Simulated microgravity induces changes in breast cancer cells

P-35-032

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Many astronauts have reported various side effects after long-term space missions in orbit such as cardiovascular changes, reduction of bone density and muscle atrophy. The effects of microgravity (μg) on cellular properties may be related to these health problems. Numerous studies have shown that μg has a major impact on cancer cells affecting proliferation, survival, migration and inducing breast cancer cells to adopt a less aggressive phenotype. Studies performed on MCF-7, a human breast cancer cell line ER-α positive, showed that in μg cells activate genes that are involved in the organization and regulation of the cell shape, cell tip formation, and membrane-to-membrane docking[1]. The purpose of this study was to evaluate the behavior of MCF-7 and SKBR-3 (human breast cancer cell line overexpressing HER-2) under simulated μg. 3D-μg simulator research cube provided by Litegrav was used in 3Dclinostat mode with random path distribution and μ-Slide 8 well for cell growth. Specifically, the evaluation of cancer cell behavior at different time points (1,3 and 5 days) was performed by phase-contrast microscopy, cytoskeleton staining, viability assays and changes in gene and protein expression by real-time PCR with Western blot confirmation. Morphological changes were observed in both cancer cell types under simulated μg, while cell viability was not affected. In particular, the difference in actin filament organization of cells in μg was confirmed by confocal laser scanning microscopy as well as differential gene expression. Data show how simulated μg induces changes in cell morphology and suggest the activation of specific gene programs, that may be involved in tumor development or the metastatic process. A deeper understanding of the mechanisms involved may lead to the development of new therapeutic strategies. Research conducted in simulated μg can provide a reliable tumor model to study different processes of cancer progression.

[1] Kopp S, et al. Sci Rep. 6, 2016