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ASTROPHARMACY AND ASTROMEDICINE: INVESTIGATION OF POTENTIAL METHODS FOR MEDICATION PRODUCTION IN LONG-TERM SPACE MISSIONS VIA AN ISS EXPERIMENT

Abstract

The rapidly growing development of space exploration and the aim for future lunar planetary missions require new and innovative approaches in space medicine and pharmacy. There are three main environmental dangers in the ISS: fire, depressurization and toxic leakage. However, there are also health dangers that may affect different systems of the human organism, such as the endocrine system, the musculoskeletal, the vestibular or the immune system. When it comes to the wellbeing of the astronauts, there are challenges raised in order to ensure that the -first of all the need for medication is reduced, and secondly that there are adequate treatment options. This means, that there should be a variety of medication and resources to enable long-term missions without needing to access Earth for further supplies. The advantage is that certain processes are facilitated due to space conditions, making the production of medication in space easier. Targeting the immune system, the present research focuses on an International Space Station experiments antibiotic production in space from marine actinobacteria. The experiment launched on Falcon 9 in 2021 and the aim is to investigate the the effects of microgravity conditions on actinobacteria, a type of Gram positive bacteria, with high guanine and cytosine contents in DNA, a source of bioactive natural and antibiotic products. Moreover, the production of secondary metabolites which is an indication of their pharmacological interest is investigated and the changes in the viscosity of the liquid of actinobacteria and nutrients. The experiment was conducted simultaneously in the ISS and in the lab, on Earth. The post-launch research demonstrated that the growth rate of the actinobacteria in the ISS was similar with the one on Earth, with no significant differences. This means that the actinobacteria were able to survive the microgravity conditions with little to no effect on the growth rate. The viscosity was higher in the ISS as compared to Earth. The paper focuses on and evaluates how this experiment, provides a cost-efficient, sustainable and autonomous way of medication production on, board with great flexibility in terms of quantity and type of antibiotics. As a result, the experiment demonstrated the ability of actinobacteria to survive in the ISS. Evaluating the results are useful for lunar and planetary missions, with no expiry date or quantity and quality restrictions.