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The Physiological Properties Of Platelets In People 18-35 Years Old, Trained In The Section Of General Physical Training.

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ABSTRACT

It is clear that the human physiological development is significantly based on the activity of platelet hemostasis. The optimal functional state of the body is largely due to adequate rheological properties of blood, which are largely influenced by the level of platelet activity. Moderate short physical exertion in young people is able to positively influence individual indicators of platelet functions. It was of great interest to study the effect of regular training on general physical training on healthy young people and especially on their functional activity of platelets. In the study, it was found out that young men aged 18–22 years of age who underwent regular physical training and who subsequently switched to irregular workouts have a consistently low platelet functional activity. For 18-35 years, platelet aggregation in the surveyed is at a low level, without experiencing significant fluctuations. The optimally low ability of platelets causes a small amount of circulating aggregates of various sizes in their bloodstream. This has a positive effect on the microcirculation of tissues in the body of a young man who regularly trained physically in adolescence, and subsequently transferred to supporting irregular exercises.

Keywords: physiology, hemostasis, adolescence, first mature age, general physical training.

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INTRODUCTION

There is no doubt that platelet hemostasis plays a significant role in the physiological development of the organism [1,2,3]. The optimal functional state of the body is largely due to adequate rheological properties of blood [4,5], which are largely influenced by the level of platelet activity [6,7]. At the same time, it is known that moderate short-term physical exertion can positively affect individual indicators of platelet functions [8-12].

At the same time, healthy young people without bad habits, passing in adolescence, regular training in general physical training, not fully clarified the functional activity of platelets, including their aggregation activity under the influence of various inductors and their combinations that are present in the blood flow and condition mechanisms of its determining. Also, in young people over 25 years of age who switched to irregular physical activities, the dynamics of the severity of platelet activity is not assessed. In this regard, the purpose of the study was formulated: to assess the dynamics of platelet activity in healthy young people who do not have bad habits and trained regularly as part of general physical training in their student years, and subsequently did not regularly attend the section.

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 147 healthy young students who regularly train 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 years), as well as 72 healthy young people 26–35 years old, who regularly trained in their student years as part of general physical training, and now have left regular training sessions, reducing x to irregular attendance section of general physical training at least once a week (24 persons 26-27 years old, 25 people 30-31 years old, 23 people 34-35 years old). All observed levels of intraplatelet lipid peroxidation were determined by the concentration of acyl hydroperoxides (AHP) with the determination of catalase and superoxide dismutase activity and the basal level of malondialdehyde (MDA) in the thiobarbituric acid reduction reaction. 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 assessed 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 U/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

Surveyed young people were under constant surveillance. All of them before the assessment of hemostasis determined the basic 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) in all examined were within the physiological norm.

It was found that the content of the primary products of lipid peroxidation-acyl hydroperoxides 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, without significant change by the age of 22 (1.97±0.12 $D_{233}/10^9$ platelets). At the same time, the level of basal MDA in platelets - the final product of lipid peroxidation at 18 years in the surveyed was 0.48±0.10 nmol/10^9 platelets, also remaining at this level up to 22 years of life (0.49±0.22 nmol/10^9 platelets). The concentration of the primary lipid peroxidation products of acylhydroperoxides in the platelets of healthy 26-27 year old young people who had previously regularly trained physically was 2.02±0.26 $D_{233}/10^9$ platelets, without significant change by 34-35 years and making up the age of 2.09±0.24 $D_{233}/10^9$ platelets (in

the control 1.98±0.17 $D_{233}/10^9$ platelets). At the same time, the level of basal MDA in platelets - the end product of lipid peroxidation in 26-27 years of the surveyed was 0.50±0.23 nmol/10^9 platelets, also remaining at this level until 34-35 years of life (0.52±0.31 nmol/10^9 platelets).

The activity of catalase and superoxide dismutase in the blood plates, which were monitored by healthy young people who regularly trained in the general physical training section, did not have reliable dynamics from 18 years old, amounting to at the beginning of the student age 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 activity of catalase and superoxide dismutase in the blood plates, which were monitored by healthy young people who left regular workouts in the general physical training section, did not have reliable dynamics from 26-27 years old (9600.0±236.1 IU/10^9 platelets and 1690.0±23.4 IU/10^9 platelets, respectively), up to 34-35 years (95500.0±195.8 IU/10^9 platelets, 1670.0±18.6 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 regardless of their transition to irregular physical training after 26-27 years. This indicated stability for 18-35 years in healthy young people who regularly exercise physically in their student years, and subsequently engaged in the section of general physical training irregularly, in the blood plates of the level of the products of labilization 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±0.22s). At a later date, thrombin and adrenaline AP developed, at 18 years old, being 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±0.12s, remaining stable until the age of 22. In the examined young people at 26-27 years of age, the time of development of antibodies under the influence of collagen was 35.1±0.29 s, being at a similar level in the older subjects. Similar activity of AP at this age in young people who left regular training was marked under the influence of ADP (46.8±0.17 s) and ristomycin (50.1±0.30 s). Later, thrombin and adrenaline AT developed, being at 26-27 years old, 57.2±0.14s and 105.2±0.34 s, respectively, not changing significantly in the older patients. In the 26-27 years with the combined use of inductors in AP physically exercising young people, for ADP + adrenaline - 37.0±0.12 s, for ADP + collagen - 26.2±0.24 s, for adrenaline + collagen - 28.3±0.21 s, remaining stable until 34-35 years of age.

The level of discocytes in healthy trained young people at 18 years of age was 85.9±0.10%, not significantly different from values at other ages. 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%.

In previously healthy young people who were regularly practicing at 26-27 years of life, the level of discocytes in the blood was 84.5 ± 0.16%, not significantly different from the values of the older patients who were included in the observation group. The number of disco-echinocytes, spherocytes, sphero-echinocytes and bipolar forms of platelets and their total number also remained stable in their bloodstream from 26 to 35 years. In young people who previously trained physically in the framework of physical therapy, the levels of free-circulating small and large platelet aggregates did not have reliable dynamics, amounting to 3.1±0.34 and 0.06±0.003 per 100 free platelets by 34–35, respectively. The content of platelets involved in the process of aggregation also did not change between 26 to 35 years, and by the end of the observation it was 6.2±0.24%.

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DISCUSSION

All morphological structures of the human body and their functions are largely formed under the influence of an adequate inflow 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 [13], which include regular moderate exercise [14]. It is known that the level of platelet lipid peroxidation and activity in the blood platelet blood plays a large role in the dynamics of the microcirculation state [15,16].

The study found that healthy young people 18–22 years old regularly moderately exercising physically as part of general physical training, consistently normal levels of antioxidant activity of platelets and a low level of lipid peroxidation in them, which largely determines the activity of blood platelets. In the case of a subsequent transition to irregular physical training in healthy young people 26-35 years old, stable normal indicators of antioxidant activity of platelets and a low level of lipid peroxidation in them remain, causing them to have a stable activity of platelets.

In the course of the survey, 18-22 year olds, who had been regularly trained as part of general physical training, and young people who had previously been regularly exercising at college age, confirmed the stability of the functional activity of platelets. This is probably largely due to the constancy of the sensitivity of platelet receptors to exogenous effects on platelets [17–20], which undoubtedly include a certain concentration of von Willebrand factor in the blood — a platelet adhesion cofactor [21] with a simultaneous number of receptors for it - (GPI c) on the surface of the blood platelets [22,23]. 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 [24-27], is also a consequence of complex adaptive reactions in the examined, causing ultimately the necessary adaptation of platelet hemostasis to the prevailing conditions of functioning [28].

Evaluation at with a number of inductors and their combinations in young people moderately exercising physically in 18-22 years, has allowed to establish the consistency they have aggregative function of platelets [29,30], steadfastly preserving in the transition to irregular loading [31]. In this case, the condition at at the impact on the strong platelet agonist aggregation – collagen and thrombin could also be largely constant activity of phospholipase C [32], ensuring the functioning phosphoinositol way through diacylglycerol and protein kinase C With fosfaurilirovaniem proteins of the contractile system [33,34]. Generated inositoltrifosfata ensures an adequate level of release of Ca2+ [35] from nutritionposition depot, that determines the permanence of the contractility of actomyosin [36]. It is not excluded that an important role in keeping young people in the 18-35, low at, also plays the stability of the activity of enzyme systems of platelets, including tromboksancintetaza [37] that lead to necessary under these conditions, the low sensitivity of platelets to stimuli from the outside [38].

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 A_2, regulating the release of arachidonic acid, and using the same sample thromboxane A_2.

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 and leave regular training indirectly indicates that the physiological level of aggregation inductors (primarily thrombin, ADP, adrenaline) remains in the blood with a low constant level of platelet sensitivity to them, despite being left regular physical activity. At the same time, in healthy young people 18–22 years of age, physically trained and older, who are already exercising irregularly, a high number of intact discoid forms of platelets remain in the bloodstream, indicating an unexpressed activity of their receptors [40]. The stability of the disco-echinocytes and other active forms of platelets is no doubt due primarily to the persistence of low expression of fibrinogen receptors (GP IIb - IIIa) on their membrane until at least 35 years of age.

Thus, as the chronological age increases, young people who are moderately trained physically in their student years, and subsequently attending the general physical training section irregularly, low platelet activity

remains, ensuring a low content of their active forms in the bloodstream, providing a physiological level of the number of circulating aggregates of different size, and thus the optimal rheological properties of their blood, regardless of the level of environmental effects on the body.

CONCLUSION

The young people aged 18–22 who regularly went through general physical training and subsequently switched to irregular trainings showed stable low functional platelet activity. For 18-35 years, platelet aggregation in these young people is at a low level, without experiencing significant fluctuations, which is apparently due to the constancy of their sensitivity to exogenous influences. The optimally low ability of platelets causes a small amount of circulating aggregates of various sizes in their bloodstream, which has a positive effect on tissue microcirculation in the body of a young person who regularly trained physically in his student years and later switched to supporting irregular exercises.

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