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Functional Features Of Platelets In Candidates And Masters Of Sports In The Athletics Of Adolescence.

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ABSTRACT

The activity of platelet hemostasis is closely related to the peculiarities of the functioning of the human body, including the magnitude of the exercise that is being tested. Optimal reactivity and morphofunctional status of the organism is largely determined by adequate platelet activity, strongly influencing the rheological properties of blood. Currently, it is known that physical activity in humans can positively influence some indicators of platelet activity. In healthy young people experiencing regular physical exertion in the amount of the relevant standards of the candidate and master of sports, the state of platelet lipid peroxidation, the level of their antioxidant protection, the degree of functional activity of blood platelets, including in blood flow conditions, have not been fully studied. The study revealed that candidates and masters of sports in athletics at the age of 18-22 years old, regularly practicing and taking part in competitions at various levels, have a consistently low functional platelet activity. During the estimated age, platelet aggregation in athletes was at a low level, without experiencing significant fluctuations, which is apparently due to their constantly low sensitivity to exogenous influences. Low platelet activity causes a small amount of circulating aggregates of various sizes in their bloodstream, which has a positive effect on the microcirculation of tissues in the body of an athlete who is experiencing significant physical exertion.

Keywords: hemostasis, sport, exercise, adolescence, health.

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INTRODUCTION

The level of activity of platelet hemostasis is closely related to the peculiarities of the functioning of the body [1-5], including the magnitude of the exercise that is being tested [6-10]. The optimal reactivity and morphofunctional status of the organism is largely determined by the adequate activity of platelets, strongly influencing the rheological properties of blood [11-14]. It is now known that physical exertion in people can positively influence some indicators of platelet activity [15-18].

At the same time, healthy young people who experience regular physical exertion in the amount of relevant standards of the candidate and master of sports have not fully studied the state of lipid peroxidation (LPO) of platelets, their level of antioxidant protection, the degree of functional activity of blood platelets, including blood flow conditions. In this regard, the goal of the present study is formulated: to determine the activity of platelet functions in young people 18–22 years old candidates and masters of sports in athletics.

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 125 healthy students of candidates and masters of sports in athletics who regularly train and take part in competitions at various levels (25 people 18 years old, 26 people 19 years old, 23 people 20 years old, 24 people 21 years old and 27 people aged 22 years old).

All athletes included in the study determined the level of intraplatelet LPO according to the concentration of the basal level of malondialdehyde (MDA) in the reduction reaction of thiobarbituric acid and the level of acyl hydroperoxides (AHP). The number of platelets in capillary blood in the Goryaev chamber was estimated. The level of platelet phospholipid-labilization products - coagulation activators (F_3 – platelets) was determined by the traditional method with calculation of the platelet activity index. The duration of platelet aggregation (AP) was recorded 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. The degree of 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

All athletes included in the research group before evaluating the platelet functions determined the basic physiological and laboratory parameters, which showed that common functional and biochemical values (temperature, heart rate, respiratory rate, internal organs, general blood and urine tests, biochemical blood composition) were within the physiological norm.

The level of the primary products of LPO-AHP in platelets of 18-year-old athletes was at the level of 1.71±0.18 $D_{233}/10^9$ platelets, did not change significantly by 22 years and was at this age 1.69±0.16 $D_{233}/10^9$ platelets. At the same time, the content of basal MDA in platelets - the end product of LPO in patients aged 18 was 0.37±0.12 nmol/10^9 platelets, remaining at this level for up to 22 years of age (0.39±0.28 nmol/10^9 platelets).

The activity of catalase and superoxide dismutase in the blood plates of the examined young candidates and masters of sports did not have reliable dynamics, amounting at 18 years of age to 10550.0±214.5 IU/10^9 platelets and 1990.0±12.7 IU/10^9 platelets, respectively. In subsequent follow-up periods, no significant changes in the activity of catalase and superoxide dismutase were observed in the examined (at 19 years 9900.0±271.6 IU/10^9 platelets, 2100.0±11.9 IU/10^9 platelets, 20 years - 9890.0±231.9 IU/10^9 platelets, 2050.0±21.3 IU/10^9 platelets, 21 years old - 10600.0±236.4 IU/10^9 platelets, 1960.0±18.6 IU/10^9 platelets, 22 years – 10150.0±280.3 IU/10^9 platelets, 2060.0±12.7 IU/10^9 platelets, respectively).

The value of the platelet activity index in 18 year olds surveyed was 19.0±0.22%, remaining at this level in older athletes as well. This indicated stability for 18–22 years in young candidates and masters of sports

who regularly exercise physically in the blood platelets of the level of the products of labilization of platelet phospholipids - blood clotting activators. In athletes 18 years of age, the time of AP development under the influence of collagen was 36.4±0.24 s, being at the same level as in older colleagues. Similar AP activity in 18 flight athletes was noted under the influence of ADP (47.9±0.12 s) and ristomycin (53.2±0.20 s). Thrombin and adrenaline AP turned out to be slower, at 59 years old 59.7±0.18s and 109.7±0.22s, respectively, not significantly changing in the older patients. At the age of 18, with the combined use of inductors, for athletes, AP was for ADP + adrenaline - 38.5±0.13s, for ADF + collagen - 29.6±0.19s, for adrenaline + collagen - 34.1±0.19s, staying stable until the age of 22.

The content of discocytes in the blood of 18 summer athletes was 88.3±0.14%, not significantly different from the values in the older patients surveyed who were 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 12.0±0.12% among the surveyed. In the blood of young athletes under observation, the levels of free-circulating small and large platelet aggregates did not have reliable dynamics, averaging 2.2±0.15 and 0.04±0.015 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 4.6±0.16%.

Thus, young athletes have consistently low platelet activity between 18 and 22 years of age, maintaining their optimal level of rheological properties of blood.

DISCUSSION

Pronounced physical activity has a positive effect on the morphological structures and their functional activity of the human body, largely due to the dynamics of the rheological properties of blood. A significant role in the dynamics of the state of microcirculation is played by the level of the LPO of platelets and their activity in the lumen of the vessel [19,20].

When conducting research, it was found that athletes 18–22 years of age regularly practicing and participating in competitions, have consistently high levels of antioxidant activity of platelets, suppressing the level of LPO in them, largely causing the constancy of activity of blood platelets [21,22].

Examination of candidates and masters of sports in athletics revealed a low functional activity of platelets, which is probably largely due to the reduced level of sensitivity of platelet receptors to exogenous influences [23]. Non-expressed activity of the platelets causes a low activity of the hemostasis system, largely affecting the functional state of the body as a whole, being in turn a consequence of complex adaptive reactions in athletes, providing the necessary adaptation of platelet hemostasis to constant pronounced physical exertion [24].

Estimation of the time of AP development with a number of inductors and their combinations in young athletes of athletes allowed us to establish a consistently low aggregative capacity of the blood plates [25,26]. Unspecified intensity of antibodies with strong agonists - collagen and thrombin causes a constancy in the reduced activity of phospholipase C, which provides the necessary level of functioning of the phosphoinositol pathway through diacylglycerol and protein kinase C [27] with a low level of phosphorylation of the contractile system proteins [28,29]. Inositol triphosphate formed in this process contributes to the weak release of Ca^{2+} [30] from intra-platelet depots, which results in a consistently low contractile ability of actomyosin [31,32]. In addition, an important role in maintaining low AP also plays the constancy of the activity of the enzyme system of thromboxane formation of platelets, combined with the low sensitivity of blood plates to thromboxane [33,34].

The weak aggregation inducers - ADP and adrenaline platelets of the examined athletes also responded slowly [35], probably due to the reduced number of receptors on them on the outer membranes [36] and the expression of expression under their influence of fibrinogen receptors (GPIIv-IIIa) [37], slight stimulation phospholipase A_2 [38], providing incomplete release of arachidonic acid phospholipids and reduced formation of thromboxane A_2 [39]. The simultaneous use of several inducers of aggregation confirmed that under the

conditions of their mutually potentiating action, close to intravascular, the same regularities that were found in the study of antibodies with isolated agonists take place [40].

The constancy of a low level of intravascular platelet activity in young athletes-athletes indirectly indicates the preservation in the blood of the physiological level of aggregation inducers (thrombin, ADP, adrenaline) with a reduced sensitivity of platelets to them between 18 and 22 years. At the same time, these athletes in the bloodstream maintain a high number of intact discoid platelets and a reduced number of their active forms, further indicating the unexpressed activity of their receptors.

CONCLUSION

Young athletes of athletes, leading an intense sports life, markedly stable low platelet activity, providing a low content of their active forms in the bloodstream, providing a physiological level of the number of circulating aggregates of various sizes. Positive changes in their platelet activity noted in them largely determine the optimal rheological properties of the blood of athletes, regardless of the level and characteristics of environmental effects on the body.

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