International Journal of Business, Human and Social Sciences
ISSN: 2517-9411
Vol:6, No:6, 2012

General Haemodynamics, Aerobic Potential and Strategy for Adaptation of Students to Team Sports

V.A. Baronenko, S.I. Bugreeva, K.R. Mekhdieva

Abstract**—**Differentiated impact of team sports (basketball, indoor soccer, handball) on general haemodynamics and aerobic potential of students who specialize in technical subjects is detected only on the fourth year of studies in the institute of higher education.

Those who play basketball and indoor soccer have shown increase of stroke and minute volume of blood indices, pumping and contractile function of the heart, oxygenation of blood and oxygen delivery to tissues, aerobic energy supply and balance of sympathetic and parasympathetic activity of the nervous regulation mechanism of the circulatory system.

Those who play handball have shown these indices statistically decreased.

On the whole playing basketball and indoor soccer optimizes the strategy for adaptation of students to the studying process, but playing handball does the opposite thing.

The leading factor for adaptation of students is: those who play basketball have increase of minute blood volume which stipulates velocity of the system blood circulation and well-timed oxygen delivery to tissues; those who play indoor soccer have increase of power and velocity of contractile function of the heart; those who play handball have increase of resistance of thorax to the system blood flow which minimizes contractile function of the heart, blood oxygen saturation and delivery of oxygen to tissues.

Keywords**—**team sports; general haemodynamics; aerobic potential; strategy for adaptation.

I. Introduction

SUCCESSFUL adaptation of students who specialize in mathematical and technical subjects to team sports depends on their general haemodynamics including functional reserves of their cardiovascular system. On molecular level it is shown in criteria of energetic potential connected to aerobic possibilities of cardiovascular system.

M.N. Kondrashova [1,2] has proved that during motion energy-supply of various functional systems is determined by the amount of succinic acid participating in tissue respiration processes. It provides high-level and rate of energy-supply.

I.A. Arshavsky [3] has established the principle of bioenergetics self-regulation during motion. This principle implies that muscular work causes great consumption of compounds rich in energy (adenosine triphosphate and others) and energy substrates (carbohydrates, fats); and increase of spent energy resources via the feedback mechanism. According to these data, he has formulated "The energy rule of skeletal muscle".

Further development of this idea is envisioned in the scientific research of F.Z. Meyerson [4,5] who has proved that in cells of trained muscles the energy balance is provided with concentration of phosphates rich in energy and their activity of genetic apparatus (DNA and RNA). Adaptation to physical activity at cell and tissue level increases activity of ATP, reduces oxygen consumption, prevents from ATP deficiency during physical activity which creates conditions for economization of energy and plastic resources of the organism preventing from deterioration and damage of vitally important systems of the organism on the whole. According to the research conducted by F.Z. Meyerson and M.G. Pshennikova [6], physical trainings increase adaptative resources of the organism due to activization of energy-supply and genetic apparatus of cells in the organism.

Energy metabolism in the cardiac muscle cells has been studied by V.I. Kapelko [7]. When the synthesis of ATP is abnormal, cellular mechanisms of self-defense mobilize, and as a result contractile function of the heart, the main energy consumer, reduces much more than energy supply [8]. This allows the cells to retain vital capacity in critical conditions for some time.

Experimentally it is proved [9] that difficult exercises in such kind of sports like aikido which involve constant change of body position during short time intervals cause arterial hypoxemia. These negative changes in blood oxygenation are irreversible and during a systematic and long training with aikido exercise they stimulate increase of effectiveness of systems which determine considered processes.

Undoubtedly, these mechanisms of bioenergetics, which operate while team sports influence the organism. However, according to the recent information, these kinds of sports train not only aerobic but also anaerobic systems. The state of general haemodynamics, processes of oxygen delivery to tissues and oxygenation of the organism and also the adaptation strategy to team sports remain unstudied. This is the purpose of our research.

II. The Research Setup and Methods of Research

The research of general haemodynamics peculiarities of students during adaptation to team sports was performed in the Sports complex of the Ural Federal University named after the first President of Russia B.N. Yeltsin during 4 years of studies (2008-2011). Seventy five students from the age of 17 to 22

Baronenko V.A, Bugreeva S.I., Mekhdieva K.R. are with the Ural Federal University named after the first President of Russia B.N.Yeltsin, Russia, 620002, Ekaterinburg, ul. Mira, 19, tel. +79122427722, kamilia_m@mail.ru

who specialize in technical subjects were examined. They were divided into 3 groups of 25 persons, according to kind of applied sports – basketball, handball and indoor soccer.

The following indices have been registered to characterize the functions of cardiovascular system: systolic and diastolic blood pressure (mm, Hg) and heart rate (bmp) using apparatus "OMRON" produced in Japan. Stroke output (ml) has been estimated with the Starr's formula and minute output (mlpm) – with the following formula:

Minute output = stroke output * heart rate [10].

Functional reserves of cardiovascular system have been estimated using the following indices: Robinson index and productivity of functioning of the heart – Ruffier index [11]. The condition of general haemodynamics has been studied with the computer apparatus MARG 10-01 "Microlux" produced in Russia, with the following criteria: elastic characteristics and tone of a vascular wall of the blood circulation system; contractile and pumping functions of the heart; resistance of vessels and thorax to system blood flow; oxygenation of blood and oxygen delivery to tissues.

All the results have been processed with mathematical-statistical methods [12]. The results differentials have been estimated with the criterion of Student and considered to be reliable if $P < 0.05$.

Correlated connections of indices, which reflect peculiarity of vital activity of the organism, have been determined by the Spirmen method. The value of adaptation has been assessed with the "method of the main components" which definitively reflects the concept of factor analysis.

All these team sports positive effects proceeds according to the principle of optimization, that has been formulated by N.Rashevsky [14] and it reads as follows that organism strives to get maximum positive effect with minimum consumption of plastic and energy resources.

TABLE I
FUNCTIONAL INDICES OF CARDIOVASCULAR SYSTEM OF STUDENTS (M±m)

Kind of sports	Indices	Sample time			
		1 year	2 year	3 year	4 year
Basketball	Heart rate (bmp)	72.6±1.5	83.7±2.44	82.0±3.1	78.0± 3.9
	Systolic blood pressure (mm Hg)	130.9±2.7	137.0±3.7	124.0±1.88	128.0± 3.5
	Diastolic blood pressure (mm Hg)	74.1±1.64	90.6±5.0	83.0±3.7	77.0± 1.2
	Pulse pressure (mmHg)	57.0±1.8	46.5±4.2	41.0±4.7	51.0±2.1
	Stroke volume (ml)	64.0±1.2	58.5±4.7	66.0±0.8	70.2±1.4 *
	Minute volume (ml)	4366.0±110.8	4520.0±299.0	4300.0±167.0	5460.0±163.0 *
	Robinson index (points)	94.93±2.54	95.1±2.2	96.0±2.4	86.0±3.3 *
	Ruffier index (points)	9.9±0.63	10.4±0.7	13.0±0.8	9.5±0.6
	Adaptation potential	2.27±0.06	2.2±0.065	2.1±0.04	2.04±0.07
Handball	Heart rate (bmp)	78.4±3.01	70.3±1.4	88.0±2.5	86.5±2.6 *
	Systolic blood pressure (mm Hg)	124.8±1.99	122.0±1.5	123.0±1.78	125.0±4.0
	Diastolic blood pressure (mm Hg)	76.0±1.22	76.0±0.9	76.0±1.9	81.5±3.0
	Pulse pressure (mmHg)	48.7±1.5	45.7±1.7	43.5±1.7	43.5±1.8
	Stroke volume (ml).	69.0±0.9	67.0±1.1	65.8±1.7	66.0±1.2
	Minute volume (ml)	4400.0±234.0	4336.0±135.0	4220.0±166.0	4180.0±176.0
	Robinson index (points)	98.10 ±2.0	91.0±1.8	86.0±2.1	106.0±3.0*
	Ruffier index (points)	10.63±0.85	12.7±0.67	14.0±0.9	10.6±0.4
	Adaptation potential	2.28±0.07	2.19±0.06	2.11±0.05	2.1±0.04
Indoor soccer	Heart rate (mmHg)	75.8±1.29	72.0±2.32	75.0±2.1	69.0±2.9
	Systolic blood pressure (mmHg)	129.0±1.42	119.0±1.8	126.0±1.5	126.0±2.6
	Diastolic blood pressure (mmHg)	67.9±1.47	68.5±0.99	70.0±1.1	95.0±2.4
	Pulse pressure (mmHg).	61.5±1.7	54.5±1.6	52.7±1.8	53.0±1.5
	Stroke volume (ml)	60.2±1.5	76.4±1.1	74.7±1.2	70.0±1.5 *
	Minute volume (ml)	4500.0±139.0	4500.0±211.0	5550.0±224.0	4830.0±198.0
	Robinson index (points)	98.23±2.4	93.0±2.6	89.0±3.4	97.0±2.9
	Ruffier index (points)	10.0±0.63	10.0±0.72	10.0±0.5	10.0±1.2
	Adaptation potential (points)	2.1±0.05	2.1±0.06	2.0±0.05	1.9±0.05

M – average; m – average error; * - statistically proved differences in comparison with basic data ($p<0.05$)

III. Results and Discussions

As indicated in Table I, basic criteria of function of cardiovascular system (1st year of studies) of all the students are within the scope of the age norm. During the second and third years of studies no aberration has been registered. On the fourth - final - year of studies, statistically proved differences between indices depending on kind of sports have been registered.

Those who play basketball have shown statistically proved increase of stroke and minute blood volume and decrease of Robinson index, which, according to the Apanasenko concept [12] indicates increase of aerobic abilities of cardiovascular system of students.

On the contrary, playing handball promotes statistically proved increase of heart rate, decrease of stroke and minute volume of blood and increase of Robinson index which indicates decrease of aerobic abilities of cardiovascular system and compensatory heart rate increase. Students playing indoor soccer have shown the following indices increase: minute and stroke volume of blood though Robinson index has remained at the initial level which indicates minimum positive influence of this kind of sports on cardiovascular system functions.

The analysis of the findings has brought out that indices of elastic characteristics and tone of blood vessels of all examined students on the fourth year of studies are within the scope of physiological standard (Table II), but differ depending on kind of sports.

TABLE II
Indices of Elastic Characteristics and Tone of Vessels Wall

Kind of sports/ Indices	Pulse filling index	Pulse wave pressure (mmHg)	Aorta pulsation amplitude (mOm)	Average blood pressure (mmHg)
Basketball	36.0±12.1	95.0±1.9	162.0±10.4	95.0±1.8
Handball	51.5±11.6	97.0±1.8	152.0±6.9	98.0±2.0
Indoor Soccer	93.0±11.9*	90.0±1.7	135.0±8.5*	91.0±2.0
Standard				80.0-105.0

* - statistically proved differences of indices ($p<0.05$)

Students who play indoor soccer have shown the principle indicia of elastic characteristics of vessels – pulse wave pressure statistically proved higher than students who play basketball and handball. At the same time students who play basketball have the criterion of minute vessels pulse indicating microcirculation of blood in tissues higher. This indicates that playing basketball and indoor soccer is more effective in increase of elastic characteristics of vessels of general circulation and microcirculation unlike the results shown by students who play handball.

The analysis of the results (Table III) has brought out that the criteria of contractile function of all the examined students regardless of the kind of sports exceed standards a little. At the same time students who play basketball have shown such indices as contractile velocity and minute cardiac index statistically proved higher comparing to students who play indoor soccer, and aortic ventricle shock work index statistically higher than those who play handball and indoor soccer.

Therefore, all applicable kinds of sports promote training of contractile function of the heart and system blood flow vessels. However, at the same time basketball is more effective in improvement of velocity and force characteristics at aortic ventricle contraction. This has not been observed among the students who play handball and indoor soccer.

TABLE III
Integral Cardiac Performance Indices
(Contractile Function)

Contractile function indices/ kind of sports	Basketball	Handball	Indoor soccer	Standard
Blood flow acceleration index, 1/s2	223.0±14.6*	202.0±10.4	202.0±10.4	80.0-160.0
Velocity index, 1/c	104.0±6.3	93.0±5.4	121.0±5.2	38.0-65.0
Stroke index, ml/m2	71.0±4.04*	59.0±4.5	58.0±4.2	30.0-65.0
Cardiac index ml/m2	5.0±0.2	5.2±0.5	4.0±0.3	2.5-4.7
Aortic work index, g*min/m2	6.8±0.3	6.6±0.5	5.1±0.6	3.0-5.5
Aortic work stroke index, g*min/m2	92.0±6.7*	77.0±5.4	70.0±5.2	37.0-82.0
Filling wave amplitude, %	2.9±0.75	7.5±2.3	8.0±2.0	

* - statistically proved differences in comparison with other students ($p<0.05$)

Criterion significance of these indices consists in its great role of determination of left ventricle volume (Table IV). It is provided by the increase of pumping function of skeletal and cardiac muscle of all the examined students which is followed by vessels and pulmonary resistance increase. However, "adequate pumping function index" is diastolic volume.

TABLE IV
Integral Cardiac Performance Indices
(Pumping Function)

Kinds of sports/ indices	Pumping function		
	Terminal left ventricle volume	Terminal diastolic index, ml/m2	Ejection fraction, %
Basketball	236.0±17.0*	119.0±17.5	60.0±1.08
Handball	187.0±17.5	104.0±6.25	59.0±2.6
Indoor soccer	186.0±19.1	101.0±12.0	60.0±1.3
Standard		60.0-100.0	50.0-70.0

* - statistically proved differences in comparison with other students ($p<0.05$)

It is known that diastolic volume depends on the muscle fiber length of left ventricle and consequently – the degree of diastolic cardiac muscle relaxation.

According to Starling's law, degree of diastolic cardiac muscle relaxation determines the power of systolic contraction (on the assumption of absence of cardiac muscle dilatation).

This means that along with increase of the diastolic volume indices within the scope of physiological standard we can observe improvement of left ventricle pumping function. In this case we are able to maintain the evident training effect of pumping function of heart and skeletal muscle on application of team sports.

Table V contains basic indices of resistance to system blood circulation. These are: total peripheral resistance of vessels, total peripheral resistance of vessels index, stroke index of peripheral resistance of vessels and thorax resistance.

As shown in the Table V, all the criteria of resistance of vessels are within the scope of standards except the level of thorax resistance, which is a little subnormal.

TABLE V
INDICES OF PERIPHERAL RESISTANCE TO SYSTEMIC BLOOD FLOW

Kind of sports / indices	Total peripheral resistance	Total peripheral resistance index, din*sec*sm*sm-5	Stroke index of total peripheral resistance	Thorax resistance, Om
Basketball	756.0±44.2	1414.0±56.6	108.0±6.0	18.0±0.7
Handball	935.0±25.7	1597.0±61.2	130.0±5.6	19.0±1.1
Indoor soccer	1032.0±30.3*	1852.0±58.7*	143.0±5.2*	19.5±1.2
Standard		1300.0-2500.0	90.0-200.0	22.0-36.0

* - statistically proved differences in comparison with other students ($p<0.05$)

In consideration of theoretical working-out of V.M.Hayutin, V.N. Chernigovsky [13] of physiological regulation mechanisms of systemic blood flow, realization of this condition proceeds with the help of conjugate vasomotor reflexes of cardiovascular system, based on functional principle: impairment of tissue metabolism during physical activity brings about mobilization of functions of systemic hemodynamics, which leads to improvement of regional microcirculation, therefore activation of tissue metabolism occurs.

We consider ascertained increase of peripheral vessels resistance of students after long-term physical exercise (team sports) within the scope of standard to be adaptive and to be an evidence of optimization of systematic blood circulation and peripheral microcirculation.

This is proved by increase of criteria of blood oxygenation (Table VI) within the scope of settled standards.

At the same time range of index of oxygen delivery of students who play basketball slightly exceeds these standards, but in the group of students, who play indoor soccer – it is statistically proved to be lower, but within the scope of standards. On the whole, judging by indices of oxygen blood saturation, oxygenation of the organism is in line with standard.

TABLE VI
INDICES OF BLOOD OXYGENATION AND HYDRATATION OF THORAX

Kind of sports/ indices	Respiratory rate, bpm	Liquid of thorax, 1/kOm	Index of oxygen delivery, ml/min/m2	Oxygen blood saturation, %
Basketball	16.4±0.97	58.0±2.5	974.0±37.7	98.0±0.34
Handball	15.0±1.5	53.5±2.3	932.0±27.6	97.0±,5.0
Indoor soccer	16.0±2.0	52.0±2.3	742.0±30.2*	97.0±0.4
Standard	10.0-18.0	26.0-45.0	450.0-950.0	96.0-99.0

* - statistically proved differences in comparison with other students ($p<0.05$)

A. Peculiarities of nervous regulation of haemodynamics mechanisms

It is proved that long-term exercise of team sports brings about vegetative regulation of organism functions optimization, which comes to balance of sympathetic and parasympathetic activity of the central nervous system.

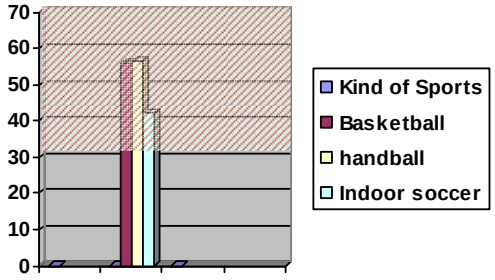

Fig 1. Indices of balance of sympathetic and parasympathetic activity of the central nervous system of students, who specialize in technical subjects, and play team sports.
Y-axis – indices in points, X-axis – kinds of sports, 0-30 – parasympathetic dominance, normal balance of parasympathetic and sympathetic systems, 70-100 – sympathetic dominance
Shaded region – standard.

B. Factor structure of haemodynamic indices and strategy for adaptation

Factor analysis of the results has shown, that strategy for adaptation of students to educational process depends on kind of sports used at physical training lessons.

It is estimated (Fig. 2) that the leading adaptation factor for students who play basketball is minute blood volume with the level positively correlating with such criteria as: contractile and pumping heart functions, resistance of blood vessels and thorax to the system blood flow and also with the indices of sympathetic and parasympathetic activity, oxygen delivery to tissues and hydration of thorax.

So the leading factor in the strategy for adaptation of students who play basketball is productivity of the system blood flow per time unit (minute) which conditions systolic heart operation (contractile and pumping functions) and also the system blood flow and timely oxygen delivery to tissues.

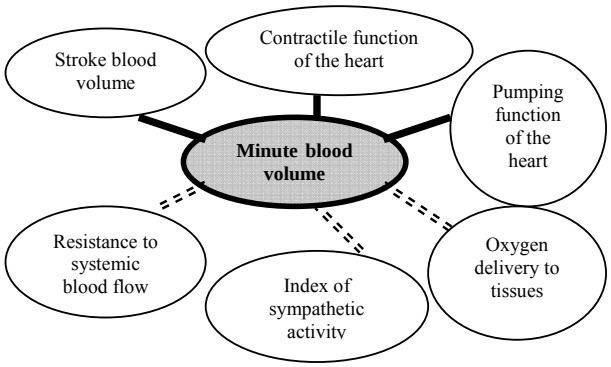

Fig.2. Factor structure of hemodynamic indices of students who play basketball
Strong positive correlative connections (r = 0.7-0.99)
Strong negative correlative connections (r = -0.7-0.99)

It is estimated that students who play handball have a different factor structure of hemodynamic indices (Fig. 3).

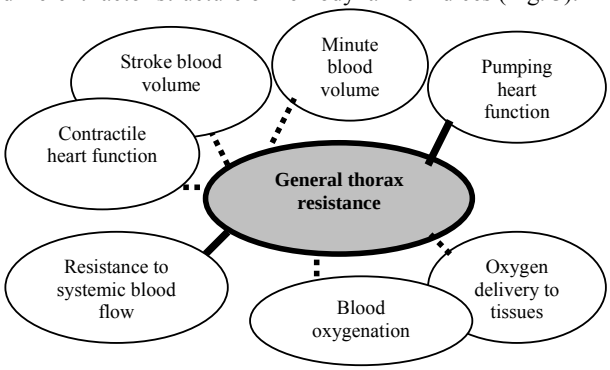

Fig.3. Factor structure of hemodynamic indices of students who play handball
Strong positive correlative connections (r = 0.7-0.99)
Strong negative correlative connections (r =-0.7-0.99)

Particularly their leading adaptation factor comprises thorax resistance indices which are in strong negative correlation bonds with the criteria of contractile heart function, oxygen delivery and oxygen saturation of blood.

This means that the leading adaptation strategy factor for students who play handball is an increase of resistance of the thorax to blood flow, which promotes decrease of contractile and increase of pumping function of the heart and also worsening of oxygen delivery to tissues and oxygen saturation of blood, and as a result of this on the whole – reduction of processes of blood and tissue oxygenation in the organism. This phenomenon gets aggravated by increase of resistance of system blood flow vessels and hydration of thorax.

Data analysis of factor structure indices of students who play indoor soccer (Fig. 4) lets conclude the following. The leading factor of adaptation strategy is the integral heart operation index – the myocardium contractility index which is in strong correlations with contractile and pumping heart operation indices, general peripheral resistance criteria and also with the blood oxygenation level and thorax hydration. At the same time there have been detected medium positive bonds with elastic properties and tone of vessels and negative bonds with the criteria of peripheral resistance of system blood circulation and thorax.

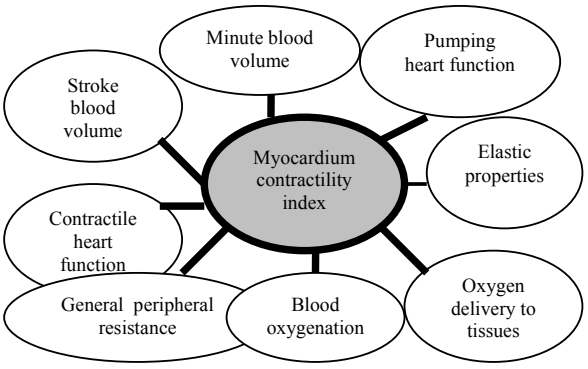

Fig.4 Factor structure of hemodynamic indices of students who play indoor soccer
Strong positive correlative connections (r = 0.7-0.99)
Average positive correlative connections (r = 0.5-0.69)

Therefore, the leading factor of adaptation strategy of students who play indoor soccer is the myocardium contractility index which characterizes velocity of pressure increase in the left ventricle of the heart from the opening of the mitral valve till the opening of the aortic valve, and contains information about velocity and power qualities of the contractile ability of the left ventricle.

IV. Conclusion

Analysis of research results of general haemodynamics of students who go in for playing sports while studying has revealed general and particular features according to elastic properties and vascular wall tone properties: contractile and pumping functions of the heart, resistance of vessels and thorax to system blood circulation, oxygenation of blood and hydration of thorax, nervous regulation of cardiovascular system functions.

It is estimated that elastic properties indices of all examined students are within the scope of physiological norm, but they differ depending on kind of sports. In particular some differences are detected with regard to basketball and indoor soccer. The results show that exercise of basketball promotes improvement of microcirculation of blood in tissues, but exercise of indoor soccer promotes an increase of blood vessels tone.

It is proved that basketball and indoor soccer train contractile functions of the heart and system blood circulation vessels tone. At the same time exercise of indoor soccer is more effective in improvement of velocity and strength of the left ventricle of heart contractions, but exercise of basketball is more effective in improvement of harmonization of system blood flow and delivery of oxygen to tissues; exercise of handball reduces these indices.

Factor structure of hemodynamic indices in the adaptation strategy of students to educational process depends on kind of sports used at physical training lessons (basketball, handball, indoor soccer).

In the hierarchy of factorial signs of adaptation strategy, the main factor is:

- those who play basketball have shown productivity of the system blood circulation per time unit (minute) which makes for effectiveness of systolic heart function (contractile and pumping functions), and also the system blood flow and timely oxygen delivery to tissues;
- Those who play handball have shown increase of thorax resistance which makes for reduction of contractile and pumping heart functions, and also impairment of oxygen delivery to tissues and saturation of blood with oxygen, and as a result on the whole decrease of blood and tissue oxygenation processes within the established standard. This phenomenon is aggravated by hydration of thorax;
- Those who play indoor soccer have shown velocity and strength of contractile ability of the left ventricle of heart.

Thus positive differentiated influence of playing sports on specifics of general haemodynamics of students who study technical subjects has been grounded. At that basketball and indoor soccer are the most effective in training the general haemodynamics mechanisms, but handball is not effective.

REFERENCES

[1] M.N.Kondrashova Accumulation and use of succinic acid in mitochondrions // Mitochondrions. Moscow. Science, 1972, p.151-170
[2] M.N.Kondrashova Vital power // Problems of energetic. Moscow. Knowledge, 1985, №2, p.17-38
[3] I.A.Arshavskiy Biological and medical aspects of adaptation and stress in the light of ontogenesis physiology // Actual matters of modern physiology. Moscow. Science, 1976, p.144-191
[4] F.Z.Meyerson About interconnection of physiological function and genetic apparatus of the cell. Moscow. Medicine, 1968, p.91
[5] F.Z.Meyerson Contraction and relaxation of the heart muscle during adaptation to physical activity / F.Z.Meyerson, V.I.Kapelko, K.Pfaier // Physiology Journal of USSR, 1979 - №5, p.793-795
[6] F.Z. Meyerson Adaptation to stress situations and physical activity / F.Z.Meyerson, M.G.Pshennikova. Moscow. Medicine, 1988, p.91
[7] V.I.Kapelko Abnormalities of energy exchange in the cells of the heart muscle: reasons and concequences / V.I.Kapelko // The Sorosovskiy Educational Journal, 2000, volume 6 - №5, p.14-20
[8] V.P.Skulachyov Laws of bioenergetics // The Sorosovskiy Educational Journal, 1977. №1. p.9-14
[9] E.V.Eliseyev Oxygenation of arterial blood and change of gaseous composition of alveolar air of those who go in for aikido depending in the body position //E.V.Eliseyev // Theory and practice of physical training, 2001.№1. p.21-23
[10] L.K.Velikanova Practical lessons in age physiology and school hygiene // Study guide. Moscow, 1992. p.131
[11] K. Ibrela Factoral analysis / K. Ibrela. Moscow, 1980. p.374
[12] G.L.Apanasenko Medical valeology / G.L.Apanasenko, L.A.Popova. Postov-on-Don, Phoenix. Kiev, Health, 2000. p. 244
[13] V.N.Chernigovskiy New data on regulatory mechanisms of blood pressure / V.N.Chernigovskiy, V.M.Hayutin // Nervous regulation of blood circulation and breathing, 1952. p.8-15
[14] N.Rashevsky Mathematical principles in biology and their applications / N.Rashevsky // Springfield, 1961. p.292.

Prof. Valentina Baronenko is Doctor of Biological Sciences, organizer and manager of the Scientific Institute of the Ural Federal University named after B.N.Yeltsin, the first president of Russia, which studies Culture of Health. The author has published more than 300 scientific works in Russian and international editions, including monographs and scientific articles, a textbook, study and methodic guides. In 2004 she was awarded to a diploma of the Russian Natural Sciences Academy in the Enlightener Activity in Physical Training nomination, and an honourable medal of Ekaterina Dashkova, a prominent social and state figure of Russia. She is awarded to a diploma as a laureate of a competition for the best scientific book conducted by the Domestic Education Development Fund in 2007.

Svetlana Bugreyeva is Candidate of Pedagogical Sciences, tutor in the Yral Federal University named after B.N.Yeltsin, the first president of Russia. Her scientific specialization is human physiology. She has written over 50 scientific works. She was a scholar of B.N.Yeltsin, the first president of the Russian Federation among postgraduates, in 2009 she was awarded to scholarship of the Sverdlovsk Region Governor, in 2011 to scholarship of the Government of the Russian Federation. In 2007 and 2010 she was the winner of competitions for young scientists conducted by the Ural State Technical University for the best scientific and research work among postgraduates in Arts.

Kamiliya Mekhdieva is Sports Medicine Exercise Therapy Doctor, tutor in the Ural Federal University named after B.N.Yelysin, the first president of Russia, postgraduate student of the Department for Theoretical Physical Training. Her scientific specialization is sports physiology. She is an author of scientific and methodic complex of a discipline called “Anatomy, Physiology and Basics of Medicine in Choreography”, the Ekaterinburg Academy of Contemporary Arts. She has written scientific learning aids in physiology and complex rehabilitation of sportsmen.