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Physiological Effects Of Physical Stress On Platelet Hemostasis In Young Individuals With High Normal Blood Pressure And Overweight.

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ABSTRACT

In modern society, the manifestations of the metabolic syndrome and, first of all, arterial hypertension and abdominal obesity begin to become “younger” more and more clearly, often developing up to 30 years and affect the most able-bodied age. Very early, high normal blood pressure and overweight can appear. Apparently, when combined with young men with high normal blood pressure and overweight, there is an activation of platelets in the subsequent, leading to the development of intravascular thrombosis. It is known that a very effective non-drug component of the correction of increased blood pressure and overweight is dosed static and dynamic exercise. At the same time, their effect on platelet hemostasis in young people with high normal blood pressure and overweight was not evaluated. In order to close gaps in the system of scientific knowledge, this scientific work was planned and carried out. It has been found that with the use of individually selected physical activities in young men with high normal blood pressure and overweight normalizes the reactivity of the cardiovascular system, blood pressure, enhanced lipid peroxidation, approaching normal body weight and platelet hemostasis. The use of rational physical training for 12 months fully optimizes the increased adhesive and aggregation functions of platelets in vitro, which is fixed with the continuation of training. The revealed changes, reaching a maximum by the end of the year of study, are the basis for prevention in these young people of strengthening of platelet hemostasis in the future.

Keywords: blood pressure, overweight, exercise, platelets, adolescence, health.

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INTRODUCTION

In modern society, the manifestations of metabolic syndrome (MS) [1,2] and first of all arterial hypertension (AH) [3,4] and abdominal obesity (AO) [5,6] begin to "look younger" more and more, developing often to 30 years and hitting the most able-bodied age [7,8]. One of the earliest predictors of metabolic syndrome (MS) [9,10] may be high normal blood pressure [11] and overweight) [12]. It cannot be ruled out that signs of platelet activation that occur when combined in young people with high normal arterial pressure and overweight may further aggravate the formation of MS, quickly leading to the development of intravascular thrombosis [13-15]. However, despite the high scientific and practical significance of this problem, the features of the functional state of platelets in young people with high normal blood pressure and overweight with burdened heredity according to MS have not been studied enough.

It is known that a very effective non-drug component of the correction of increased blood pressure and overweight is dosed static and dynamic exercise [16-20]. At the same time, their effect on platelet hemostasis in young people with high normal blood pressure and overweight was not evaluated.

In this regard, the authors set the task: to evaluate the possibilities of measured physical activity in terms of correcting disorders of platelet hemostasis in young people with high normal blood pressure and overweight.

MATERIAL AND METHODS

The research was approved by the Ethics Committee of Russian State Social University (record №5 from 12.05.2014).

The study included 27 young people aged 18 years with high normal blood pressure and overweight, a risk of 1-2, including 19 males and 8 females. Among the young people included in the study, there was a predisposition to cardiovascular and metabolic diseases, including MS and, in some cases, smoking. The control group consisted of 147 healthy young people of similar age, without bad habits and hereditary burden, who regularly exercise physically as part of general physical training. The survey included the determination of anthropometric indicators: body mass, body mass index, waist circumference, hip circumference with the calculation of waist circumference/hip circumference. The value of the index of functional reactivity of the cardiovascular system was traditionally determined. According to the value of its increment against the background of psycho-emotional load, the type of reactivity of the cardiovascular system was assessed: when the value of the functional reactivity index was more than 20 standard units. Reactivity was considered hyperfunctional, with a functional reactivity index of less than 10 conventional units, the response to the load was assessed as hypofunctional, and with functional reactivity index values from 10 to 20 conventional units, the type of functional reactivity was normal.

Plasma lipid peroxidation activity was determined by the content of thiobarbituric acid-active products using the Agat-Med kit and the antioxidant potential of the liquid part of blood, and intraplatelet lipid peroxidation by basal malondialdehyde concentration in the reduction of thiobarbituric acid. The number of platelets in capillary blood in the Goryaev chamber was counted. Platelet aggregation (AP) was studied by a visual micromethod using as inducers ADP (0.5×10^{-4} M), collagen (dilution 1: 2 of the main suspension), thrombin (0.125 units / ml), ristomycin (0.8 mg / ml), adrenaline (5×10^{-6} M) and hydrogen peroxide (7.3×10^{-3} M). All under the supervision of 27 young people with high normal blood pressure and overweight were prescribed regular dosed physical exercises according to the scheme developed by the authors, including morning hygienic gymnastics, therapeutic and preventive gymnastics and fractional exercise during the day. The design of the study included the initial assessment of the studied parameters and the determination of their dynamics against the background of 1, 2 and 4 years of regular physical activity and after 3 subsequent years of their irregular implementation. Statistical processing of the results obtained was carried out using Student's t-test.

RESEARCH RESULTS

When included in the study, systolic blood pressure in the examined was equal to 137.6 ± 1.84 mm. Hg Art., diastolic - 89.0 ± 1.96 mm. Hg Art., heart rate - 90.1 ± 2.12 beats per 1 min. The increment of the

functional reactivity index on the load was 40.7 ± 1.46 conditional units, which was regarded as a manifestation of a pronounced hyperfunction of the cardiovascular system.

As a result of 12 months of correction in young people with high normal blood pressure and overweight, systolic blood pressure decreased to 131.3 ± 1.92 mm. Hg Art., diastolic - up to 84.6 ± 2.07 mm. Hg Art., heart rate decreased to 82.0 ± 1.38 beats per 1 minute. When the load was fulfilled, a decrease in the increment of the functional reactivity index by 20.1 ± 1.16 used units was observed, which indicates the elimination of the cardiovascular system hyperfunction, increase in its tolerance to psycho-emotional stress and economization of cardiac activity. Normalization of reactivity of the cardiovascular system was noted only after 2 years of training - the increment of the functional reactivity index reached 16.4 ± 2.07 conventional units.

In the initial state, the average body weight of the examined was 82.9 ± 0.15 kg, with a body mass index of 29.8 ± 0.11 kg/m² and a waist / hips ratio of 1.06 ± 0.006 .

After 1 year of regular dosed physical training in young people who, at the age of 18, had high normal arterial pressure and overweight, their body weight decreased to 72.4 ± 0.11 kg, while overweight decreased to 26.0 ± 0.06 kg/m² with a decrease in waist/hip volume to 0.85 ± 0.006 .

The observed young people with high normal blood pressure and overweight in the outcome showed a significant increase in plasma lipid peroxidation. Thus, the concentration of thiobarbituric acid-active products in their plasma was 3.61 ± 0.19 $\mu\text{mol/l}$, in the control - 3.21 ± 0.81 $\mu\text{mol/l}$ ($p < 0.05$). The level of MDA in platelets was also increased (0.69 ± 0.09 nmol/ 10^9 platelets), in the control - 0.49 ± 0.16 nmol/ 10^9 platelets ($p < 0.01$). Activation of free-radical oxidation in young people with high normal blood pressure and overweight became possible due to the weakening of the antioxidant activity of their body to $30.6 \pm 0.12\%$, against $38.8 \pm 0.22\%$ in control ($p < 0.01$).

Observance within 1 year of young people with high normal arterial pressure and overweight rationally measured physical activity normalized lipid peroxidation of plasma and platelets. Thus, in the plasma, the content of thiobarbituric acid-active products was 3.32 ± 0.10 $\mu\text{mol/l}$ with an increase in its antioxidant activity of $37.8 \pm 0.17\%$. Against the background of regular workouts in young people, a decrease in the activity of lipid peroxidation in platelets was achieved - basal MDA in them was 0.50 ± 0.12 nmol/ 10^9 platelets. The content of platelets in the blood of young people with high normal blood pressure and overweight before and against the background of the correction was within the normal range. In those included in the study before the start of training, an acceleration of platelet aggregation was found, most pronounced under the influence of collagen - 26.9 ± 0.16 s (in the control - 34.6 ± 0.17 s). Somewhat slower AT developed in individuals with high normal blood pressure and overweight under the influence of ADP (37.5 ± 0.10 s) and ristomycin (41.7 ± 0.14 s). AP with H₂O₂ in the group of individuals with high normal arterial pressure and overweight was 43.0 ± 0.19 s. Thrombin and adrenaline antibodies also developed faster than controls ($p < 0.01$) and were equal in young people with high normal arterial pressure and overweight of 47.2 ± 0.12 s and 92.4 ± 0.10 s, respectively.

Against the background of regular physical exertion in young people with high normal blood pressure and overweight, the AP time has increased under the influence of all inductors tested. After 12 months Correction of the most active inducer of AP they turned out to be collagen. ADF, ristomycin and H₂O₂ were somewhat less active. Later, AP developed ($p < 0.01$) under the influence of thrombin and adrenaline.

Further three-year observation of the continued workout by young people who had high normal blood pressure and overweight at 18 years did not reveal the negative dynamics of all normalized functional and laboratory parameters until the end of observation even if they were not strictly observed between 22 and 25 years.

DISCUSSION

It is known that the use of rational physical exertion in cardiac patients can improve metabolism by stimulating the hidden reserves of the body [21-24].

Thus, as a result of the use of physical training in young people with high normal blood pressure and overweight, normalization of the functional reactivity of the cardiovascular system in response to the dosed psycho-emotional stress was noted, ensuring tolerance to it, optimizing hemodynamics under stress and reducing, thereby, the degree of risk of subsequent arterial hypertension [25-28].

The use of physical training in young people with overweight contributed to weight loss, thereby reducing the risk of subsequent obesity, primarily in the abdominal type, as the most unfavorable in terms of the formation of metabolic disorders.

The revealed initial enhancement of free-radical oxidative processes in plasma and platelets in the examined young people with high normal blood pressure and overweight indicated a decrease in the antioxidant system of the body [29,30]. In addition, the increased formation of MDA by their platelets is a marker of the beginning increase in the activity of the metabolism of membrane phosphoinositols and increasing thromboxane formation [31]. The positive effect of a complex of physical training on lipid peroxidation in the body of young people with high normal blood pressure and overweight is obviously mediated by its effect on the activity of the sympathetic nervous system and on thin cellular processes [32,33]. It manifested itself to the maximum by the end of the first year of training [34]. A decrease in the level of MDA in platelets in the observed young people with high normal blood pressure and overweight indirectly indicates a decrease in the activity of arachidonate metabolism enzymes in platelets with the achievement of the physiological level of thromboxane formation in them [35,36].

The improvement in AP levels in young individuals with high normal blood pressure and overweight during the use of metered exercise indicates a positive effect on platelet hemostasis [37,38]. These effects are due to the improvement of metabolic processes, a decrease in hypersympathicotonia and the optimization of lipid peroxidation in plasma and platelets. The prolongation of AP time under the influence of ristomycin in observable young people with high normal blood pressure and overweight during training indicates a decrease in von Willebrand factor blood levels [39]. The positive dynamics of AP with H₂O₂ in them additionally indicates an increase in the activity of the antioxidation system in platelets, first of all, catalase and superoxide dismutase [40].

We can assume that rational physical exertion in young people with high normal arterial pressure and overweight is preferable to apply immediately after establishing the fact of increase in blood pressure and body weight, which effectively optimizes the reactivity of the cardiovascular system, blood pressure, body mass and platelet hemostasis during the year of training. Continued physical activity can consolidate the achieved optimization of platelet hemostasis in young people with high normal blood pressure and overweight, helping to reduce their risk of developing MS and the development of vascular complications at an older age.

CONCLUSION

The use of dosed physical loads in young people with high normal arterial pressure and overweight eliminates the increased reactivity of the cardiovascular system, the incipient obesity they have increased lipid peroxidation, bringing to normal the activity of impaired platelet hemostasis. These changes reach a maximum by the end of the year of study, largely preventing these young people from strengthening platelet hemostasis in the future.

REFERENCES

- [1] Zavalishina SYu. (2018) Functional Properties Of Anticoagulation And Fibrinolysis In Calves Of Plant Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 1082-1087.
- [2] Zavalishina SYu. (2018) Functional Antiaggregatory Properties Of Blood Vessels In Calves During Transition From Dairy To Plant Type Of Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 1110-1116.
- [3] Zavalishina SYu. (2018) Physiological Features Of Vascular Hemostasis In Calves Of Dairy-Vegetative Food. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 1137-1143.
- [4] Zavalishina SYu.(2018) Functional Features Of Platelets In Newborn Calves With Iron Deficiency. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 1153-1158.

- [5] Zavalishina SYu. (2018) Functional Activity Of Plasma Hemostasis In Neonatal Calves With Iron Deficiency, Who Received Ferroglucin And Glycopin. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 1186-1191.
- [6] Bikbulatova AA, Matraeva LV, Erokhin SG, Makeeva DR, Karplyuk AV. (2018) Methodical Foundations Of Carrying Out Competitions Of Professional Skill Among People With Disabilities. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 243-247.
- [7] Vorobyeva NV, Mal GS, Skripleva EV, Skriplev AV, Skoblikova TV. (2018) The Combined Impact Of Amlodipin And Regular Physical Exercises On Platelet And Inflammatory Markers In Patients With Arterial Hypertension. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(4) : 1186-1192.
- [8] Maksimov VI, Zavalishina SYu, Parakhnevich AV, Klimova EN, Garbart NA, Zabolotnaya AA, Kovalev Yul, Nikiforova TYu, Sizoreva EI. (2018) Physiological Dynamics Of Microrheological Characteristics Of Erythrocytes In Piglets During The Phase Of Milk Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 454-459.
- [9] Maksimov VI, Zavalishina SYu, Parakhnevich AV, Klimova EN, Garbart NA, Zabolotnaya AA, Kovalev Yul, Nikiforova TYu, Sizoreva EI. (2018) Functional Activity Of The Blood Coagulation System Against The Background Of The Influence Of Krezacin And Gamavit In Newborn Piglets Who Underwent Acute Hypoxia. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 2037-2042.
- [10] Tkacheva ES, Zavalishina SYu. (2018) Physiological Aspects Of Platelet Aggregation In Piglets Of Milk Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 74-80.
- [11] Tkacheva ES, Zavalishina SYu. (2018) Physiology Of Platelet Hemostasis In Piglets During The Phase Of Newborns. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 1912-1918.
- [12] Bikbulatova AA, Andreeva EG. (2018) Achievement of psychological comfort in 5-6-Year-Old children with scoliosis against the background of daily medicinal-prophylactic clothes' wearing for half a year. Bali Medical Journal. 7(3): 706-711. DOI:10.15562/bmj.v7i3.947.
- [13] Bikbulatova AA, Andreeva EG. (2018) Restoration Of The Profile Of Bioregulators Of Blood Plasma In People Of Second Adulthood With Osteochondrosis Of The Spine Against The Background Of Daily Wearing Of Medical And Preventive Clothing. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(4) : 413-419.
- [14] Bikbulatova AA. (2018) Bioregulatory Effects Of The Daily Wearing Of Medical And Preventive Pants On The Body Of Pregnant Women Suffering From Habitual Miscarriages Of The Fetus. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(4) : 889-896.
- [15] Makhova AV. (2018) Physiology Of The Hypothalamus In The Human Body. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 478-484.
- [16] Zavalishina SYu. (2018) Functional Properties Of Coagulation Hemostasis In Calves During The Phase Of Dairy-Vegetative Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 784-790.
- [17] Zavalishina SYu. (2018) Functioning Of Mechanisms Of Hemocoagulation Restriction In Calves At Change Of Methods Of Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 800-806.
- [18] Zavalishina SYu. (2018) Functional Activity Of Anticoagulant System In Calves During Early Ontogeny. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 837-843.
- [19] Zavalishina SYu. (2018) Functional Properties Of Fibrinolysis In Calves Of The First Year Of Life. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 870-876.
- [20] Zavalishina SYu. (2018) Physiological Features Of Coagulation In Calves Of Plant Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 899-904.
- [21] Zavalishina SYu. (2018) Functional Activity Of Thrombocytes In Newborn Calves. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 919-924.
- [22] Zavalishina SYu. (2018) Functioning Of Platelets In Milk And Vegetable Nutrition Calves. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 943-949.
- [23] Zavalishina SYu. (2018) Deficiency Of Iron As A Cause Of Dysfunction In Calves And Piglets. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 978-983.
- [24] Zavalishina SYu. (2018) Functional Properties Of Hemocoagulation In Calves Of Dairy Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 1016-1022.
- [25] Zavalishina SYu. (2018) Physiology Of Vascular Hemostasis In Newborn Calves. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(5) : 1037-1044.

- [26] Tkacheva ES, Zavalishina SYu. (2018) Physiological Features Of Platelet Aggregation In Newborn Piglets. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(5) : 36-42.
- [27] Bikbulatova AA, Pochinok NB, Matraeva LV, Erokhin SG, Makeeva DR, Karplyuk AV.(2018) Formation Of International Practice Of Holding Competitions Of Professional Skills Among Professionals With Disabilities. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 2018; 9(5) : 296-302.
- [28] Bikbulatova AA, Pochinok NB, Matraeva LV, Erokhin SG, Makeeva DR, Karplyuk AV.(2018) The Russian Historical Aspect Of The Development Of The International Federation Of Abilimpix. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(5) :329-335.
- [29] Bikbulatova AA, Pochinok NB, Soldatov AA, Matraeva LV, Erokhin SG. (2018) Organization Of International Competitions Of Professional Skill Among People With Disabilities. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(5) : 379-387.
- [30] Skoryatina IA, Zavalishina SYu. (2017) Ability to aggregation of basic regular blood elements of patients with hypertension and dyslipidemia receiving non-medication and simvastatin. *Bali Medical Journal*. 6(3):514-520. DOI:10.15562/bmj.v6i3.553.
- [31] Bikbulatova AA. (2018) Peculiarities of abnormalities of locomotor apparatus of children at preschool age with scoliosis of I-II degree living in Central Russia. *Bali Medical Journal*. 7(3): 693-697. DOI:10.15562/bmj.v7i3.738.
- [32] Bespalov DV, Kharitonov EL, Zavalishina SYu, Mal GS, Makurina ON. (2018) Physiological Basis For The Distribution Of Functions In The Cerebral Cortex. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(5): 605-612.
- [33] Skorjatina IA. (2018) Therapeutic Possibilities Of Rosuvastatin In The Medical Complex In Relation To Disaggregation Vascular Control Over Erythrocytes In Persons With Arterial Hypertension And Dyslipidemia. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(2) : 977-983.
- [34] Apanasyuk LA, Soldatov AA. (2017) Socio-Psychological Conditions for Optimizing Intercultural Interaction in the Educational Space of the University. *Scientific Notes of Russian State Social University*. 16(5-144) : 143-150. doi: 10.17922/2071-5323- 2017-16-5-143-150.
- [35] Bikbulatova AA, Karplyuk AV. (2018) Professional And Labor Orientation Of Persons With Disabilities In The Resource Educational And Methodological Center Of The Russian State Social University. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(4) : 1648-1655.
- [36] Maloletko AN, Yudina TN. (2017) (Un)Making Europe: Capitalism, Solidarities, Subjectivities. *Contemporary problems of social work*. 3 (3-11) : 4-5.
- [37] Glagoleva TI, Zavalishina SYu, Mal GS, Makurina ON, Skorjatina IA. (2018) Physiological Features Of Hemo-coagulation In Sows During Sucking. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(4):29-33.
- [38] Zavalishina SYu, Makurina ON, Vorobyeva NV, Mal GS, Glagoleva TI. (2018) Physiological Features Of Surface Properties Of The Erythrocyte Membrane In Newborn Piglets. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(4):34-38.
- [39] Pozdnyakova ML, Soldatov AA. (2017) The Essential and Forms of the Approaches to Control the Documents Execution. *Contemporary problems of social work*. 3 (1-9): 39-46. doi: 10.17922/2412-5466-2017-3-1-39-46.
- [40] Bikbulatova AA, Karplyuk AA, Parshin GN, Dzhabfar-Zade DA, Serebryakov AG. (2018) Technique for Measuring Vocational Interests and Inclinations in High-School Students with Disabilities. *Psikhologicheskaya nauka i obrazovanie-psychological science and education*. 23(2) : 50-58. doi: 10.17759/pse.2018230206.