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Physiological Characteristics Of Platelet Activity In Young People Experiencing Moderate Exercise.

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ABSTRACT

At the present time, it becomes obvious that platelet hemostasis plays an important role in the physiological development of a person. Normal morphofunctional state of the body is largely due to adequate rheological properties of blood, which are significantly affected by the level of platelet activity. It is known that moderate exercise in young people can positively affect individual indicators of platelet functions. Healthy young people who have no bad habits and regularly exercise as part of general physical training have not fully clarified the state of platelet lipid peroxidation, the activity of their antioxidant enzymes, the level of functional readiness of blood platelets, including their aggregation activity under the influence of various inductors and combinations thereof, available in blood flow conditions. The severity of the morphological activity of platelets in the vessels was not assessed in these young people. To close the existing gaps in the system of scientific views, this study was conducted. In those undergoing general physical training at the age of 18–22, the stability of low functional platelet activity was revealed. During this age, platelet aggregation in them was at a low level, without experiencing significant fluctuations. This is largely due to the constancy of their sensitivity to exogenous influences. The optimally low activity of platelets causes a small amount of circulating aggregates of various sizes in their bloodstream, which has a pronounced positive effect on the microcirculation of tissues in the body of a young person who is physically regularly exercising moderately.

Keywords: platelets, adolescence, general physical training, blood rheology, microcirculation, hemostasis.

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INTRODUCTION

At present, it becomes obvious that platelet hemostasis plays an important role in the physiological development of the organism [1-5]. Normal morphofunctional state of the body is largely due to adequate rheological properties of blood [6,7], which are significantly affected by the level of platelet activity [8-10]. At the same time, it is known that moderate exercise in young people can positively affect individual indicators of platelet functions [11-14].

However, in healthy young people who do not have bad habits and regularly train as part of general physical training, the state of lipid peroxidation (LPO) of platelets, the activity of their antioxidant enzymes, the level of functional readiness of blood platelets, including their aggregation activity under the influence of various inductors and their combinations, which are present in the conditions of blood flow. The severity of the morphological activity of platelets in the vessels was not assessed in these young people. In this regard, the purpose of the study was formulated: to find out the activity of platelet functions in healthy young people who do not have bad habits and regularly train as part of general physical training.

MATERIAL AND METHODS

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

The study group included 147 healthy young students, who trained as part of general physical training, first in physical education classes, and at the end of the program of the subject in the sports section in general physical training (28 people 18 years old, 31 people 19 years old, 29 people 20 years old, 27 people 21 years old and 32 people aged 22).

The level of intraplatelet LPO was determined in all patients by concentration of the basal level of malondialdehyde (MDA) in the reduction reaction of thiobarbituric acid and by the level of acyl hydroperoxides (AHP). The number of platelets in the capillary blood in the Goryaev chamber was counted. The products of platelet-containing phospholipid-coagulation activators (F3-platelets) were evaluated with the calculation of the platelet activity index. The duration of platelet aggregation (AP) was determined 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), as well as combinations of ADP and adrenaline, ADP and collagen, adrenaline and collagen to simulate real blood flow conditions. Intravascular platelet activity was determined visually using a phase contrast microscope. Statistical processing of the results obtained was carried out using Student's t-test.

RESEARCH RESULTS

The young people included in the study group were under constant surveillance. Before evaluating hemostasis, they determined the main physiological parameters, carried out morphological and biochemical blood tests, which showed that the estimated total functional and biochemical values (temperature, heart rate, respiration rate, general blood and urine tests, biochemical blood tests) were all examined within the physiological norm.

The content of the primary products of LPO-AHP in platelets of healthy 18-year-old young people who regularly exercise physically was at the level of 1.96±0.19 $D_{233}/10^9$ platelets, not changing significantly by 22 years and at that age was 1.97±0.12 $D_{233}/10^9$ platelets. At the same time, the level of basal MDA in platelets - the end product of LPO at 18 years of age was 0.48±0.10 nmol/10^9 platelets, also remaining at this level for up to 22 years of life (0.49±0.22 nmol/10^9 platelet count).

The level of activity of catalase and superoxide dismutase in the blood plates, which were monitored by healthy young people, did not have reliable dynamics from 18 years, amounting at this age to 9650.0±114.3 IU/10^9 platelets and 1720.0±17.6 IU/10^9 platelets, respectively. In subsequent follow-up periods, no changes in catalase and superoxide dismutase activity were observed (at 19 years 9700.0±251.6 IU/10^9 platelets, 1700.0±17.6 IU/10^9 platelets, 20 years - 9660.0±132.6 IU/10^9 platelets, 1640.0±26.9 IU/10^9 platelets, 21 years

old - 9600.0±132.7 IU/10^9 platelets, 1680.0±12.9 IU/10^9 platelets, 22 years – 9920.0±184.6 IU/10^9 platelets, 1710.0±19.9 IU/10^9 platelets, respectively).

The level of the platelet activity index at 18 years in the examined corresponded to 20.5±0.19%, remaining at this level in the older surveyed. This indicated stability for 18–22 years in healthy young people who regularly exercise physically in the blood platelets of the level of labilization products of platelet phospholipids - blood clotting activators. In examined young people at 18 years of age, the time of AP development under the influence of collagen was 34.2±0.15 s, being at the same level in subsequent years. Similar AP activity in healthy 18 year old trained young people was observed under the influence of ADP (45.2±0.11 s) and ristomycin (49.4±0.22 s). At a later date, thrombin and adrenaline antibodies developed, being at age 57.9±0.16 s and 104.2±0.17 s, respectively, not changing significantly in the older patients. At 18 years of age with combined use of inductors in AP physically young people, for the ADP + adrenaline - 37.5±0.19 s, for the ADP + collagen - 27.2±0.22 s, for adrenaline + collagen - 29.4±0.12c, remaining stable until the age of 22.

The level of discocytes in healthy trained young people at 18 years of age was 85.9±0.10%, not significantly different from the values at other ages included in the observation group. The number of disco-echinocytes, spherocytes, sphero-echinocytes and bipolar forms of platelets also remained stable in their bloodstream from 18 to 22 years. As a result, the sum of the active forms of platelets also did not undergo significant changes, averaging 14.9±0.15% among the surveyed. In the blood of young people under moderate supervision, who exercise moderately physically, the levels of free-circulating small and large platelet aggregates did not have reliable dynamics, averaging 2.8±0.14 and 0.06±0.012 per 100 free platelets, respectively. The number of platelets involved in the process of aggregation also did not change between 18 and 22 years in the examined, averaging 5.8±0.12%.

DISCUSSION

Morphological structures and their functional activity of the human body are largely formed under the influence of an adequate influx of nutrients due to the necessary level of blood rheology, which can change during ontogenesis under the influence of a large number of environmental factors [15-18], which include regular moderate exercise [19-23]. It is known that a large role in the dynamics of the state of microcirculation is played by the level of LPO of platelets and activity in the blood circulation of blood plates [24-27].

The study found that healthy young people 18–22 years old regularly moderately exercising physically as part of physical therapy, have consistently normal levels of platelet antioxidant activity and a low level of POL in them, which largely determines their blood platelet activity [28].

When examining young people of this age trained as part of general physical training, the stability of the functional activity of platelets was confirmed. This is probably largely due to the constancy of the sensitivity of platelet receptors to exogenous influences on platelets, which undoubtedly include a certain concentration in the blood of von Willebrand factor - a cofactor of platelet adhesion with a simultaneous number of receptors to it - (GPI в) on the surface of blood plates [29.30]. The stability of the receptor composition on the membranes of the blood plates, caused by the reaction of the hemostasis system to the features of the functional activity of the organism as a whole, are also a consequence of complex adaptive reactions in the examined [31], causing ultimately the necessary adaptation of platelet hemostasis to the existing conditions of functioning [32].

Studying AP with a number of inductors and their combinations in young people, who exercise moderately physically, made it possible to establish the constancy of the aggregative function of the blood plates at the age of 18-22 years [33]. At the same time, the state of antibiotics when platelets are affected by strong agonists of aggregation - collagen and thrombin can be due in many respects to the constancy of the activity of phospholipase C, which ensures the functioning of the phosphoinositol pathway through diacylglycerol and protein kinase C [34] with phospholation of the contractile system proteins [35]. Inositol triphosphate that is generated at the same time provides an adequate level of Ca^{2+} release from intra-platelet depots, which determines the contractility of actomyosin [36]. It is possible that the stability of the activity of the enzyme systems of platelets, including thromboxane formation, causing the low sensitivity of blood

platelets to external stimuli necessary in given conditions, also plays an important role in maintaining low AP [37].

Similar platelet reactions in the surveyed youth contingent were marked by weak aggregation inducers - ADP and adrenaline, interacting with their membrane receptors and causing the required level of expression of fibrinogen receptors (GPIIv-IIIa), stimulating phospholipase A2, regulating the release of arachidonic acid, and using the same sample, I'll be i [38].

Evaluation of antibodies with the simultaneous use of several inductors showed their mutually potentiating action, confirming the patterns found in the study of antibodies with isolated agonists [39].

The stability of the level of intravascular platelet activity in young people who regularly exercise physically indirectly indicates that the physiological level of aggregation inducers (primarily thrombin, ADP, adrenaline) remains in the blood with a low constant level of platelet sensitivity [40]. At the same time, in healthy young people who are physically trained for 18–22 years old, a high number of intact discoid forms of platelets remain in the bloodstream, which indicates an unexpressed activity of their receptors. The stability of the disco-echinocytes and other active platelet forms is undoubtedly primarily due to the persistence of low expression of fibrinogen receptors on their membrane (GP IIb - IIIa).

CONCLUSION

Thus, as young people moderately physically exercising grow up, low platelet activity remains, providing a low content of their active forms in the bloodstream, providing a physiological level of the number of circulating aggregates of various sizes, which determines the optimal rheological properties of their blood regardless of the level of environmental effects on an organism.

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