

## Comparison of Physical and Chemical Effects on Senescent Cells

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**Abstract :** Every day cells in our organism are exposed to various factors: chemical agents, reactive oxygen species, ionizing radiation, and others. These factors can cause damage to DNA, cellular membrane, intracellular compartments, and proteins. The fate of cells depends on the exposure intensity and duration. The prolonged and intense exposure causes the irreversible damage accumulation, which triggers the permanent cell cycle arrest (cellular senescence) or cell death programs. In the case of low dose of impacts, it can lead to cell renovation and to cell functional state improvement. Therefore, it is a pivotal question to investigate the factors and doses that result in described positive effects. In order to estimate the influence of different agents, the proliferation index and levels of cell death markers (annexin V/propidium iodide), senescence-associated  $\beta$ -galactosidase, and lipofuscin were measured. The experiments were conducted on primary human fibroblasts of the 8th passage. According to the levels of mentioned markers, these cells were defined as senescent cells. The effect of low-frequency magnetic field was investigated. Different modes of magnetic field exposure were tested. The physical agents were compared with chemical agents: metformin (10 mM) and taurine (0.8 mM and 1.6 mM). Cells were incubating with chemicals for 5 days. The highest decrease in the level of senescence-associated  $\beta$ -galactosidase (21%) and lipofuscin (17%) was observed in the primary senescent fibroblasts after 5 days after double treatments with 48 h intervals with low-frequency magnetic field. There were no significant changes in the proliferation index after magnetic field application. The cytotoxic effect of magnetic field was not observed. The chemical agent taurine (1.6 mM) decreased the level of senescence-associated  $\beta$ -galactosidase (23%) and lipofuscin (22%). Metformin improved the activity of senescence-associated  $\beta$ -galactosidase on 15% and the level of lipofuscin on 19% in this experiment. According to these results, the effect of double treatment with 48 h interval with low-frequency magnetic field and the effect of taurine (1.6 mM) were comparable to the effect of metformin, for which anti-aging properties are proved. In conclusion, this study can become the first step towards creation of the standardized system for the investigation of different effects on senescent cells.

**Keywords :** biomarkers, magnetic field, metformin, primary fibroblasts, senescence, taurine

**Conference Title :** ICCMB 2017 : International Conference on Cellular and Molecular Biology

**Conference Location :** Singapore, Singapore

**Conference Dates :** May 04-05, 2017