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The Cytoprotective Role of Antioxidants in Mammalian Cells Exposed to Variable Temperature, Pressure Overload and Radiation in the Stratosphere

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Abstract : Researchers are still looking for an answer to the question which has been fascinating the mankind for generations, specifically – is there life beyond Earth? As long as routine flights to other planets remain beyond our reach, there is a need to find alternative ways to conduct the astrobiological research. It is worth noticing that the part of the Earth's atmosphere, stratosphere, has been found to show subcosmic environmental conditions, namely temperatures around -50°C, very rarefied air, increased cosmic radiation and the Sun's ultraviolet radiation. This phenomenon gives rise to the opportunity for the use of stratospheric environment as a research model for the space conditions. Therefore the idea of conducting astrobiological experiments during the stratospheric flights arose. Up to now, the preliminary work in this field included launching balloons containing solely microbiological samples into the stratosphere to figure out if they would be able to survive under the stratospheric conditions. In our study, we take this concept further, sending the human healthy and cancerous cells treated with various compounds to investigate whether these medicines are capable to protect the cells against stratospheric stress. Due to oxidative stress caused by ionizing radiation and temperature shock, we used natural compounds which display antioxidant properties. In this way, we were able to reduce the reactive oxygen species production affecting cells, which results in their death. After-flight laboratory tests of biological samples from the stratosphere have been performed and indicated the most active antioxidants as potential agents which can minimize the harmful impacts of stratospheric conditions, especially radiation and temperature.

Keywords : antioxidants, stratosphere, balloon flight, oxidative stress, cell death, radiation
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