Biomedical Communication

Hematological Parameters in Mature Age Men Who Have Begun Regular Sports Walking

Ilya N. Medvedev[1], Vladimir Yu. Karpov[1], Maxim V. Eremin[1], Olga G. Rysakova[1], Alexander V. Dorontsev[2] and Dmitry A. Ivanov[3]

[1]Russian State Social University, 129226, Moscow, Russia

[2]Astrakhan State Medical University, 414000, Astrakhan, Russia

[3]Moscow State University of Psychology and Education, 115432, Moscow, Russia

ABSTRACT

Rheological features of erythrocytes significantly determine the processes of microcirculation in all vessels of the body. In people of mature age, even without obvious pathology, there is a gradual deterioration in the rheological properties of erythrocytes. In this regard, they need regular exercise to improve the properties of red blood cells important for microcirculation. The work was carried out on 38 men of mature age without obvious pathology and who have not been involved in any kind of sport during their life. During the course of the study, they began to regularly engage in race walking 4 times a week. The control group consisted of 35 men of mature age, who were engaged in race walking for at least 5 years at least 4 times a week. To obtain scientific information, traditional biochemical, hematological and statistical research methods were used. After six months of sports walking in the blood of physically untrained men, the level of arachidonic acid metabolites was optimized, the content of cholesterol and lipid peroxidation products decreased in the composition of erythrocyte membranes with an increase in phospholipids in them. After six months of physical training in previously untrained men, the level of altered types of red blood cells increased. For men of mature age with an initial low muscle activity, who began regular sports walking, gradual optimization of the surface characteristics of erythrocyte membranes is characteristic, which improved the course of their microcirculation processes.

KEY WORDS: MEN, MATURE AGE, RACE WALKING, PHYSICAL ACTIVITY, ERYTHROCYTES, SURFACE PROPERTIES OF THE CELL MEMBRANE.

INTRODUCTION

Poor physical fitness is increasingly common among modern people of mature age (Filippov and Petrov, 2015; Bespalov et al., 2018). This circumstance provides conditions for the development of various pathologies to which a person has a predisposition (Drapkina and Shepel, 2015; Kotova et al., 2017). Such a danger was revealed when examining different categories of the population in many countries of the world (Skoryatina and Zavalishina, 2017; Zavalishina, 2018a). In conditions of low physical activity in humans, the functional reserves of internal organs decrease, metabolism is inhibited and the overall resistance of the body weakens (Zavalishina, 2018b; Zavalishina, 2018c, Checinska-Maciejewska et al., 2019; Karpov et al., 2020).

Article Information:*Corresponding Author: ilmedv1@yandex.ru
Received 10/07/2021 Accepted after revision 08/09/2021
Published: 30th September 2021 Pp- 1015-1019

Available at: https://bbrc.in/
Article DOI: http://dx.doi.org/10.21786/bbrc/14.3.17

Long-term low muscle training provides a gradual aggravation of the course of existing diseases and the development of their dangerous complications (Zavalishina, 2018d; Tkacheva and Zavalishina, 2018a). Very quickly, weak muscle activity impairs the work of the cardiovascular system and the blood system (Carrizzo et al., 2013). The situation developing in the body leads to functionally extremely unfavorable changes (Zavalishina, 2018e; Zavalishina, 2018f). Low physical fitness provides, especially in men in adulthood, a high risk of rheological disorders in their vascular bed. This is largely due to the deterioration of the surface properties of blood cells and especially erythrocytes. This contributes to the formation of hypoxia in all organs (Zavalishina, 2018g). The chronic oxygen deficiency in cells arising under these conditions further weakens anabolic processes and reduces the body's defenses (Zavalishina, 2018h). The resulting conditions lead to the formation of permanent vasospasm, which impairs the function of all cells (Tkacheva and Zavalishina, 2018b, Zavalishina et al., 2021b).

It has been noticed that with poor physical fitness, conditions are quickly formed to increase the risk of atherosclerosis, surges in blood pressure and the appearance of persistent arterial hypertension (Zavalishina, 2018i; Tkacheva and Zavalishina, 2018c, Zavalishina et al., 2021b). Under these conditions, the rheological properties of the main population of blood cells, erythrocytes, are actively violated. In adulthood, this may additionally be facilitated by chronic pathology of varying severity (Zavalishina, 2018j; Vorobyeva et al., 2018). Considering the large negative consequences of the low level of muscle training in relation to the functioning of the whole organism, it is urgent to continue the search for options for eliminating hypodynamia in people of mature age with an improvement in the state of the parameters of their blood and, first of all, erythrocytes. The purpose of the study: to establish changes in the rheological properties of erythrocytes in physically inactive mature men who began regular training in the framework of sports walking.

MATERIAL AND METHODS

The observation group consisted of 38 men of mature age (average age was 47.5±1.1 years). All of them during their life did not experience physical exertion higher than household. All of these men began regular free-pace race walking for an hour a day, 4 times a week. The control group consisted of 35 healthy men of mature age (the average age was 48.2±1.3 years), who regularly engaged in race walking for at least 5 years at least 4 times a week. The duration of one training session was at least 1 hour. The blood levels of thromboxane B2 and 6-keto-prostaglandin F1α were determined in the subjects taken under observation using an enzyme-linked immunosorbent assay using a set of reagents manufactured by Enzo Life Science (USA). After washing and resuspension of erythrocytes in the composition of erythrocyte membranes, the cholesterol content was assessed using an enzymatic colorimetric method using a kit manufactured by Vital Diagnosticum (Russia) and the concentration of total phospholipids by the amount of phosphorus present in erythrocytes (Kolb and Kamyshnikov, 1982).

The intensity of the processes of lipid peroxidation inside erythrocytes was assessed after washing erythrocytes in the course of recording the amount of malondialdehyde and acyl hydroperoxides in them by using traditional research methods (Volchegorskiy et al., 2000). In the blood of the examined, the number of discoid and altered erythrocytes was recorded using light phase-contrast microscopy using a traditional technique. Representatives of the observation group were examined at baseline, after 3 months and 6 months of systematic race walking. The entire control group was examined once. Statistical processing of the results of the observation were carried out by the student's t-test.

RESULTS AND DISCUSSION

Physiologically unfavorable changes in the ratio of the products of arachidonic metabolism were revealed in the surveyed, who at the beginning had poor physical fitness. The level of thromboxane B2 in their plasma was higher than that in the control group by 25.2% ($p < 0.01$), while the concentration of 6-keto-prostaglandin F1a in them was lower than the level in the control group by 14.6% ($p<0.01$) (table). In the examined untrained men in the erythrocyte membranes, the concentration of cholesterol was initially higher than that in the control group by 15.2%, while the number of total phospholipids was initially lower than the control by 17.7% ($p<0.01$). In mature men who did not regularly experience physical exertion, the outcome of the level of acyl hydroperoxides and the amount of malondialdehyde were higher than those in the control group by 35.6% ($p<0.01$) and 34.5% ($p<0.01$), respectively.

When taken under observation in the blood of men with poor physical fitness, the content of normal discoid erythrocytes was lower than in the control by 17.1% ($p<0.01$) (table). The number of erythrocytes in them, which had a reversibly and irreversibly disturbed shape, at the time of taking under observation was higher than in the control group, by 42.2% and 4.1 times, respectively ($p<0.01$). As a result of regular sports walking in the group of men with initial low training, the imbalance of the metabolic products of arachidonic acid decreased. At the end of the study, the amount of thromboxane B2 in the blood of these men decreased by 23.0% ($p<0.05$). This was accompanied by an increase in blood concentration of 6-keto-prostaglandin F1α by 13.6% ($p<0.05$) by the end of the study. In the membrane structures of erythrocytes in initially untrained men under conditions of regular sports walking, the cholesterol level decreased by 12.8% by the end of the entire observation. This was accompanied by an increase in the content of total phospholipids in their erythrocytes by 16.1% ($p<0.05$). By the end of the study, the levels of acyl hydroperoxides decreased by 33.0% ($p<0.01$) and the amount of malonic diadehyde by 34.5% ($p<0.01$) in men who began to experience physical activity in the structures of erythrocytes.

Against the background of systematic physical training in the framework of sports walking, the level of normal erythrocytes-discocytes increased by 16.7% in the blood of mature men compared to the initial level ($p<0.05$) (table). During the observation period, the number of reversibly disturbed erythrocytes and the number of their irreversibly damaged varieties in the blood of those who started regular sports walking decreased by 39.1% ($p<0.01$) and 4.0 times ($p<0.01$), respectively. Long-term maintenance of the normal level of any parameters in a person can be only in conditions of regular dosed physical activity (Zavalishina, 2020a). With prolonged low muscle activity, numerous disorders in the body always develop with the realization of a hereditary predisposition to pathological conditions (Karpov et al., 2020).

The negative influence of low physical activity on the state of blood parameters and, first of all, its rheological properties is very strongly manifested (Sungurova et al., 2018). It has long been established that prolonged low muscle activity contributes to the formation of any violations of the rheological parameters of the blood and, above all, their largest group - erythrocytes. Under these conditions, a strong increase in the level of lipid

peroxidation products occurs, which leads to biologically unfavorable rearrangements in erythrocyte membranes and significantly disrupts their work (Zavalishina, 2018k). This is further aggravated by the appearance in conditions of weak muscle activity by changes in the ratio of lipid fractions in the composition of erythrocyte membranes. The current situation can significantly worsen the parameters of these blood cells (Zavalishina, 2020b).

Disturbances in the level and ratio of phospholipid molecules and cholesterol molecules in their membranes form highly biologically unfavorable changes in erythrocytes (Zavalishina, 2018l). This disrupts the permeability of erythrocyte membranes and impairs the function of their membrane proteins due to the appearance of defects in their secondary and tertiary structure. The emerging situation has an extremely negative effect on all life processes in the membranes of the bulk of erythrocytes in the blood (Karpov et al., 2021).

Table 1. Levels of indicators taken into account in the surveyed

Blood indicators	Started training, n=38, M±m			Long-term practitioners (control), n=35, M±m
	start of observation	3 months of observation	6 months of observation	
Discoid erythrocytes, %	75.2±0.33 P<0.01	82.0±0.29 P<0.05	87.8±0.22 p1<0.05	88.1±0.16
Reversibly altered red blood cells, %	12.8±0.24 p<0.01	10.9±0.14 p<0.01 p1<0.01	9.2±0.10 p1<0.05	9.0±0.14
Irreversibly altered erythrocytes, %	12.0±0.16 p<0.01	7.1±0.11 p<0.01 p1<0.05	3.0±0.05 p1<0.01	2.9±0.23
Thromboxane B_2, pg / ml	197.1±0.45 p<0.01	172.3±0.60 p<0.05	160.2±0.71 p1<0.01	157.4±0.74
6-keto prostaglandin F1a, pg/ml	82.4±0.38 p<0.01	88.0±0.29 p<0.05	93.6±0.22 p1<0.05	94.4±0.38
Erythrocyte cholesterol, µmol / 1012 erythrocytes	1.06±0.010 p<0.01	0.99±0.016 p<0.05	0.94±0.009 p1<0.05	0.92±0.014
Total phospholipids of erythrocytes, µmol / 1012 erythrocytes	0.62±0.014 p<0.01	0.67±0.018 p<0.05	0.72±0.006 p1<0.05	0.73±0.016
Acylhydroperoxide of erythrocytes, D233 /1012 erythrocytes	4.15±0.012 p<0.01	3.47±0.022 p<0.01	3.12±0.018 p1<0.01	3.06±0.017
Malondialdehyde of erythrocytes, nmol /1012 erythrocytes	1.91±0.007 p<0.01	1.64±0.010 p<0.05	1.42±0.016 p1<0.01	1.42±0.019

Note: p is the statistical reliability of the differences between the indicators of the observation group and the indicators of the control group; p1 - statistical reliability of changes in the level of indicators in the observation group during the study.

An increase in the level of erythrocytes with a reversible disruption of the shape, and an increase in the number of erythrocytes that have irreversibly lost their normal shape, lead to an increase in the number of aggregates formed by erythrocytes in the blood of untrained men, which can greatly impair their implementation of microcirculation. With prolonged low physical fitness in the vascular walls of mature men, there is a low activity of formation of biologically active compounds important for hemostasis and blood rheology. Under the conditions that have arisen, the level of proaggregants in the blood of these men significantly increases. There comes a pronounced intensification of thromboxane synthesis and the synthesis of its functional antipode - prostacyclin is suppressed. Due to this, there is a pronounced physiological imbalance of metabolites of arachidonic acid with a predominance of the activity of proaggregants. This situation is characterized by a violation of the microrheological parameters of erythrocytes, and then rheological processes in small vessels.

This has a very negative effect on metabolism in all organs and contributes to the formation of pathology in them. For the general improvement of the whole organism of men of mature age during their life, who avoided regular physical exertion, systematic training in the framework of sports walking was recommended. Against their background, in the erythrocytes of the surveyed men there was a decrease in the level of peroxidation products of lipid molecules. This situation provided the optimization of the structure and function of their cell membranes. It is clear that the

improvement in the parameters of erythrocytes in those who began to train for race walking developed largely due to the positive dynamics of the lipid composition of erythrocyte structures. This created conditions for positive changes in the surface characteristics of the membranes of their erythrocytes (Zavalishina et al., 2021a).

Normalization of the level of phospholipids and cholesterol molecules in erythrocyte membranes is considered functionally very preferable. It promotes the normalization of the level of regulatory substances in the composition of erythrocytes, the degree of permeability and rigidity of their membranes and promotes the stimulation of the function of their membrane proteins acting as receptors (Zavalishina et al., 2021b). With regular sports walking, previously poorly physically trained men demonstrated a decrease in the content of altered types of red blood cells in their blood and an increase in the number of their normal forms. It is clear that a decrease in the content of altered erythrocytes in the blood in mature men leads to a significant weakening in their blood of the process of aggregation between erythrocytes. This circumstance significantly facilitates perfusion in all tissues of their body.

CONCLUSION

Low muscle activity often leads to an increase in the number of malformed red blood cells. This can impair blood circulation, especially in the capillaries, and inhibit metabolism. It was found that in mature men with low training, who began to regularly engage in race walking, the activity of lipid peroxidation processes decreased in erythrocytes. Against the background of regular physical training, the number of damaged red blood cells in their blood decreased, thereby improving microcirculation. Taking into account the optimization of the properties of the erythrocyte membrane in mature men after six months of sport walking, it is legitimate to widely recommend this type of physical activity to mature men to optimize their physical condition.

REFERENCES

Bespalov, D.V., Kharitonov, E.L., Zavalishina, S.Yu., Mal, G.S. and Makurina, O.N. (2018). Physiological Basis for The Distribution of Functions in The Cerebral Cortex. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(5): 605-612.

Carrizzo, A., Puca, A. and Damato, A. (2013). Resveratrol improves vascular function in patients with hypertension and dyslipidemia by modulating NO metabolism. Hypertension, 62, 359-366.

Drapkina, O.M. and Shepel, R.N. (2015). Physical inactivity is a disease of the century: low physical activity as a risk factor for diseases of the cardiovascular system and premature aging. Cardiology: news, opinions, training, 3(6), 53-58.

Checinska-Maciejewska, Z., Niepolski, L., Checinska, A., Korek, E., Kolodziejczak, B., Kopczynski, Z., Krauss, H., Pruszynska-Oszmalek, E., Kolodziejski, P. and Gibas-Dorna, M., (2019). Regular cold water swimming during winter time affects resting hematological parameters and serum erythropoietin. J Physiol Pharmacol, 70, pp.747-756.

Filippov, E.V. and Petrov, V.S. (2015). Analysis of low physical activity among the working-age population of the Ryazan region (according to the Meridian-RO study). Clinician, 9(3), 22-27.

Karpov, V.Yu., Zavalishina, S.Yu., Komarov, M.N. and Koziakov, R.V. (2020). The Potential of Health Tourism Regarding Stimulation of Functional Capabilities of the Cardiovascular System. Bioscience Biotechnology Research Communications, 13(1), 156-159.

Karpov, V.Y., Zavalishina, S.Y., Bakulina, E.D., Dorontsev, A.V., Gusev, A.V., Fedorova, T.Y. and Okolelova, V.A. (2021). The Physiological Response of the Body to Low Temperatures. J Biochem Technol, 12(1): 27-31.

Kolb, V.G. and Kamyshnikov, V.S. (1982). Clinical Chemistry Handbook. Minsk: Belarus publishing house, 367.

Kotova, O.V., Zavalishina, S.Yu., Makurina, O.N., Kiperman, Ya.V., Savchenko, A.P., Skoblikova, T.V., Skripleva, E.V., Zacepin, V.I., Skriplev, A.V. and Andreeva, V.Yu. (2017). Impact estimation of long regular exercise on hemostasis and blood rheological features of patients with incipient hypertension. Bali Medical Journal, 6(3), 514-520.

Skoryatina, I.A. and Zavalishina, S.Yu. (2017). Ability to aggregation of basic regular blood elements of patients with hypertension and dyslipidemia receiving non-medication and simvastatin. Bali Medical Journal, 6(3), 521-528.

Sungurova, N., Sysoeva, N., Glamazdin, I. and Kryukovskaya, G. (2018). Internet techlologies as a means of establishing informative preferences and motivational attitudes of natural sciences specialties students. 10th International Conference on Education and New Learning Technologies (EDULEARN). Palma, SPAIN. JUL 02-04, 8898-8907.

Tkacheva, E.S. and Zavalishina, S.Yu. (2018a). Physiology Of Platelet Hemostasis In Piglets During The Phase Of Newborns. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(5), 1912-1918

Tkacheva, E.S. and Zavalishina, S.Yu. (2018b). Physiological Aspects of Platelet Aggregation in Piglets of Milk Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(5), 74-80.

Tkacheva, E.S. and Zavalishina, S.Yu. (2018c). Physiological Features of Platelet Aggregation in Newborn Piglets. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(5), 36-42.

Volchegorskiy, I.A., Dolgushin, I.I., Kolesnikov, O.L. and Tseilikman, V.E. (2000). Experimental modeling and

laboratory assessment of the adaptive reactions of the body. Chelyabinsk: publishing house of the Chelyabinsk State Pedagogical University, 167.

Vorobyeva, N.V., Mal, G.S., Zavalishina, S.Yu., Glagoleva, T.I. and Fayzullina, I.I. (2018). Influence Of Physical Exercise On The Activity Of Brain Processes. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 240-244.

Zavalishina, S.Yu. (2018a). The Functional State of Vascular Hemostasis in Calves During the Neonatal Phase. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 1507-1512.

Zavalishina, S.Yu. (2018b). Physiology of Antiaggregatory Manifestations of The Vascular Wall in Newborn Calves with Iron Deficiency, Receiving Metabolic Significant Effects. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 1530-1536.

Zavalishina, S.Yu. (2018c). The Functional State of Primary Hemostasis in Newborns Calves with Dyspepsia. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 1543-1549.

Zavalishina, S.Yu. (2018d). Dynamics Of The Functional State Of Platelet Functions In Newborn Calves Receiving Correction For Dyspepsia. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 1566-1572.

Zavalishina, S.Yu. (2018e). Functional Features of Primary Hemostasis in Newborns Calves with Functional Disorders of The Digestive System. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 2018; 9(6): 1630-1636.

Zavalishina, S.Yu. (2018f). Elimination of platelet dysfunctions in newborn calves with functional digestive disorders. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 1650-1656.

Zavalishina, S.Yu. (2018g). Prevention of Violations of The Functional Status of Platelet Hemostasis in Newborn Calves with Functional Disorders of The Digestive System. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 1672-1678.

Zavalishina, S.Yu. (2018h). Physiological Mechanisms of Hemostasis in Living Organisms. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(5), 629-634.

Zavalishina, S.Yu. (2018i). Physiological Control of The Vascular Wall Over Platelet-Induced Aggregation in Newborn Calves with Iron Deficiency. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 1601-1606.

Zavalishina, S.Yu. (2018j). Functional Activity Of Primary Hemostasis In Calves During The First Year Of Life. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 1575-1581.

Zavalishina, S.Yu. (2018k). Physiological Features of Primary Hemostasis in Newborns Calves with Functional Digestive Disorders. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 1514-1520.

Zavalishina, S.Yu. (2018l). Functional Features of Hemostasis In Calves Of Dairy And Vegetable Nutrition. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 9(6), 1544-1550.

Zavalishina, S.Yu. (2020a). Functional Activity of the Cardiorespiratory System and the General Level of Physical Capabilities Against the Background of Regular Physical Exertion. Bioscience Biotechnology Research Communications, 13(4), 2327-2331.

Zavalishina, S.Yu. (2020b). Functional Features of Hemostasis in Weakened Newborn
Calves Treated with Aminosol. Bioscience Biotechnology Research Communications, 13(3), 1251-1256.

Zavalishina, S.Y., Bakulina, E.D., Eremin, M.V., Kumantsova, E.S., Dorontsev, A.V. and Petina, E.S. (2021a). Functional Changes in the Human Body in the Model of Acute Respiratory Infection. J Biochem Technol, 12(1), 22-26.

Zavalishina, S.Y., Karpov, V.Y., Zagorodnikova, A.Y., Ryazantsev, A.A., Alikhojin, R.R. and Voronova, N.N. (2021b). Functional Mechanisms for Maintaining Posture in Humans during Ontogenesis. Journal Biochemical Technology, 12(1), 36-39.