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Author: Mr. Thomas CHRETIEN
University of Trento, Department of Physics, National PhD in Space Science and Technology, Italy

Dr. Stefania Pighin
University of Trento, Italy
Dr. Lucia Savadori
University of Trento, Italy

CONSEQUENCES OF NORMOBARIC MILD HYPOXIA ON DECISION-MAKING AND SLEEP

Abstract

Mars has been the new goal of space exploration for the past 20 years, according to NASA officials. For this reason, NASA, and most of the main space agencies worldwide are working to establish a permanent presence on the moon through the Artemis program. With at least 14 months of transit time to Mars, the journey would last about 500 days (17 months). Crew performance and health are essential for successful human exploration beyond low Earth orbit. Therefore, it is important to look at the hostile features of space and its effect on human physiology. Today, astronauts sleep on the ISS which displays a perfectly normoxic controlled environment but tomorrow habitats and pressurized rovers will display a different atmosphere. As one of NASA's knowledge gaps, it will be paramount to determine whether mild hypoxia will impair cognitive performance and sleep and therefore in need of countermeasures. Indeed, the new Exploration vehicles and habitats designed for astronauts to live inside for up to two weeks will most likely use the 8.2 psia and 34 per cent of molecular oxygen (the equivalent of 19.1 per cent molecular oxygen at Earth pressure) named exploration atmosphere. The aim of this research is therefore to better understand the relationship between mild hypobaric hypoxia and its effect on sleep and decision-making. NASA is currently investigating the physiological and psychological consequences of mild hypoxia, however, assessment concerning neurocognitive functions, sleep performance and other functions was purely opportunistic as they focused on a pre-breath protocol validation. Participants will be exposed and monitored in the mild hypoxia and normoxic atmosphere with actigraphy while sleeping for 1 night at Earth's gravity. Participants will receive information about the sequence of the mild hypoxic and baseline sessions in a counterbalanced manner. The next day, they will complete a series of cognitive tasks and sleep questionnaires to determine subjective sleep quality and the impact of sleep on decision-making and risk-taking. While data collection and subsequent analysis for this project are still ongoing, results of this study will provide original empirical evidence on the effect of a slight decrease in oxygen during sleep on both the quality of sleep itself and the cognitive functions upon awakening. These findings could offer valuable insights into the need to implement potential countermeasures in mild hypoxic conditions. This will prove to be relevant to the experiences of future astronauts travelling to locations beyond the ISS, such as Mars.