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Functional Properties Of Platelets In Amateur Tennis Players Aged 18-35 Years.

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ABSTRACT

The characteristics of platelet activity in vitro and in vivo and the level of functional mechanisms that ensure their aggregation readiness have not been fully studied in young people who regularly experience physical exercise. It has been established that for people 18–22 years old who regularly exercise physically in the tennis section, is characterized by the stability of low lipid peroxidation against the background of high activity of the antioxidant platelet system. At the same time, in healthy young people 26–35 years of age in the past regularly trained physically in the big tennis section, stable normal levels of antioxidant activity of platelets and a low level of lipid peroxidation in them were found. At the same time, regularly practicing tennis students have stably low functional platelet activity, probably largely due to the constancy of their receptor sensitivity to exogenous influences with a constant number of receptors for them on the surface of blood plates. The optimal functioning of the receptor apparatus of the blood plates with regular severe physical exertion in the tennis section is a result of complex adaptive reactions and low levels of peroxidation in the patients, leading eventually to the adaptation of the blood plates to the existing conditions of functioning. The constancy of intravascular platelet activity in young men who regularly train in the tennis section, and subsequently switched to irregular training, indicates the content of tennis players in the bloodstream of the physiological level of aggregation inductors with low platelet sensitivity to them. At the same time, trainees have a high number of intact discoid platelets in their blood, confirming the low activity of their receptors. The stability of the concentration of the active forms of platelets in the blood is also associated with a constantly reduced expression of fibrinogen receptors on their membrane.

Keywords: hemostasis, physiology, tennis, physical activity, adolescence, first adulthood.

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INTRODUCTION

There is no doubt that the development of morphofunctional characteristics of the body and the fluid properties of blood is closely related to the level of platelet activity [1-3]. At the same time, the level of physical activity of the organism affects the severity of platelet functions [4-5].

At the same time, the characteristics of platelet activity in vitro and in vivo and the level of functional mechanisms that ensure their aggregation readiness have not been fully studied in young people who regularly experience physical activities [6-10]. In this regard, the goal of the study was set: to evaluate the activity of platelet functions in healthy young people without bad habits who regularly train physically using the example of a big tennis section.

MATERIAL AND METHODS

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

Under supervision were 120 healthy young men of 18-22 years old who continuously train in the big tennis section from the time they entered the institute until the end of the student age (24 people 18 years old, 26 people 19 years old, 22 people 20 years old, 23 people 21 years old and 25 people 22 years old) and 72 healthy young people 26-35 years old who regularly trained in college years in the big tennis section, and now have left regular workouts, reducing them to the level of irregular workouts on the tennis court at least once a week (24 people 26-27 years old, 25 people 30-31 years, 23 people 34-35 years).

The level of intraplatelet lipid peroxidation (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 activity of intra-platelet antioxidant enzymes was established for catalase and superoxide dismutase. In capillary blood, platelet count was determined in the Goryaev chamber. The products of platelet-induced phospholipid-coagulation activators (F3-platelets) were evaluated in the traditional way 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. The intravascular activity of platelets was determined visually using a phase contrast microscope. Statistical processing of the results obtained by the t-student criterion.

RESEARCH RESULTS

In young people under observation, the main physiological and biochemical parameters were within the physiological norm.

The level of the initially formed POL-AHP products in the platelets of healthy 18-year-old young people practicing in the tennis section was 1.96 ± 0.14 D233 / 109 platelets, not changing significantly by 22 years (1.94±0.11 $D_{233}/10^9$ platelets). At the same time, the content of MDA in platelets - the end product of POL in 18 year old tennis players was 0.44±0.12 nmol/10^9 platelets, without experiencing reliable dynamics up to 22 years of age (0.46±0.17 nmol/10^9 platelets). The level of the primary products of LPO-AHP in platelets of healthy 26-27 year old young people who had previously been trained in the tennis section was at 2.06±0.15 $D_{233}/10^9$ platelets, not changing significantly by 34-35 years and making up age 2.08±0.25 $D_{233}/10^9$ platelets. At the same time, the level of basal MDA in platelets - the end product of LPO in 26-27 years of the surveyed was 0.52±0.27 nmol/10^9 platelets, also remaining at this level up to 34-35 years of life (0.52±0.14 nmol/10^9 platelets).

The activity of catalase and superoxide dismutase in the platelets of healthy young people in the study at the age of 18 was 9610.0±118.3 IU/10^9 platelets and 1650.0±12.4 IU/10^9 platelets, respectively. The older young people of college age practicing with large tennis did not have significant dynamics of activity of these enzymes (at 19 years old 9780.0±186.1 IU/10^9 platelets, 1740.0±17.3 IU/10^9 platelets, 20 years – 9720.0±190.6 IU/10^9 platelets, 1750.0±12.0 IU/10^9 platelets, 21 years old - 9690.0±231.4 IU/10^9 platelets, 1690.0±19.1 IU/10^9

platelets, 22 years - 9680.0±151.4 IU/10^9 platelets, 1720.0±9.6 IU/10^9 platelets, respectively). The activity of catalase and superoxide dismutase in the blood plates of older patients also did not experience any significant changes from 26–27 years old (9690.0±216.7 IU/10^9 platelets and 1690.0±16.5 IU/10^9 platelets, respectively), to 34 -35 years (9590.0±192.8 IU/10^9 platelets, 1690.0±22.3 IU/10^9 platelets, respectively).

The value of the platelet activity index, indicating the degree of labilization of platelet phospholipids - blood clotting activators at 18 years of age, was 20.4±0.12%, remaining at this level in the older ones (platelet activity index at 26-27 years old is 22.4±0.20%), not significantly differing from that of those who irregularly train in the tennis section.

In 18-year-old AP students attending the big-tennis section, under the influence of collagen, developed over 33.4 ± 0.16s, being at a similar level in the older subjects. Low AP activity in healthy 18 year old trained young people was observed under the influence of ADP (43.6±0.25 s) and ristomycin (48.2±0.15 s). At a later date, thrombin and adrenaline antibodies occurred, at 18 years old, 57.8±0.06 s and 101.3±0.14 s, respectively, not significantly changing in the older patients. The study of the simultaneous influence of several inductors in AP students who were trained in the tennis section of 18 year old students was for ADF + adrenaline - 36.1±0.10 s, for ADP + collagen - 26.2±0.13 s, for adrenaline + collagen - 29.1±0,08s, remaining at this level until 22 years of age. In young people at 26-27 years of age, included in the study, AP under the influence of collagen developed over 35.8±0.24 s, being at a similar level in all older subjects. Similar activity of AP at this age in young people who stopped regular training in the big tennis section was noted under the influence of ADP (46.8±0.22 s) and ristomycin (50.7±0.13 s). At a later date, thrombin and adrenaline AP developed, being at 26-27 years old, 57.5±0.12 s and 104.3±0.21 s, respectively, not changing significantly in the older patients. At the age of 26-27 years with combined use of inductors in AP physically young people, for ADP + adrenaline - 37.2 ± 0.10 s, for ADP + collagen - 27.2±0.09 s, for adrenaline + collagen - 28.9±0.18s, remaining stable until 34-35 years of age.

The blood levels of discocytes in 18-year-old tennis players was 85.1±0.17%, not significantly different from the values in the older people surveyed. The level of disco-echinocytes, spherocytes, sphero-echinocytes and bipolar forms of platelets also remained stable in their bloodstream from 18 to 22 years. At the same time, the sum of the active forms of platelets also did not undergo significant changes, averaging 14.5±0.15% among the examined patients. In the blood of young people of college age who are being trained in the big tennis section, the levels of free-circulating small and large platelet aggregates did not have reliable dynamics, averaging 2.6±0.11 and 0.05±0.010 per 100 free-lying 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 5.6±0.14%. The content of discoid platelets in the blood of healthy previously trained young people to 26-27 years of age was 85.3 ± 0.10%, not significantly different from the values at other ages included in the study. The number of disco-echinocytes, spherocytes, sphero-echinocytes and bipolar forms of platelets also remained stable in their bloodstream from 26 to 35 years. As a result, the sum of active forms of platelets also did not change significantly. In the blood of young people who were previously physically trained in the big tennis section under observation, the levels of free-circulating small and large platelet aggregates did not have reliable dynamics, reaching 2.9±0.19 and 0.06±0.005 per 100 free by 34–35 years lying platelets, respectively. The number of platelets involved in the process of aggregation, in the examined, also did not change between 26 to 35 years, amounting to 5.8±0.12% by the end of the observation.

DISCUSSION

The functioning of the human body is largely determined by a wide range of environmental factors [11,12], including regular physical exertion, which has a serious impact on the state of microcirculation in tissues through an impact on the activity of blood plates in the bloodstream [13-16].

It was found that healthy young people aged 18–22 years, who regularly exercise physically in the tennis section, show consistently low lipid peroxidation against the background of high activity of the antioxidant platelet system [17]. At the same time, in healthy young people 26–35 years of age in the past regularly trained physically in the big tennis section, stable normal levels of platelet antioxidant activity were found and low levels of lipid peroxidation in them, which largely determines the low level of blood plate stimulation by products of free radical origin 18-21].

Regularly practicing tennis students revealed a consistently low functional activity of platelets, probably largely due to the constantly low level of stimulation by lipid peroxidation products [22,23] of their receptors for aggregation inductors and Willebrand factor [24] - a platelet adhesion cofactor [25, 26]. The optimal functioning of the receptor apparatus of the blood plates with increased physical activity in the tennis section is a consequence of complex adaptive reactions in the examined [27-30], leading ultimately to the adaptation of the blood plates [32] to the existing conditions of functioning [32].

Evaluation of AP with a number of inductors and their combinations in people in adolescence regularly practicing in the tennis section, and subsequently leaving regular training, revealed a low ability of platelets to aggregate at the age of 18-35 years. The detectable low AT activity under the action of strong aggregation inducers was ensured by the constancy of the low functional capacity of phospholipase C [33, 34], which controls the functioning of the phosphoinositol pathway, phospholation of the contractile system proteins [35], the level of Ca^{2+} release [36] from the intrathromycin retardants and the actomyosin contractile system [37]. In young tennis players, a decrease in the reaction of platelets to weak aggregation inducers due to a decrease in the expression of fibrinogen receptors (GPIIb-IIIa) and a decrease in the activity of phospholipase A_2, regulating the release of arachidonic acid from phospholipids and the formation of thromboxane A_2 from it [38]. At the same time, the combination of several inductors showed their mutually potentiating action, confirming the regularities established in the study of antibodies with isolated agonists [39].

The constancy of intravascular platelet activity in young people who regularly train in the big tennis section, and subsequently switched to irregular workouts, indirectly indicates the content in the bloodstream of the physiological level of aggregation inductors with low sensitivity to them platelets [40]. At the same time, in students 18–22 years of age, a high number of intact discoid platelets remains in the bloodstream, confirming the low activity of their receptors. The stability in the blood of the level of active forms of platelets is also associated with the constantly low expression of fibrinogen receptors on their membrane (GP IIb - IIIa).

CONCLUSION

The young people aged 18–22 years who undergo physical training in the section of tennis, and subsequently train irregularly for at least 35 years, show a consistently low sensitivity of platelets to all physiological inductors and their combinations. At amateur tennis players of 18-35 years of age who regularly trained in their student years, an optimally low intravascular activity of platelets is recorded, causing a small amount of circulating aggregates of various sizes in their bloodstream.

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