ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

The Effect Of Metered Exercise On Platelet Activity In Adolescents.

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ABSTRACT

The normal morphofunctional state of the body is largely due to the adequate rheological properties of the blood, which are significantly affected by the level of platelet activity. The study found that in healthy young people aged 18-22 years who regularly physically exercise physically in the framework of general physical training, there is a stable normal antioxidant activity of platelets and a low level of lipid peroxidation in them, which in many respects causes the constancy of the activity of blood plates. When examining young people of this age who were training in the framework of general physical training, the stability of the functional activity of platelets was confirmed. Probably, this is largely due to the constant level of sensitivity of platelet receptors to exogenous effects on platelets, which undoubtedly include a certain concentration in the blood of von Willebrand factor - the cofactor of platelet adhesion with the simultaneous constancy of the number of receptors to it - on the surface of blood plates. 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, is also a consequence of the complex adaptive reactions in the subjects, ultimately necessitating the adaptation of platelet hemostasis to the existing functioning conditions. With the growth of young people who are moderately trained physically, low platelet activity is maintained, providing a small content of their active forms in the bloodstream, providing a physiological level of the number of circulating aggregates of various sizes, which determines the optimal rheological properties of their blood, regardless of the level of environmental influences on the body.

Keywords: platelets, physical activity, youthful age, hemostasis, physiology.

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ISSN: 0975-8585

INTRODUCTION

At present, it becomes obvious that the activity of platelet hemostasis plays an important role in the genetically determined process of human development [1-3]. The normal morphofunctional state of the organism is largely due to the adequate rheological properties of blood [4-6], which are significantly influenced by the level of platelet activity [7, 8]. This is true under normal conditions at any age [9,10]. This is confirmed by various pathologies [11-13]. At the same time, it is known that moderate physical load in young people is able to positively influence individual parameters of platelet functions [14, 15]. At the same time, in healthy young people who do not have bad habits and regularly train in the framework of general physical training (DPP), the state of lipid peroxidation (LPO) of platelets, the activity of their antioxidant enzymes, the level of functional readiness of the blood platelets, in t.ch. Their aggregation activity under the influence of various inducers and their combinations, available in conditions of blood flow. These young people also do not appreciate the severity of the morphological activity of platelets in the vessels. In this regard, the goal of the study was formulated: to determine the activity of platelet functions in healthy young people who do not have bad habits and who regularly train in the framework of general physical training.

MATERIALS AND METHODS

The study group included 147 healthy young students practicing physical training at the beginning of the physical training program, and at the end of the subject program in the sports section on PFD (28 people 18, 31 people 19 years, 29 people 20 years, 27 people 21 years and 32 people aged 22 years). All subjects were assessed the level of intra-platelet lipid peroxidation by the concentration of the basal level of malonicdialdehyde (MDA) in the reduction reaction of thiobarbituric acid and by the level of acyl hydroperoxides (AHP) [16]. Counted the number of platelets in the capillary blood in the chamber Goryaeva. The products of labialization of platelet phospholipids - activators of coagulation (F3 - platelets) were evaluated by the traditional method with the calculation of the platelet activity index (ITA). The duration of platelet aggregation (AT) was determined by visual micromethod [17] using ADP ($0.5x10^{-4}$ M), collagen (1: 2 dilution of the basic suspension), thrombin (0.125 units / ml), ristomycin (0,8 mg / ml), epinephrine ($5x10^{-6}$ M), as well as the combination of ADP and epinephrine, ADP and collagen, adrenaline and collagen to simulate real blood flow conditions. Intravascular activity of platelets (BAT) was determined visually using a phase contrast microscope [17]. Statistical processing of the results was carried out using Student's t-test.

RESULTS AND DISCUSSION

The young people included in the study group were under constant surveillance. Prior to assessing hemostasis, the main physiological parameters were determined, morphological and biochemical blood tests were performed, showing that the estimated total functional and biochemical values (temperature, heart rate, respiratory rate, general blood and urine tests, biochemical blood tests) were within all physiological norm.

The content of the primary products of POL-AGP in the thrombocytes of healthy 18 year old young people who regularly trained physically was at the level of 1.96±0.19 $D_{233}/10^9$ platelets, Significantly unchanged at 22 years of age and constituted 1.97±0.12 at this age $D_{233}/10^9$platelets. At the same time, the level of basal MDA in platelets - the final product of LPO at 18 years of age - 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/10^9platelets).

The level of activity of catalase and SOD in the blood plates, under the supervision of healthy young people, did not have reliable dynamics from 18 years old, making at this age 9650.0±114.3 IU/10^9platelets and 1720.0±17.6IU/10^9platelets, respectively. In the subsequent observation period, the subjects observed no changes in the activity of catalase and SOD (at 19 years 9700.0±251.6 IU/10^9platelets, 1700.0±17.6 IU/10^9platelets, 20 years - 9660.0±132, 6 IU/10^9platelets, 1640.0±26.9 IU/10^9platelets, 21 years - 9600.0±132.7 IU/10^9platelets, 1680.0± 12.9 IU/10^9platelet, 22 years - 9920,0±184.6 IU/109platelet, 1710.0±19.9 IU/10^9platelet, Respectively). The level of ITA at 18 years of age in the surveyed corresponded to 20.5 ± 0.19%, remaining at this level in the older surveyed. This indicated stability for 18-22 years in healthy young people who regularly train physically, in blood platelets of the level of products of labialization of platelet phospholipids - activators of blood coagulation. In the examined young people at the age of 18 years, the time of development of AT under the influence of collagen was 34.2±0.15 s, being at the same level in the following years. Similar activity of AT in healthy 18-year-old trained young people was observed under the influence of

ADP (45.2±0.11 s).And ristomycin (49.4±0.22 sec.). In later terms, thrombin and adrenaline AT developed, accounting for 18.9±0.16 sec. and 104.2±0.17 seconds, respectively, without changing significantly in older subjects. At 18 years with combined use of inducers in physically trained young people, AT was adrenaline for ADP + - 37.5±0.119 s, for ADP + collagen - 27.2±0.22 s, for adrenaline + collagen - 29.4±0.12 s, remaining stable until the age of 22 (Table). The level of discocytes in the blood in healthy trained young people at 18 years of age was 85.9±0.10%, significantly not differing from the values at other ages 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, amounting to an average of 14.9±0.15% in the examined subjects. In the blood of young people who are moderately trained physically, the levels of free-circulating small and large aggregates of platelets did not have significant dynamics, averaging 2.8±0.14 and 0.06±0.012 per 100 freely lying platelets, respectively. The number of platelets involved in the aggregation formation process also did not change between 18 to 22 years, an average of 5.8±0.12%. Thus, regularly moderately trained young people physically have a stably low platelet activity between 18 and 22 years of age, able to maintain the optimal rheological properties of blood.

DISCUSSION

Morphological structures and their functional activity of the human body are largely formed under the influence of an adequate influx of nutrients due to the necessary level of rheology of blood [18], which can change during ontogeny under the influence of a large number of environmental factors, including regular moderate exercise [19]. It is known that a significant role in the dynamics of the state of microcirculation is played by the level of LPO of platelets and activity in the bloodstream of blood plates [20,21].

The study found that in healthy young people aged 18-22 years, who regularly physically exercise physically in the framework of PFD, stably normal antioxidant activity of thrombocytes and a low level of LPO are noted, which in many respects causes the constancy of the activity of the blood platelets. When examining young people of this age who were training in the PEF, the stability of the functional activity of platelets was confirmed. Probably, this is largely due to the constant level of sensitivity of platelet receptors to exogenous effects on platelets, which undoubtedly include a certain concentration in the blood of von Willebrand factor-a coagulant of platelet adhesion with a simultaneous constancy of the number of receptors for it (GPI in) on the surface of blood plates. 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, is also a consequence of the complex adaptive reactions in the examinees, ultimately necessitating the adaptation of platelet hemostasis to the established functioning conditions [22].

The study of AT with a number of inducers and their combinations in young people, moderately trained physically, made it possible to establish the constancy of the aggregative function of blood plates at the age of 18-22 years. At the same time, the state of AT with the influence on platelets of strong aggregation agonists - collagen and thrombin - can be largely conditioned by the activity of phospholipase C, which ensures the functioning of the phosphoinositol pathway through diacylglycerol and protein kinase C with the phosphorylation of proteins of the contractile system [23]. Generated in this case, inositol triphosphate provides an adequate level of Ca2 + release from the intra-platelet depot, which causes the contractility of actomyosin to remain unchanged [24,25]. It is possible that an important role in maintaining a low AT is also played by the stability of the activity of enzymatic systems of platelets, incl. tromboksanobrazovaniya, causing the necessary in these conditions low sensitivity of blood platelets to stimuli from the outside [26,27].

Analogous platelet responses in the surveyed young people were noted for weak aggregation inducers, ADP and adrenaline, interacting with the receptors of their membranes and causing the necessary level of expression of fibrinogen receptors (GPIIb-IIIa), stimulating phospholipase A2, regulating the yield of arachidonic acid phospholipids with increasing thromboxane A2 [28]. The evaluation of AT with the simultaneous use of several inducers showed their mutual potentiating effect, confirming the patterns revealed in the study of AT with isolated agonists. Stability of BAT level in young people who regularly train physically, indirectly indicates the preservation in the blood of the physiological level of inducers of aggregation (primarily thrombin, ADP, adrenaline) with a low constant level of sensitivity to them platelets. At the same time, in healthy young people, physically trained for 18-22 years, a high amount of intact discoid form of platelets is preserved in the bloodstream, which indicates the ineffective activity of their receptors.

Stability of the level of disco-echinocytes and other active forms of platelets is undoubtedly associated primarily with the persistence of low expression on their membrane of fibrinogen receptors (GP IIb-IIIa) [29]. Conclusion As young people who physically train physically mature, low platelet activity is maintained, providing a small content of their active forms in the bloodstream, providing a physiological level of the number of circulating aggregates of various sizes, which determines the optimal rheological properties of their blood, regardless of the level of environmental influences on the body.

Table: Aggregative capacity of platelets in healthy young people who train in the framework of general physical training

Indicators	Young people undergoing general physical training, n=147 M±m				
	18 years, n=28	19years,n=31	20years, n=29	21 years, n=27	22years, n=32
ADP,s	45.2±0.11	46.5±0.12	47.4±0.16 p<0.05	46.1±0.20 p<0.05	45.9±0.13 p<0.05
Collagen, s	34.2±0.15	33.9±0.20	34.3±0.24 p<0.05	35.0±0.15 p<0.05	35.4±0.08 p<0.05
Thrombin, s	57.9±0.16	56.5±0.23	56.9±0.17 p<0.05	57.2±0.09 p<0.05	57.5±0.17 p<0.05
Ristomycin, s	49.4±0.22	48.9±0.15	49.0±0.14 p<0.05	48.2±0.18 p<0.05	49.6±0.16 p<0.05
H_2O_2, s	50.2±0.21	49.6±0.14	49.9±0.12 p<0.05	51.9±0.19 p<0.05	49.1±0.24 p<0.05
Adrenaline, s	104.2±0.17	103.1±0.24	100.6±0.20 p<0.05	102.5±0.16 p<0.05	106.5±0.12 p<0.05
ADP +adrenaline, s	37.5±0.19	36.9±0.17	37.2±0.20 p<0.05	36.5±0.17 p<0.05	37.6±0.19 p<0.05
ADP +collagen, s	27.2±0.22	27.9±0.19	27.5±0.15 p<0.05	28.2±0.24 p<0.05	27.8±0.10 p<0.05
adrenaline+collagen, s	29.4±0.12	29..8±0.16	30.2±0.07 p<0.05	30,0±0.08 p<0,05	28,.5±0,14 p<0.05

Legend: p - reliability of differences in the estimated indicators in different age periods.

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