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Physiological Activity Of The Blood Plates In Regularly Practicing Amateur Football Players.

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ABSTRACT

Currently, the amount of scientific data on the close relationship between the level of physical activity of a person and the degree of functional readiness of platelet hemostasis is increasing. There is no doubt that the normal morphofunctional state of the body is largely determined by the fluidity of blood through the vessels, which is largely dependent on the level of platelet activity. At the same time, the features of platelet activity in various types of physical activity, including outdoor ball games, which are popular among young people, are not well known. Young people who regularly train in the football section showed stability of the functional activity of platelets, probably largely due to the constancy of their receptor sensitivity to exogenous influences (concentration in the blood of aggregation inducers and von Willebrand factor - a co-factor of platelet adhesion) at the optimal number of receptors for them on the surface of the blood platelets. The constancy of the aggregation activity of the blood platelets in response to an increase in the physical activity of the organism as a whole, are the result of complex adaptive reactions in the examined, leading, ultimately, to the adaptation of platelet hemostasis to the prevailing functioning conditions. The constant level of intravascular platelet activity in young people who regularly train in the football section indicates that the physiological level of aggregation inducers (primarily thrombin, ADP, adrenaline) remains in the blood with a low constant level of platelet sensitivity to them. At the same time, in healthy football players aged 18–22 years, a high number of intact discoid platelet forms remains in the bloodstream, which also indicates an unexpressed activity of their receptors. The stability of the level of disco-echinocytes and other active forms of platelets is no doubt due primarily to the constancy of the reduced expression of fibrinogen receptors on their membrane.

Keywords: football, regular training, adolescence, platelets, hemostasis.

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INTRODUCTION

Currently, there is an increasing amount of scientific data on the close relationship between the level of physical activity of a person and the degree of functional readiness of platelet hemostasis [1,2,3]. There is no doubt that the normal morphofunctional state of the body is largely determined by the blood flow through the vessels, which largely depends on the level of platelet activity [4,5]. At the same time, the characteristics of platelet activity in various types of physical activity [6,7], including outdoor ball games, which are popular among young people [8,9], are not well known.

However, healthy young people who regularly train at the amateur level in the football section have not fully clarified the activity of lipid peroxidation in platelets, the level of antioxidant enzymes in them, the degree of ability of blood plates to aggregate under the influence of physiological inductors and their combinations and the severity of morphological platelet activity in the lumen of blood vessels. In this regard, the goal of the study is formulated: to evaluate the activity of platelet functions in healthy young people without bad habits, who regularly practice amateur in the football section.

MATERIAL AND METHODS

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

134 healthy young men of college age who were training in the football section at the time of inclusion in the observation group for at least 1 year (26 people 18 years old, 27 people 19 years old, 28 people 20 years old, 25 people 21 years old and 28 people aged 22 years old). The level of intraplatelet lipid peroxidation was determined in all patients by concentration of basal level of malondialdehyde (MDA) in the reduction reaction of thiobarbituric acid and by the level of acylhydroperoxides (AHP). The activity of intra-platelet antioxidant enzymes was established for catalase and superoxide dismutase.

The number of platelets in the capillary blood in the Goryaev chamber was counted. The products of platelet-induced phospholipid-coagulation activators (F3-platelets) labilization were traditionally evaluated by calculating 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 by the t-Student criterion.

RESEARCH RESULTS

The young people included in the study group were under constant observation, did not have deviations in clinical and laboratory status. The level of the initially formed lipid peroxidation products of acylhydroperoxides in platelets of healthy 18-year-old young people practicing in the football section was 1.92 ± 0.12 D₂₃₃/10⁹ platelets, not changing significantly by 22 years (1.93 ± 0.10 D₂₃₃/10⁹ platelets). At the same time, the content of MDA in platelets - the final product of lipid peroxidation in 18 year old football players was 0.42 ± 0.10 nmol/10⁹ platelets, unchanged until 22 years of age (0.47 ± 0.11 nmol/10⁹ platelets).

The activity of catalase and superoxide dismutase in the blood plates that control the intensity of lipid peroxidation in the observed healthy young people at 18 were very high (9600.0 ± 126.2 IU/10⁹ platelets and 1750.0 ± 15.3 IU/10⁹ platelets, respectively). For older football players of student age, there were no changes in the activity of catalase and superoxide dismutase (at 19, 9750.0 ± 234.2 IU/10⁹ platelets, 1720.0 ± 18.2 IU/10⁹ platelets, 20 years - 9600.0 ± 154.1 IU/10⁹ platelets, 1680.0 ± 20.3 IU/10⁹ platelets, 21 years old - 9620.0 ± 176.1 IU/10⁹ platelets, 1650.0 ± 14.7 IU/10⁹ platelets, 22 years old - 9670.0 ± 146.1 IU/10⁹ platelets, 1680.0 ± 18.6 IU/10⁹ platelets, respectively).

The platelet activity index at 18 years in the examined corresponded to $20.1 \pm 0.14\%$, remaining at this level in the older surveyed. This proved stability in the blood plates of 18-22 year old healthy young people

who regularly train in the football section, the level of labilization products of platelet phospholipids - blood clotting activators.

In 18 year old football players, the time of AP development under the influence of a collagen inducer was 34.1 ± 0.19 s, being at a similar level in the older patients as well. Low AP activity in healthy 18 flight trained young people was observed under the influence of ADP (44.8 ± 0.16 s) and ristomycin (48.9 ± 0.16 s). Later, thrombin and adrenaline AP developed, at 58 years of age being 58.1 ± 0.20 s and 102.9 ± 0.12 s, respectively, not changing significantly in the older patients. With the combined use of inductors, the AT people trained in the 18-year-old football section for the combination ADP+adrenaline - 36.2 ± 0.11 s, for ADP + collagen - 26.4 ± 0.14 s, for adrenaline + collagen - 29.2 ± 0.09 s, remaining at a similar level until the age of 22.

The blood level of 18 year old football players of inactive platelets - discocytes corresponded to $85.2 \pm 0.16\%$, not significantly different from the values of those who train older people 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 $14.9 \pm 0.14\%$ among the patients. In the blood of young people who are trained in the football section, the levels of free-circulating small and large platelet aggregates did not have reliable dynamics, averaging 2.7 ± 0.15 and 0.06 ± 0.014 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 $5.7 \pm 0.13\%$.

Thus, people of college age who are regularly practicing amateur in the football section have a consistently low platelet activity, ensuring the optimal level of their rheological properties of blood.

DISCUSSION

The functional activity of the human body is formed and maintained by an adequate level of blood rheology [10,11], depending on a large number of environmental factors [12], including the presence of regular moderate exercise. A serious influence on the state of microcirculation is exerted by activity in the blood circulation of the blood plates, which in turn depends on the level of lipid peroxidation in them [16–20].

It has been established that in healthy young people 18–22 years of age regularly exercising physically in the football section, persistently low lipid peroxidation indicators are registered against the activation of the antioxidant platelet system, which largely determines their low platelet activity.

Young people who regularly train in the football section showed stability of the functional activity of platelets, probably largely due to the constancy of their receptor sensitivity to exogenous influences (concentration in the blood of aggregation inducers and von Willebrand factor - a co-factor of platelet adhesion) at the optimal number of receptors for them on the surface of blood platelets [21-24]. The constancy of receptor activity on the membranes of the blood platelets in response to an increase in the physical activity of the organism as a whole is a result of complex adaptive reactions in the examined [24-30], leading eventually to the adaptation of platelet hemostasis to the prevailing functioning conditions [31].

Evaluation of AP with a number of inductors and their combinations in people of college age practicing in the football section revealed the ability of platelets to aggregate at the age of 18-22 years. At the same time, the activity of antibodies under the action of strong agonists of aggregation - collagen and thrombin is determined by the constancy of the activity of phospholipase C, which ensures the functioning of the phosphoinositol pathway through diacylglycerol and protein kinase C with phosphorylation of the contractile system proteins [32,33]. Inositol triphosphate released at the same time from membranes stimulates an adequate level of Ca^{2+} release from intra-platelet depots, providing the necessary level of actomyosin contractility [34]. It is obvious that in maintaining a low AP, the stability of the activity of thromboxane formation, which causes the low ability of blood platelets to aggregate, is of great importance [35,36].

Young amateur footballers also noted a decrease in the response of platelets to weak aggregation inducers - ADP and adrenaline [37]. At the same time, in view of other mechanisms for the implementation of this AP, we can speak about the dynamics of the activity of these mechanisms when playing football [38]. The level of expression of fibrinogen receptors (GPIIb-IIIa), stimulating phospholipase A₂, regulates the release of

arachidonic acid phospholipids with increased formation of thromboxane A₂ [39]. The study of antibodies with several inductors showed their mutually potentiating action, confirming the patterns found in the study of antibodies with isolated agonists.

The constant level of intravascular platelet activity in young people who regularly train in the football section indicates that the physiological level of aggregation inductors (primarily thrombin, ADP, adrenaline) remains in the blood with a low constant level of platelet sensitivity [40]. At the same time, in healthy football players aged 18–22 years, a high number of intact discoid platelet forms remains in the bloodstream, which also indicates an unexpressed activity of their receptors. The stability of the disco-echinocytes and other active platelet forms is undoubtedly primarily due to the constancy of the reduced expression of fibrinogen receptors on their membrane (GP IIb - IIIa).

CONCLUSION

In the period from 18 to 22 years, young people who train in the football section have low platelet activity, providing a low content of their active forms in the bloodstream, maintaining the physiological level of the number of circulating aggregates of various sizes and optimal rheological properties of their blood, regardless of the level and nature of environmental influences on the body.

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