

Synthesis of derivatives of chalcones and study of their effect on the oxidative proteins modification

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Abstract

Oxidative proteins modification represents an early and the most reliable marker of the oxidative stress. In view of this fact the study of this parameter is being used more frequently by researchers now. HEK293A cells (Human Embryonic Kidney) – cells line, obtained from human embryonic kidney cells. This cells line became popular due to simple cultivation and is often a test object in biotechnology, pharmacology and gene therapy. One of the perspective synthetic technique to obtain analogues of many natural products is click-reaction leading to 1,2,3-triazoles fragment in the structure of the reaction product. Chalcones are quite well studied class of natural and synthetic compounds which possess a wide range of biological activity, particularly antioxidant. At present time a lot of report appears on the synthesis of various derivatives of the natural chalcones, including those with various heterocycles in their structure. Nevertheless, a range of issues concerning the structure-activity relationship of these derivatives are still not clear. To study some of this points we synthesized chalcone derivatives both with and without 1,2,3-triazole fragment. We studied the effect of 1,2,3-triazole pharmacophore at 3'-position in the A-ring of 2,4,5-trimethoxychalcone molecule on the biological activity towards the oxidative proteins modification in the HEK293A cells. It is found that an increase in oxidative proteins modification is associated with the presence of 1,2,3-triazole fragment in the A-ring of the chalcone molecule. It suggests the appearance of prooxidant activity. However further studies are needed to understand the mechanism of this effect.

References

- [1] L. Mander, H.-W.B. Liu. Comprehensive natural products. Chemistry and biology. V. 3. Development and modification of bioactivity. UK, Oxford: Elsevier. **2010**. 1316p. P.5.
- [2] Parvesh Singh, Amit Anand, Vipin Kumar. Recent developments in biological activities of chalcones: A mini review. *European Journal of Medicinal Chemistry*, Volume 85, 6 October **2014**, P. 758-777.
- [3] H.C. Kolb, K.B. Sharpless. The growing impact of click chemistry on drug discovery. *Drug discovery today*. **2003**. Vol.8. Iss.24. P.1128-1137.
- [4] Discovery of bioactive molecules from CuAAC click-chemistry-based combinatorial libraries. Wang X. [et al.]. *Drug discovery today*. **2016**. Vol.21. Iss.1. P.118-132.
- [5] A.A. Shevelkova, E.K. Aylamazyan, I.I. Evsyukova. Characteristics of the proteins oxidative modification and the functional state of erythrocytes in pregnancy complicated with chronic placental insufficiency. *Zh. akush.i zhen. bolezni*. **2015**. No.5.
- [6] S.S. Tarasov. Content of proteins oxidative modification products in the plasma of pregnant and lactating females of European rabbit (*Oryctolagus cuniculus*). S.S. Tarasov, A.S. Koryagin. *Vestn. TvGU. Ser.: Biologia i ecologia*. **2017**. No.2. P.102-110.
- [7] Yu.V. Nikitina, I.V. Mukhina. Changes in oxidative processes in brain tissue and blood of rat in early ontogenesis. *Vestnik NNGU*. **2009**. No.6-1. P.124-131.

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- [8] Di Liu, Ting Zhang, Zhifei Chen, Ying Wang, Shuang Ma, Jiyun Liu, Jingbo Liu. The beneficial effect of ginsenosides extracted by pulsed electric field against hydrogen peroxide-induced oxidative stress in HEK-293 cells. *Journal of Ginseng Research*. **2017**. Vol.41(2). P.169-179.
- [9] S.E. Laevsky, G.V. Avramenko, M.A. Fomina, and N.V. Korotkova. Synthesis and biological evaluation of 1,2,3-triazol-1*H*-yl derivatives of chalcones as possible pharmacological analogues of benzo[*c*]phenanthridine alkaloids. *Butlerov Communications*. **2016**. Vol.46. No.6. P.74-80. DOI: 10.37952/ROI-jbc-01/16-46-6-74
- [10] E.E. Dubinina. Oxygen's metabolism products in the cells functional activity. *St.Petersburg: Meditsinskaya pressa*. **2006**. 400p.
- [11] L.A. Jones, J.C. Holmes, R.B. Seligman. Spectrophotometric Studies of Some 2,4-Dinitrophenylhydrazones. *Analytical chemistry*. **1956**. Vol. 28. No.2. P.191-198.
- [12] *Pat. 2524667 RF. MPK G01N 33/52*. Method of complex estimation of the content of OPM's products in tissues and biological fluids [text]. M.A. Fomina [et al.]; Ryazan' state medical univ. n/a. acad. I.P. Pavlov. -2013102618/15; application 21.01.2013; published 27.07.**2014**, Bull. No.21. 8p.