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Functional Activity Of Platelet Hemostasis Of Amateur Soccer Players Aged 26-35, Who Regularly Trained In Adolescence.

Medvedev IN*.

Russian State Social University, st. V. Pika, 4, Moscow, Russia, 129226.

ABSTRACT

The state of the human body is largely determined by the rheological properties of blood, which are largely associated with the activity of platelet hemostasis. It is known that platelet functions may vary depending on the conditions of life, incl. on the intensity of the exercise. In young people who regularly engaged in the age of 18-22 years in the football section and subsequently transferred to irregular training, a stable low functional platelet activity was revealed. For 26-35 years, their platelet aggregation was at a low level, without experiencing significant fluctuations. Apparently, this is due to the constancy of their sensitivity to exogenous influences. The optimally low platelet activity causes a small amount of circulating aggregates of various sizes in their bloodstream, which has a stable positive effect on the microcirculation of tissues in the body of a young person who has previously been physically trained regularly.

Keywords: platelet activity, young age, cessation of regular physical activity, microcirculatory features of platelets, football section.

**Corresponding author*

INTRODUCTION

Ontogenetic dynamics of various functions of the body is an important step in maintaining hemostasis at any age [1-4]. The dynamics of the activity of the parameters of the hemostasis system [5-8] is of great importance in this. At the same time, the state of the human body is largely determined by the rheological properties of blood, which are largely associated with the activity of platelet hemostasis [9,10]. It is known that platelet functions may vary depending on the living conditions, including the intensity of the exercise stress [11–13]. At the same time, the activity of platelet functions in young people who have no bad habits, who in the past regularly trained physically, but subsequently reduced the intensity and frequency of training, remains insufficiently studied. The dynamics of the ability to aggregate their platelets under the influence of various inductors and their combinations, which are present in blood flow conditions, has not been evaluated. Also, they did not reveal the severity of intravascular platelet activity *in vivo*. In this regard, the purpose of the study was formulated: to determine the activity of platelet functions in healthy young people 26-35 years old, who have no bad habits, who left regular intensive training in the football section.

MATERIALS AND METHODS

The study was approved by the local ethics committee of the Russian State Social University on September 14, 2016 (protocol №19). The study was conducted on the basis of the Russian State Social University.

There were 71 healthy young people aged 26-35 under observation, each of whom in their student years regularly and intensively engaged in the football section, going about 22 years of age (after graduation from the university) to irregular training, at least once a week (25 people 26–27 years old, 24 people 30-31 years old, 22 people 34-35 years old). The control group is represented by 134 healthy young people aged 18–22 years regularly 4 times a week who exercise physically in the football section. All young people from the experimental and control groups had common functional and biochemical parameters that were within the generally accepted norm. All examined individuals studied the level of intraplatelet lipid peroxidation (LPO) according to the content of the basal level of malondialdehyde (MDA) in the reduction reaction of thiobarbituric acid and the level of acyl hydroperoxide (AHP). All estimated activity of catalase and superoxide dismutase platelets. In the capillary blood in the Goryaev chamber, the platelet count was determined. The stabilization of platelet phospholipids (F_3 – platelets) was evaluated according to the traditional method with calculation of the platelet activity index. Platelet aggregation (AP) was recorded by a visual micromethod using as inducers ADF (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. The intravascular activity of platelets was determined visually using a phase contrast microscope. Statistical processing of research results was carried out using Student's t-test.

RESULTS AND DISCUSSION

The content of acylhydroperoxides in the platelets of healthy 26-27 year old young people who were engaged in the football section earlier was at a level of 2.04 ± 0.24 D₂₃₃/10⁹ platelets, not changing significantly by 34-35 years and at this age was 2.06 ± 0.20 D₂₃₃/10⁹ platelets (in control 1.97 ± 0.15 D₂₃₃/10⁹ platelets). The level of basal MDA in platelets - the end product of LPO in 26-27 year old patients was 0.51 ± 0.22 nmol/10⁹ platelets, remaining at this level for up to 34-35 years of life (0.50 ± 0.16 nmol/10⁹ platelets) with the value in the control of 0.46 ± 0.12 nmol/10⁹ platelets. The activity of catalase and superoxide dismutase in the blood plates of the examined healthy young people did not have significant differences between the levels characteristic for 26-27 years (9620.0 ± 254.4 IU/10⁹ platelets and 1670.0 ± 18.6 IU/10⁹ platelets, respectively) and the level of 34-35 years (9570.0 ± 172.4 IU/10⁹ platelets, 1680.0 ± 21.4 IU/10⁹ platelets, respectively) with their activity in the control 9648.0 ± 161.4 IU/10⁹ platelets, 1660.0 ± 17.2 IU/10⁹ platelets, respectively.

The platelet activity index in the 26-27 year olds surveyed was $21.2 \pm 0.17\%$, not significantly differing from that in the older observed ones and the control values ($20.5 \pm 0.08\%$), which indicated that they were comparable platelet phospholipid labilization. In young people at 26-27 years of age included in the study, AP under the influence of collagen developed over 35.2 ± 0.25 s (in control 34.2 ± 0.16 s), not significantly differing from the values of the older subjects. At the same time, AP in 26-27 year olds, who stopped regular training of

young people under the influence of ADP was 46.5 ± 0.16 s (in the control 46.0 ± 0.18 s) and ristomycin - 50.2 ± 0.18 s (in the control 49.0 ± 0.14 s). Thrombin and adrenaline AP turned out to be even more slowed down, resulting in 57.1 ± 0.10 s and 105.8 ± 0.15 s, respectively (in the control 56.7 ± 0.14 s and 103.0 ± 0.16 s, respectively), not significantly different from similar values in the older surveyed. When combined inductors were used in 26-27 year-olds, AP physically irregularly trained young people did not significantly differ from those in 34-35 year olds: ADP + adrenaline 37.5 ± 0.18 s and 37.4 ± 0.24 s, respectively; for ADP + collagen, 27.4 ± 0.22 s and 28.6 ± 0.34 s, respectively; for adrenaline + collagen, 28.5 ± 0.25 s and 27.4 ± 0.26 s, respectively (in control, 36.6 ± 0.12 s, 27.0 ± 0.14 s, and 29.3 ± 0.09 s, respectively).

The number of discoid platelets in the blood of 26-27 year-old healthy, previously regularly trained young people was $84.2 \pm 0.12\%$, not significantly different from the values characteristic of the older observed (tab.). 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 undergo significant changes. In the blood of young people under observation, who had previously been actively and regularly trained physically, the number of free-circulating small and large platelet aggregates did not have reliable dynamics, amounting to 34–35 years to 3.0 ± 0.22 and 0.07 ± 0.004 per 100 free lying platelets, respectively. The number of platelets involved in the process of aggregation in the patients also did not change between 26 to 35 years, amounting to $5.9 \pm 0.20\%$ by the end of the observation.

Table. Intravascular platelet activity in healthy young people in their youthful years regularly engaged in the football section

Platelet forms and variants of their aggregates	Young people regularly engaged in youth in the football section			Control, n=134, M±m
	26-27 years, n=25	30-31 year, n=24	34-35 years, n=26	
Discocytes, %	84.2 ± 0.12	83.5 ± 0.20	84.0 ± 0.19	85.1 ± 0.12
Disco-echinocytes, %	9.9 ± 0.16	11.0 ± 0.24	10.1 ± 0.22	9.4 ± 0.15
Spherocytes, %	2.9 ± 0.12	2.8 ± 0.17	3.0 ± 0.11	2.7 ± 0.18
Sphero-echinocytes, %	1.8 ± 0.12	1.7 ± 0.11	1.8 ± 0.15	1.6 ± 0.17
Bipolar forms, %	1.2 ± 0.10	1.0 ± 0.16	1.1 ± 0.17	1.1 ± 0.09
Sum of active forms, %	15.8 ± 0.12	16.5 ± 0.17	16.0 ± 0.17	14.9 ± 0.14
The number of platelets in the aggregates, %	5.7 ± 0.17	5.4 ± 0.14	5.9 ± 0.20	5.7 ± 0.13
The number of small units of 2-3 platelets per 100 free platelets	2.6 ± 0.16	2.8 ± 0.18	3.0 ± 0.22	2.7 ± 0.15
The number of medium and large aggregates, 4 or more platelets, per 100 free-lying platelets	0.07 ± 0.005	0.08 ± 0.006	0.07 ± 0.004	0.06 ± 0.014

Note: the reliability between the evaluated groups of the examined was not revealed.

DISCUSSION

Healthy young people of 26-35 years old, who had previously regularly trained in the football section, have consistently high levels of platelet antioxidant activity and, as a result, low intensity of LPO in them [14]. This largely determines the low sensitivity of platelet receptors to exogenous influences, including von Willebrand factor - the cofactor of platelet adhesion with a constant number of receptors to it (GPI) on the surface of blood platelets. This was the result of complex adaptive reactions of the body in the examined, ensuring the preservation of optimal adaptation of platelet hemostasis to the conditions of functioning [15-20].

In young people 26–35 years old, who were regularly engaged in the football section in their student years, the constancy of the aggregative function of the blood platelets was noted. The stability of antibodies

with strong agonists (collagen and thrombin) indicates constancy in the examined mechanisms of platelet activation through phospholipase C and the phosphoinositol pathway at a low level of phosphorylation of the contractile system proteins [21]. Slow AP in the examined young people in response to weak aggregation inducers - ADP and adrenaline indicates a small level of expression on the membranes of the blood plates of fibrinogen receptors (GPIIb-IIIa) with constantly unexpressed stimulation of phospholipase A₂ in them and the whole arachidonic acid metabolism cascade. The results of the combined use of inductors allowed us to establish the mutually potentiating effect of inductors with the mutual reinforcement of the mechanisms identified with the isolated application of inductors [22].

The stably low level of intravascular platelet activity in young people involved in the football section indicated that the physiological level of aggregation inducers (primarily thrombin, ADP and adrenaline) remained in their blood with adequate constant platelet sensitivity to them. The continued low number of active forms of platelets and their aggregates in the bloodstream of healthy young people 26–35 years old who regularly trained physically between the ages of 18–22 years old further confirms their reduced receptor activity in their blood platelets [23].

CONCLUSION

Regularly and intensively trained at the age of 18-22 years in the football section of 26-35 year-old young people have a consistently low ability of platelets to aggregate, which, apparently, is due to sufficient perfection of their regulatory mechanisms that preserve the optimal response to physiological inducers of aggregation. Non-expressed intravascular platelet activity in the bloodstream of young people who had previously been regularly engaged in the football section causes a consistently low level of freely circulating aggregates of various sizes, ensuring an optimal state of microcirculation in their bodies.

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