this process.

In the structure of the incidence of schoolchildren aging from 7 to 9 during the 2016-2017 school year, respiratory diseases, diseases of the musculoskeletal system, skin and subcutaneous tissue, some infectious and parasitic diseases, diseases of the digestive organs, the eye and its adnexa predominated. The reported morbidity data confirm and supplement the results of studies (Sitnik, 2013; Andrieieva, 2017; Bodnar, 2018).

Determination of the morbidity rate of schoolchildren aging from 7 to 9 years is necessary not only for carrying out annual statistical data, but also for correcting the forms and content of physical education and for checking of the efficiency of means and methods of pedagogical influence

Conclusions

In the course of monitoring of the physical condition of 7-9-year-old schoolchildren, we found that the studied indicators of physical development vary in accordance with the general biological patterns characteristic of children aging 7-9 years. Analysis of individual body mass indexes, indicates a negative dynamic in the number of schoolchildren with excessive body weight. This fact causes concern, as in boys of 8 years there are 30.2 % and in girls of 9 years there are 33.3 % with excessive body weight.

The average statistical indicators of the functional state of schoolchildren of 7-9 years are within the limits of age norms, their positive dynamics with age is observed. The predominantly low level of physical performance in schoolchildren aging from 7 to 9 years is indicative of the process of forming the adaptive capabilities of the cardiovascular system to dynamic loads. Analysis of the results of physical fitness indicates a positive dynamics of the basic motor qualities in the annual cycle, and the lack of reliable changes between boys and girls.

High incidence rate and frequency of morbidity of schoolchildren aging from 7 to 9 years indicate a low level of resistance of the body. The respiratory diseases are in the first place and the diseases of the locomotor system are in the second place. The number of children with impaired posture in the sagittal and frontal plane is increasing every year and this fact is a cause for concern.

Conflicts of interest – If the authors have any conflicts of interest to declare.

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