RESEARCH ARTICLE

Study of Activated Cellular Immunity due exposition to Systemic Endotoxinemia by Physical Exertion of Athletes

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ABSTRACT

Background: According to the study, the indices of cellular antiendotoxin immunity can be applied to assess the athletes' adaptation to physical exertion at various stages of a one-year training program. In the early 90s of the 20th century, a new theory appeared about the role of endotoxin (ET) of intestinal microflora in physiology and human pathology, which, in our opinion, can be used to systematize knowledge about the development mechanisms of a general adaptation syndrome and form the basis of the general theory of its pathogenesis.

Aim of the study: The study aims was to study the role of systemic endotoxinemia and indicators of cellular immunity in athletes of various sports specialization in assessing adaptation to physical activity. The article shows the possibility of using indicators of the cellular link of antiendotoxin immunity for assessment of the adaptation of the body of athletes to physical activity at different stages of the annual training cycle.

Methodology: A study of the content of ET in the bloodstream and indicators of the granulocyte link was carried out to estimate antiendotoxin immunity for various athletes.

Results: The results obtained show that trained and untrained people have a clearly expressed endotoxinemia, and the indicators of endotoxinemia significantly increase during exercise in the control group and among athletes.

Conclusion: Our findings allow us to draw a conclusion about the very likely participation of ET in the development of pathological processes when adapting to physical activity.

Recommendations: Make other studies among different athletes to analyze the relation and adaptation between immunity and endotoxins.

Keywords: Adaptation, Cellular immunity, Physical activity, Systemic endotoxinemia.

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INTRODUCTION

The results due to hard exercise of athletes during competition and training lead to common fatigue and mood disturbances.[1] "The physical and psychosocial demands during intense exercise can initiate a stress response activating the sympathetic-adrenomedullary and hypothalamus-pituitary-adrenal (HPA) axes, resulting in the release of stress and catabolic hormones, inflammatory cytokines and microbial molecules".[2] The trillions of bacteria existing in the gut have major roles in many issues of human biology, obtaining metabolism, neuronal, endocrine and immune function. The digestive tract microbiome and its effect on host behavior, intestinal barrier and immune process are critical aspects of the brain-gut axis.[3] Endotoxin release from gut flora may play a key role in the development of inflammation by stimulating the secretion of inflammatory cytokines.[4] The human body has a number of cellular factors of antiendotoxin immunity (Kupffer cells, macrophages, polymorphonuclear leukocytes) able to bind with ETs using a dependent mechanism. Various sports simulate almost all features functioning of the human systems for the body, including immunity.[5] This study focus on events of altering values of immunity factors with levels of athlete's exercise and training may be helpful to other studies in the future.

MATERIALS AND METHODS

A study of the content of ET in the bloodstream and indicators of the granulocyte link was carried out to estimate antiendotoxin immunity in 57 athletes: weightlifters (n = 12); Track and field athletes (n = 17); triathletes (n = 12) and basketball

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Table 1: Dynamics of indicators of the content of ET in the LAL test in athletes of different sports specialization and non-athletes when performing physical activity

Experimental groups	*Studied indicators*	
	Plasma endotoxin, EU/mL/LAL	
	Physical activity	
	before	*after*
Control n = 12	1,921 ± 0,14	2,831 ± 0,18*
Weightlifters, n = 12	1,566 ± 0,11*	2,492 ± 0,02*
Track and field athletes, n = 17	1,958 ± 0,11	1,122 ± 0,13
Triathletes, n = 12	1,243 ± 0,03*	0,991 ± 0,15*
Basketball , n= 16	2,851 ± 0,25*	1,595 ± 0,27
Conditionally healthy volunteers, n = 30	0,1 ± 0,03	

Note: *differences in indicators are significant in the groups of examination before and after physical activity ($p < 0.05$)

Table 2: Dynamics of ET binding by leukocytes in athletes of different sports specialization and non-athletes with performed physical activity

Experimental groups	*Studied indicators*					
	Content of LPS-positive leukocytes,%				*ET binding reserves leukocytes,%*	
	in-vivo		*in-vivo + in-vitro*			
	Physical activity					
	before	*after*	*before*	*after*	*before*	*after*
Control group, n = 12	2,33 ± 0,64	2,25 ± 0,52	6,08 ± 1,06 *	3,912 ± 0,75 *	3,75 ± 0,61	1,66 ± 0,50*, **
Weightlifters, n = 12	3,75 ± 0,32*, **	2,05 ± 0,47 *	8,251 ± 1,03*, **	4,250 ± 0,47 *	5,50 ± 0,32 *	2,00 ± 0,32 *
Track and field athletes, n = 17	3,00 ± 0,23	2,12 ± 0,60	7,37 ± 0,77 *	6,12 ± 0,71*,**	3,37 ± 0,70	4,00 ± 0,56**
Triathletes, n = 12	3,330 ± 0,11*	1,330 ± 0,14 *	6,660 ± 0,28 *,**	3,251 ± 0,59 *,**	3,330 ± 0,14 *	2,121 ± 0,38*, **
Basketball players, n = 16	4,122 ± 0,30*,**	1,752 ± 0,36*	8,201 ± 0,48*,**	4,001 ± 0,42*,**	4,870 ± 0,24*	2,25 ± 0,33*
Conditionally healthy volunteers, n = 30	3,50 ± 0,4		8,60 ± 0,5		5,10 ± 0,3	

Note:*- Differences in indicators are significant in the groups of examination before and after physical activity ($p < 0.05$); ** - differences in indicators are significant in relation to the comparison group ($p < 0.05$).

players (n = 16). The average age of the subjects was 18.5 ± 1.2 years. Athletes were examined at various stages in the training processes.[12] students not involved in sports made up the control group. The average age of these subjects was 18.5 ± 0.5 years. As indicators of the norm, the results of a survey of practically healthy people in age 20–40 years (n = 30). The concentration of ET in the bloodstream was determined by the activity of blood plasma in the LAL test. Bicycle ergo metric test was used as physical activity.

Statistical data processing was performed using MedCalc (Ver.5.1.1.0.) at a significance level of $p < 0.05$.

RESULTS

The results obtained show that trained and untrained people have a clearly expressed endotoxinemia, and the indicators of endotoxinemia significantly increase during exercise in the control group and among athletes.

DISCUSSION

In the blood plasma of trained and untrained people before physical activity contains significantly more ET than in the blood plasma of healthy individuals (normal values). Among athletes in blood plasma basketball players contain significantly more ET than in the blood plasma of athletes, weightlifters and triathletes Table 1. It is explained the fact that the basketball players were in the competitive period (corresponding to the decompensation phase). When analyzing indicators of the LAL test after exercise, there was a clearly pronounced endotoxinemia in the control group and in weightlifters. The examined weightlifters were in the competitive period (decompensation phase), which confirms a sharp decrease in immunity, *i.e.,* the ability to bind ET in the bloodstream.[6]

In the control group, the increase in Limulus amoebocyte lysate (LAL) test indicators is explained by the stress response of the body to physical load.[7] A decrease in ET indices in the bloodstream in the groups of athletes, triathletes, and basketball players indicates immunological adaptation to physical activity.[8] The indicators of the leukocyte link of antiendotoxin immunity[9] are presented in Table 2.

Before physical exercise, the content of (Lipopolysaccharide) LPS-positive leukocytes was within the normal range in the groups of athletes, in the control group showed a significant decrease in these indicators. The reserves of ET binding to leukocytes were retained in all the surveyed groups, but among triathletes and athletes, they were reduced by 1.5 times in relation to the indicators of the norm and by 1.3 and 1.6 times in relation to the indicators of athletes of other specializations. Such dynamics indicate a relative in Indicators of ET binding to leukocytes *in-vivo*, *in-vivo* + *in-vitro* after exercise were significant reduced in the control group and in the groups of weightlifters, triathletes and basketball players. Reserves of ET binding by leukocytes significantly reduced in the control group and in the groups of athletes (except for Track and field athletes), *i.e.,* there is insufficient leukocyte link of antiendotoxin immunity.

The results obtained show that trained and untrained people have a clearly expressed endotoxinemia, and the indicators of endotoxinemia significantly increase during exercise in the control group and among athletes. These data allow us to draw a conclusion about the very likely participation of ET in the development of pathological processes.[10]

When adapting to physical activity. The control group and athletes (except Track and field athletes) are also characterized by revealed by us the relative insufficiency of the granulocyte link of antiendotoxin immunity, which is expressed a decrease in the reserves of ET binding by leukocytes after exercise sufficiency of the granulocyte link of antiendotoxin immunity.

CONCLUSION

Our findings allow us to draw a conclusion about the very likely participation of ET in the development of pathological processes when adapting to physical activity due to activity of the immune system.

RECOMMENDATIONS

Make other studies among different athletes to analyze the relation and adaptation between immunity and endotoxins.

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