



## **Total antioxidant activity of extraction products of muscles and roe of northern pike (*Esox lucius*)**

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### **Abstract**

The antioxidant properties of the products of water and ethanol extraction from muscle and roe of northern pike assessed using coulometric analysis with electrogenerated radicals of bromine have been studied in this paper. The total antioxidant activity (TAOA) of the products was measured using the certified coulometric measurement method with the *Expert-006-Antioxidant* system (*Econix-Expert Ltd*, Moscow, Russia). The published data show that lyophilized water extracts of pike muscle prevent the human embryo fibroblasts from premature senescence induced by H<sub>2</sub>O<sub>2</sub> in its sublethal concentration, while the cell proliferation is upregulated by the muscle extracts. So it is reasonable to study the biologically active substances of the pike muscle extracts as well as the targets of those substances and the signal pathways activated by them. At the same time the biological effects of such multicomponent mixture as an extract can be the result of synergetic action of multiple substances without any significant activity of any single substance of the mixture, as we had shown earlier on the extracts of various medicinal plants. This paper comprises the results of biochemical examination of the lyophilized water extracts of pike muscle, as well as of sediments obtained during the water extraction from pike muscle and ethanol extraction from pike roe. The fish were obtained from the Uglich Reservoir (Tver region, Russia). The spinal muscle tissue and roe were collected from

the fish and stored at -18 °C till extraction. To get the extracts, the tissues were grinded, flushed with water or ethanol with 3:1 ratio, homogenized with blender; the extraction was performed during 1 h. The sediment was removed via centrifugation at 6000 G for 15 min. After that the supernatant was lyophilized. The purpose of this study was to estimate the TAOA of the products of water and ethanol extraction from muscle and roe of pike. The data obtained during the study shows that TAOA of lyophilized water extract from pike muscle is significantly higher than TAOA of dried of sediments obtained during the water extraction from pike muscle and ethanol extraction from pike roe.

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## References

- [1] R. Gormley. Fish as a functional food. *Food Science and Technology*. **2006**. Vol.20. Iss.3. P.25-28.
- [2] P. Castrogiovanni, F.M. Trovato, C. Loreto, H. Nsir, M.A. Szychlińska, G. Musumeci. Nutraceutical supplements in the management and prevention of osteoarthritis. *International Journal of Molecular Sciences*. **2016**. Vol.17. Iss.12. P.2042.
- [3] W. Najm, D. Lie. Dietary Supplements Commonly Used for Prevention. *Primary Care – Clinics in Office Practice*. **2008**. Vol.35. Iss.2. P.749-767.
- [4] H.I.H. El-Sayyad. Cholesterol overload impairing cerebellar function. *The Promise of Natural Products. Nutrition*. **2015**. Vol.31. Iss.5. P.621-630.
- [5] H. Matsufuji, T. Matsui, M. Nakashima, Y. Osajima, E. Seki, K. Osajima. Angiotensin I-converting Enzyme Inhibitory Peptides in an Alkaline Protease Hydrolyzate Derived from Sardine Muscle. *Bioscience, Biotechnology, and Biochemistry*. **1994**. Vol.58. Iss.12. P.2244-2245.
- [6] A.A. Boldyrev. Carnosine: new concept for the function of old molecule. *Biochemistry*. **2012**. Vol.77. No.4. P.403-418. (Russian)
- [7] Dmitry L. Maslov, Oxana P. Trifonova, Anton N. Mikhailov, Konstantin V. Zolotarev, Kirill V. Nakhod, Valeriya I. Nakhod, Nataliya F. Belyaeva, Marina V. Mikhailova, Petr G. Lokhov and Alexander I. Archakov. Comparative Analysis of Skeletal Muscle Metabolites of Fish with Various Rates of Aging. *Fishes*. **2019**. Vol.4. Iss.2. P.25.
- [8] M.V. Mikhailova, N.F. Belyaeva, N.I. Kozlova, K.V. Zolotarev, A.N. Mikhailov, A.E. Berman, A.I. Archakov. Protective action of fish muscle extracts against cellular senescence induced by oxidative stress. *Biomedical Chemistry*. **2017**. Vol.63. No.4. P.351-355. DOI: 10.18097/PBMC20176304351
- [9] A.A. Lapin, I.G. Garifullin, and V.N. Zelenkov. Biochemical study of hepatoprotective collection of plant origin. *Butlerov Communications*. **2019**. Vol.59. No.7. P.91-96. DOI: 10.37952/ROI-jbc-01/19-59-7-91 (Russian)
- [10] A.A. Lapin, I.G. Garifullin, S.D. Litvinov. Biochemical assessment of antioxidant activity of herbal hepatoprotectors. *Bulletin of Medical Institute "REAVIZ": Rehabilitation, Physician and Health*. **2019**. No.5(41). P.214-219. (Russian)
- [11] E.V. Ferubko, V.N. Zelenkov, A.A. Lapin, and T.D. Dargaeva. Study of the antioxidant activity of plant harvest with antiulcer action and its components. *Butlerov Communications*. **2019**. Vol.60. No.10. P.60-66. DOI: 10.37952/ROI-jbc-01/19-60-10-60 (Russian)
- [12] A.A. Lapin, and V.N. Zelenkov. The use of vyazolistnogo labaznik (*Filipendula ulmaria* (L.) Maxim) to increase the antioxidant activity of hepatoprotective collection of plant

origin. *Butlerov Communications*. **2020**. Vol.61. No.3. P.112-119. DOI: 10.37952/ROI-jbc-01/20-61-3-112 (Russian)

- [13] E.V. Ferubko, A.A. Lapin, T.D. Dargaeva, V.N. Zelenkov. Estimation of the hepatoprotective activity of Hexafit at the D-galactosamine-induced hepatitis, the antioxidant activity of the drug and its ingredients. *Butlerov Communications*. **2020**. Vol.64. No.11. P.70-76. DOI: 10.37952/ROI-jbc-01/20-64-11-70 (Russian)
- [14] M.V. Mikhajlova, K.V. Zolotarev, N.F. Belyaeva, M.A. Sanzhakov, A.N. Mikhajlov, A.S. Khrenov, A.I. Archakov. Method for obtaining a compendial extract. *Patent RU 2657511*, registered from 14.06.**2018**. (Russian)
- [15] A.A. Lapin, N.G. Romanova, V.N. Zelenkov. Use of galvanostatic pendantometry method in determining the antioxidant activity of various types of biological raw materials and products of their processing. *Moscow: MSHA, K.A. Timiryazeva*. **2011**. 197p. (Russian)
- [16] Anatoly A. Lapin, Valery N. Zelenkov, Konstantin V. Zolotarev, Anton N. Mikhailov, Nikolay V. Bodoev, Marina V. Mikhaylova. Total antioxidant activity of extraction products of muscles and roe of northern pike (*Esox lucius*). *Butlerov Communications*. **2021**. Vol.65. No.1. P.114-119. DOI: 10.37952/ROI-jbc-01/21-65-1-114 (Russian)