Influence of Acyclic Sports on Figures of the Respiratory System of Young Athletes of 10-12 Years

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Abstract

This work examines the impact of sports on functional indicators of respiratory system of children of school age of 10-12 years old engaged in acyclic types of sports activities. Research methods used: physiometry: lung capacity, breathing rate, respiratory minute volume, respiration depth, specific assay breath (timed expiratory capacity), mathematical and statistical methods. Average rates of lung capacity, breathing rate, respiratory minute volume, respiration depth, changes of these indicators of school children of 10-12 years old engaged in acyclic types of sports activities were defined. Respiratory samples revealed a significant increase in the functional reserve of the respiratory system.

Keywords: Respiratory System, Lung Capacity, Breathing Rate, Respiration Depth, Sport

Introduction

Recently there has been a tendency to increase the number of children engaged in regular sports activities, consequently the young athletes develop neurohumoral mechanisms of urgent and long-term adaptation, characteristic for each type of sports activity, providing a fast connection of functions to achieve maximum beneficial results. However, in children's sports we must follow the principle that the active load should be dosed according to the age-related functional capabilities of an organism (N. A. Agadzhianian, 2004).

Well developed breathing apparatus is a reliable guarantee of adequate activity of cells. It is known that the death of cells in the body ultimately associated with the lack of oxygen therein. And conversely, it was found that the more the body's ability to absorb oxygen the higher the human physical performance.

Trained external breathing apparatus is the first step to the road to better health.

Research Objective

To reveal the influence of sports on indicators of the respiratory system of children of 10-12 years old engaged in acyclic sports.

Research Tasks

To determine functional state of respiratory system of children of 10-12 years old engaged in acyclic sports.
To determine physiological reserves of respiratory system of children 10-12 years old engaged in acyclic sports.

Organization and Research Methods

The objects of the research were boys of 10-12 years old, living in Kaindy town, Chui oblast, Kyrgyz Republic, schools number 1, 2, 3, training in child and youth sports school.

Children were engaged in basketball, volleyball, freestyle wrestling and boxing. Total: 260 children. For each sport 62-68 boys, 20-25 children in each age group were studied.
Duration of exercises was 90 minutes, three times a week.

Research Methods

We investigated the respiratory rate and respiratory minute volume using Volumeter for 1 minute at rest.
Respiration depth was calculated by computational method according to formula:

Respiration depth = respiratory minute volume/ breathing rate

Lung capacity was determined using a dry inspirometer. This research was carried out in a state of rest, in vertical position. The examined produced a deep breath and deep breathing-out into the inspirometer, repeating the procedure three times. We took into account the index with the highest value and recorded data of values in milliliters.

Stange-Genchi samples were conducted by holding of breath on inhalation and exhalation with a stopwatch. The study was conducted on the tidal breathing phase, length of time during which the child after three deep breaths at the height of the fourth inhalation and exhalation is able not to breathe was determined. Healthy child reacts to the test differently depending on age, sex and level of physical development.

Mathematical and Statistical Methods

- arithmetic middling;
- standard deviation;
- error of arithmetic middling;

Evaluation of reliability of difference between homogeneous indicators was carried out on the critical value of the Student's t-test. T-actual and number of degrees of freedom were calculated for this purpose.

Research Results

At intense physical activity external respiration apparatus can improve its performance by 10-15 times. Herewith, pulmonary ventilation increases, which is enhanced by the breathing rate and respiration depth. Sport activity promotes development of breathing apparatus (M. P. Abramovich, 2010).

Indicators of respiratory rate of children of 10-12 years old engaged in different types of sports activities becomes less frequently over the years: individuals engaged in freestyle wrestling from 20,2 ± 1,8 to 16,4 ± 1,2 times per min., engaged in boxing from 21,3 ± 2,3 to 18,3 ± 1,5 times per min., engaged in volleyball from 24,0 ± 1,9 to 20,4 ± 1,3 times per min., and engaged in basketball from 23.9 to 19.3 times per min.

Decrease in frequency of breathing was observed at children engaged in freestyle wrestling, as opposed to other specializations. Higher respiratory rates have persons engaged in basketball, which in 10 years old is more by 2.8 times per minute, 11 years old by 2.0 times per minute, and 12 years old by 2.9 times per minute, as compared to children engaged in freestyle wrestling (Table 1). The indicators of respiration rate of individuals engaged in volleyball as against boxing specialization have the same authentic tendency (P<0,001, P<0,01) for increase in all age periods, which is in 10 years old 2.7 times per min, in 11 years old 1 9 times per min., and in 12 years old 2.1 times per min.

Table 1: Indicators of Breathing Rate of Children of 10-12 Years Old Engaged in Different Types of Sports Activities

No.	Sports	10 years old	11 years old	12 years old
1.	Wrestling (n=68)	20,2±1,8	18,3±1,5	16,4±1,2
2.	Boxing (n=62)	21,3±2,3	20,4±1,8	18,3±1,5
3.	Volleyball (n=67)	24,0±1,9 ***2	22,3±1,4 **2	20,4±1,3 **2
4.	Basketball (n=63)	23,0±1,3 ***1	20,3±1,2 **1	19,3±1,7 ***1

Note: **- authentic at (P<0,01), *** authentic at (P<0,001), ***1- difference in indicators between freestyle wrestling and basketball, **2- difference between volleyball and boxing.

Respiratory minute volume of children of 10-12 years old engaged in different kinds of sports activities increases over the years: highest rates of respiratory minute volume observed in children engaged in basketball: from 3984,3 ± 41,2 ml. to 4750,2 ± 49,3 ml. and lowest rates in individuals engaged in freestyle wrestling, which is from 3520 ± 37,0 ml. to 4250,3 ± 46,0 ml (Table 2.).

Table 2: Indicators of Respiratory Minute Volume of Children of 10-12 Years Old Engaged in Different Kinds of Sports Activities

No.	Sports	10 years old	11 years old	12 years old
1.	Wrestling (n=68)	3520,3±37,0	3830,3±37,2	4250,3±40,0
2.	Boxing (n=62)	3670,0±40,4	4010,3±33,2	4370,4±44,3
3.	Volleyball (n=67)	3756,1±39,4	4106,4±40,3	4200,1±50,3
4.	Basketball (n=63)	3884,3±41,2	4130,5±41,2	4550,2±49,3

Respiration depth of children engaged in acyclic sports increases over the years. The lowest indicators in all age periods observed at individuals engaged in volleyball and basketball (Table 3.).

Table 3: Indicators of Respiration Depth of Children of 10-12 Years Old Engaged In Different Kinds of Sports Activities

No.	Sports	10 years old	11 years old	12 years old
1.	Wrestling (n=68)	174,2±13,0	209,3±19,4	259,1±21,4
2.	Boxing (n=62)	172,3±10,7	196,5±11,5	238,8±17,4
3.	Volleyball (n=67)	156,8±10,2 **1	184,1±10,8 **1	205,8±16,4 **1
4.	Basketball (n=63)	173,2±11,0 *2	208,3±14,6 *2	246,1±18,2 *2

Note: **- authentic at (P<0,01), * authentic at (P<0,05), **1- difference in indicators between freestyle wrestling and basketball, *2- difference between volleyball and boxing.

The highest indicators were observed at children engaged in freestyle wrestling. In all age groups, as compared with indicators of children of other studied groups, indicators were significantly higher (P <0,01), (P <0,05).

Lung capacity is a factor of mobility of the lungs and chest. Determination of lung capacity is important mainly for the diagnosis (Ch. Weiss et al, 1986; W.A. Briscoe, 1990).

Lung capacity of young athletes engaged in various sports is higher and they can ventilate more air through the lungs per unit of time than their peers not engaged in sports (Abramovich M.P., 2010).

Indicators of lung capacity of children of 10-12 years old engaged in various kinds of sports activity increases with the increase of years. The highest indicators of lung capacity observed at individuals engaged in freestyle wrestling, herewith from 2105,3 ± 10,4 to 2063,7 ± 14,4 ml. The lowest indicators were observed at individuals engaged in volleyball, herewith from 1874,2 ± 11,2 to 2175,1 ± 15,3 (Table 4).

Table 4: Indicators of Lung Capacity of Children of 10-12 Years Old Engaged in Different Kinds of Sports Activities

No.	Sports	10 years old	11 years old	12 years old
1.	Wrestling (n=68)	2105,3±10,4	2320,5±12,3	2560,7±14,4
2.	Boxing (n=62)	1938,3±13,1	2170,1±14,6	2320,3±15,4
3.	Volleyball (n=67)	1874,2±11,2	2035,6±13,3	2175,1±15,3
4.	Basketball (n=63)	2024,3±15,3	2267,3±16,3	2430,2±17,4

Breath-holding of children at inspiration (Stange) of all specializations increases with the increase of years, which amounts to: wrestlers from 37,4 ± 0,3 sec to 42,3 ± 0,8 s, boxers from 36,3 ± 0,7 to 39,3 ± 0,7 sec, volleyball players from 35,4 ± 0,5 to 38, 4 ± 0,8 sec, basketball players from 35,3 ± 0,8 to 40,5 ± 0,9 sec.

The maximal breath holding time at inspiration (Genche) in all age groups was observed at children engaged in wrestling and boxing. The indicators of children engaged in volleyball and basketball are lower (Table 5).

Table.5 Breath-Holding Test (Stange-Genchi Samples) of Children of 10-12 Years Old Engaged In Different Kinds of Sports Activities

No.	Sports	Stange	Genchi
10 years old			
1.	Wrestling (n=68)	37,4± 0,3	28,3±0,4
2.	Boxing (n=62)	36,3±0,7	27,4±0,3
3.	Volleyball (n=67)	35,4±0,5	25,2±0,5
4.	Basketball (n=63)	35,3±0,8	26,4±0,3
11 years old			
1.	Wrestling (n=68)	39,5± 0,7	30,2±0,5
2.	Boxing (n=62)	37,4±0,9	29,4±0,6
3.	Volleyball (n=67)	36,8±0,7	27,4±0,7
4.	Basketball (n=63)	37,2±0,6	28,2±0,8
12 years old			
1.	Wrestling (n=68)	42,3± 0,8	33,4±0,7
2.	Boxing (n=62)	39,3±0,7	31,8±0,8
3.	Volleyball (n=67)	38,4±0,8	30,2±0,9
4.	Basketball (n=63)	40,5±0,9	30,9±0,8

Discussion

Muscle work causes a manifold increase in the volume of pulmonary ventilation. Minute volume of pulmonary ventilation of athletes training predominantly for endurance reaches 130-150 l/min or more. Increase in pulmonary ventilation at work of untrained individuals is the result of hurried breathing. Athletes with a high breathing rate have an increasing respiration depth. This is the most rational way of urgent adaptation of breathing apparatus to load. Deep breathing is accompanied by a decrease in relative volume of the so-called harmful space.

Achievement of the limit values of pulmonary ventilation, which is typical for highly experienced athletes, is the result of high coherence of acts with contraction of respiratory muscles, as well as movements in space and time: ataxia in the respiratory muscles destroys the respiratory rhythm and leads to deterioration of pulmonary ventilation (N. A. Fomin, Iu. N. Vavilov, 1991).

Lung capacity is an indicator reflecting the functionality of the respiratory system. It allows you to indirectly estimate the area of respiratory surface of the lungs, where gas exchange occurs between the alveolar air and blood capillaries of the lungs, that is, determines the possibility of adaptation of the organism to physical activity, to deficiency of oxygen in inspired air (S.B. Tikhvinskii, S.V. Khrushchev, 1991).

The examination of the respiratory system of children of 10-12 years old engaged in various kinds of sports activity revealed that the indicators respiratory rate of the persons engaged in wrestling is less than of persons engaged in other sporting activities. The highest rates of lung capacity are also found in children engaged in freestyle wrestling, herewith from 2105,3 ± 10,4 to 2063,7 ± 14,4 ml. The higher the value of the lung capacity, the greater the respiratory surface of the lungs is, which means that increase in pulmonary ventilation rate is achieved more easily. The value of lung capacity characterizes the degree of development of respiratory muscle and functional capacity of respiratory system.

Reserve capacities of breathing of children and adolescents increases under the influence of physical exercises: lung capacity and minute pulmonary ventilation clearly increases, more oxygen is used from liter of ventilated air, oxygen-transport function of blood circulation increases, oxygen capacity of blood increases, the mechanisms of tissue respiration improves, ability to continue physical activity increases expressed in hypoxemic and hypercapnic conditions with generation of a large oxygen debt (S. B. Tikhvinskii, S. V. Khrushchev , 1991).
Children and adolescents are able to hold their breath less than adults. Their blood oxygen saturation reduces faster than of adults and breathing after delay resumes at even higher oxygen content in the blood. Therefore children and adolescents are inferior to adults in respect of ability to overcome the lack of oxygen, hypoxic and hypercapnic changes in blood (A.G. Khripkova, 1990).

The greatest delay of breathing at inhale (Stange) and at breathing-out (Genchi) in all age groups is seen in children engaged in wrestling and boxing. Indicators of the children engaged in volleyball and basketball are lower.

Conclusion

Average rates of lung capacity, respiratory rate, respiratory minute volume, respiration depth and changes in these indicators of schoolchildren of 10-12 years old engaged in acyclic kinds of sports activities were defined.

Among children of 10-12 years old engaged in various kinds of sports activity was revealed that tidal volumes of children engaged in freestyle wrestling are more adapted to muscle strain in comparison with children engaged in other acyclic sports.

Physiologic reserves and endurance of the respiratory system of children engaged in wrestling and boxing is higher than of young athletes engaged in volleyball and basketball.

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