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FOOD ODOR PERCEPTION AND VIRTUAL REALITY FOR SPACE APPLICATIONS

Abstract

This study investigates the psychological impacts of isolation and confinement on astronauts' senses during space missions, focusing particularly on food odor perception. Utilizing Virtual Reality (VR) to replicate the International Space Station (ISS) environment, researchers aimed to understand how such conditions affect astronauts' food-related sensory perceptions. The study had three main objectives: to assess the impact of a VR-simulated ISS environment on food odor perception, to examine how VR-induced emotions influence these perceptions, and to combine sensory data with chemical analyses. In the initial experiment, 44 participants rated the intensity of eight food odors plus a control in both a neutral setting and within the VR ISS simulation. Results showed significant increases in the perceived intensity of vanilla and almond odors in the VR environment compared to the neutral setting. Conversely, lemon odor intensity remained unchanged across contexts. Notably, nasal trigeminal stimuli odors—eucalyptus, peppermint, and vinegar—were also rated as more intense in the VR setting, suggesting that the VR environment could affect food palatability in space. A second pilot study with 16 participants evaluated five food odors at different times during the VR experience to simulate long-duration mission effects like confinement. This phase revealed that the perception of smell intensity increased over time, particularly for control-blank samples, highlighting a potential interaction between time and VR-induced psychological experiences ($P<0.01$). Subsequent chemical analyses confirmed these sensory evaluations, indicating that VR can indeed alter odor perception through environmental context manipulation. These exploratory studies underscore the potential of using VR technology to study and possibly enhance astronauts' sensory experiences in space, offering insights into how isolation and confinement might impact eating behaviors and nutrition. Further research in VR settings could provide valuable information for preparing astronauts for the sensory challenges of long-duration space travel.