

Relationship between anxiety level and metabolomic profile of human blood serum

O. N. Kolossova¹, E. Z. Zasimova², I. V. Sleptsov¹, S. M. Rozhina¹, B. M. Kershengolts¹

¹Institute for Biological Problems of Cryolithozone, Federal Research Center, Yakutsk Scientific Center, SB Russian Academy of Sciences, Yakutsk 677000, Russian Federation

²Institute of Physical Culture and Sports North-Eastern Federal University, M. K. Ammosova, Yakutsk 677000, Russian Federation

Abstract. The aim. To study the relationship between the level of anxiety (personal and situational) of student-athletes and the metabolomic profile of blood plasma. In the study in April 2021, on the basis of informed voluntary consent, 17 student-athletes (mas-wrestling) of the first courses of the Institute of Physical Culture and Sports of NEFU named after M.K. Ammosova. The results obtained indicate a correlation between the level of anxiety (ST and LT) and metabolic processes in the body, as a result of which the profile of low molecular weight compounds differs.

Key words: level of anxiety, situational and personal anxiety, athletes, metabolomic profile of blood plasma, metabolites, threonine, urea.

Conflict of interest. The authors declare the absence of obvious and potential conflicts of interest associated with the publication of this article.

Citation: Kolossova ON, Zasimova EZ, Sleptsov IV, Rozhina SM, Kershengolts BM. Relationship between anxiety level and metabolomic profile of human blood serum. *Siberian Medical Review*. 2022;(2):101. DOI: 10.20333/25000136-2022-2-100-101

The aim of the research. In recent years, there has been a growing number of studies of metabolic profiling of biological fluids in order to search for new biomarkers of diseases [1-3]. Metabolomic studies acquire great importance in studying the mechanisms of human adaptation to extreme conditions. Analysing the obtained metabolic profiles of blood plasma, one can obtain a specific “imprint” that reflects the physiological state of the organism.

The aim. To study the relationship between the level of anxiety (personal and situational) of student-athletes and the metabolomic profile of blood plasma.

Material and methods. In the study in April 2021, on the basis of informed consent, 17 student-athletes (mas-wrestling) of the first years of study at Institute of Physical Culture and Sports of NEFU named after M.K. Ammosova. C. Spielberger test [4] was used to identify the level of personal (LT) and situational (ST) anxiety. Identification and determination of the concentration of metabolites in blood plasma samples was carried out by gas chromatography with mass spectrometry (GC-MS). Statistical processing of the results was performed on the MetaboAnalyst platform, 5.0 [5].

Results. In the course of the ST study, athletes were found to have 53% with a low and 47 % with an average level of anxiety. The proportion of athletes with a high level of LT (23 %) was 2 times higher than that of students of technical specialties. 59 % of athletes had an average level of LT and 18 % had a low level. When studying the metabolomic profile of blood plasma in a group of student-athletes, 92 low molecular weight compounds were identified. Statistically significant differences at various levels of LT were found for 9 low molecular weight compounds: Threonine, Palmitic acid, Oleic Acid, 2,3,4,5-Tetrahydroxy-

pentanoic acid-1,4-lactone, D-Glucopyranosiduronic acid, Phosphoric acid, Stearic acid, 4,7,10,13,16,19-Docosahexaenoic acid and Palmitoleic acid. At a high level of LT, the content of the amino acid threonine is much lower than at an average level of LT, which may be the cause of increased excitability of the nervous system.

There were no individuals with a high level of TS among student-athletes. But even between the average and low levels of ST, there are statistically significant differences in 10 metabolites. The most significant differences in plasma urea levels are: the lower the CT level, the lower the urea concentration.

Conclusion. The results obtained indicate a correlation between the level of anxiety (ST and LT) and metabolic processes in the body, as a result of which the profile of low molecular weight compounds differs. It can be assumed that by adjusting the metabolic profile by biogenic methods, it is possible to correct the negative consequences of psychoemotional stress.

References

1. Chen X, Liu L, Palacios G, Gao J, Zhang N, L G, Lu J, Song T, Zhang Y, Lv H. Plasma metabolomics reveals biomarkers of the atherosclerosis. *Journal of Separation Science*. 2010;33(17-18):2776-83. DOI: 10.1002/jssc.201000395
2. Trifonova OP, Balashova EE, Maslov DL, Grigor'ev AI, Lisitsa AV, Ponomarenko EA, Archakov AI. Metabolic blood test to create a digital image of a healthy person. *Biomeditsinskaya Khimiya*. 2020;66(3):216-223. (In Russian)
3. Kolossova ON, Khlebnyy ES, Baisheva NV. Fatty acid profile of the blood serum of pregnant women in Yakutsk as a biomarker of the risk of miscarriage. *Arctic and Subarctic Natural Recourses*. 2020;(4):100-111. (In Russian)

4. Spielberger CD. Manual for the State-Trait Anxiety Inventory (Form Y): Palo Alto, CA: Mind Garden; 1983. 236 p.

5. Pang Z, Chong J, Zhou G, Morais D, Chang L, Barrette M, Gauthier C, Jacques PE, Li S, Xia J. MetaboAnalyst 5.0: narrowing the gap between raw spectra and functional insights. *Nucleic Acids Research*. 2021;1(49):388-396. DOI: 10.1093/nar/gkab382

Author information

Olga N. Kolosova, Doctor of Biological Sciences, Professor, Chief Researcher, Institute for Biological Problems of Cryolithozone SB RAS; Address: 41, Lenina Str, Yakutsk, Russian Federation 677000; Phone: +7(924)1772912; e-mail: kololgonik@gmail.com, <https://orcid.org/0000-0002-6965-2600>

Ekaterina Z. Zasimova, doctor, Institute of Physical Culture and Science of the North-Eastern Federal University named after M.K. Ammosov; Address: 42, Kulakovskiy Str., Yakutsk, Russian Federation 677007; Phone: +7(914)2717142; e-mail: zasim-vak@mail.ru, <https://orcid.org/0000-0003-3311-6897>

Igor V. Sleptsov, PhD, Senior Researcher, Institute for Biological Problems of Cryolithozone SB RAS; Address: 41, Lenina Str., Yakutsk, Russian Federation 677000; Phone: +7(924)8657957; e-mail: neroxasg@mail.ru, <https://orcid.org/0000-0002-5980-579X>

Sakhayana M. Rozhina, Junior Researcher, Institute for Biological Problems of Cryolithozone SB RAS; Address: 41, Lenin Str., Yakutsk, Russian Federation 677000; Phone: +7(968)1543621; e-mail: sahayana-rozhina@mail.ru, <https://orcid.org/0000-0001-7223-9297>

Boris M. Kershengolts, Doctor of Biological Sciences, Professor, Chief Researcher, Institute for Biological Problems of Cryolithozone SB RAS; Address: 41, Lenin Str., Yakutsk, Russian Federation 677000; Phone: +7(914)2351175; e-mail: kerschen@mail.ru, <https://orcid.org/0000-0001-8823-3981>

Received 17 February 2022

Revision Received 25 February 2022

Accepted 11 March 2022