Taste perception in VR and microgravity

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Background

Taste perception is known to be altered in microgravity, which can significantly impact astronauts' food acceptance and overall dietary experience. This study examines the effects of microgravity and virtual reality (VR) on the sensory perception and overall liking of products, specifically lemonade and vegetable soup, under controlled experimental conditions. The results indicate that overall liking for both products decreased significantly in microgravity, consistent with prior research on sensory suppression in space environments. However, VR demonstrated a compensatory effect, as overall liking scores in VR-enhanced microgravity stabilized and closely resembled those observed under normal gravity. This suggests that VR has the potential to mitigate the adverse effects of microgravity on taste perception, thereby improving food acceptability for astronauts. These findings underscore the necessity for further research into sensory modulation in altered gravity environments, particularly for long-duration space missions

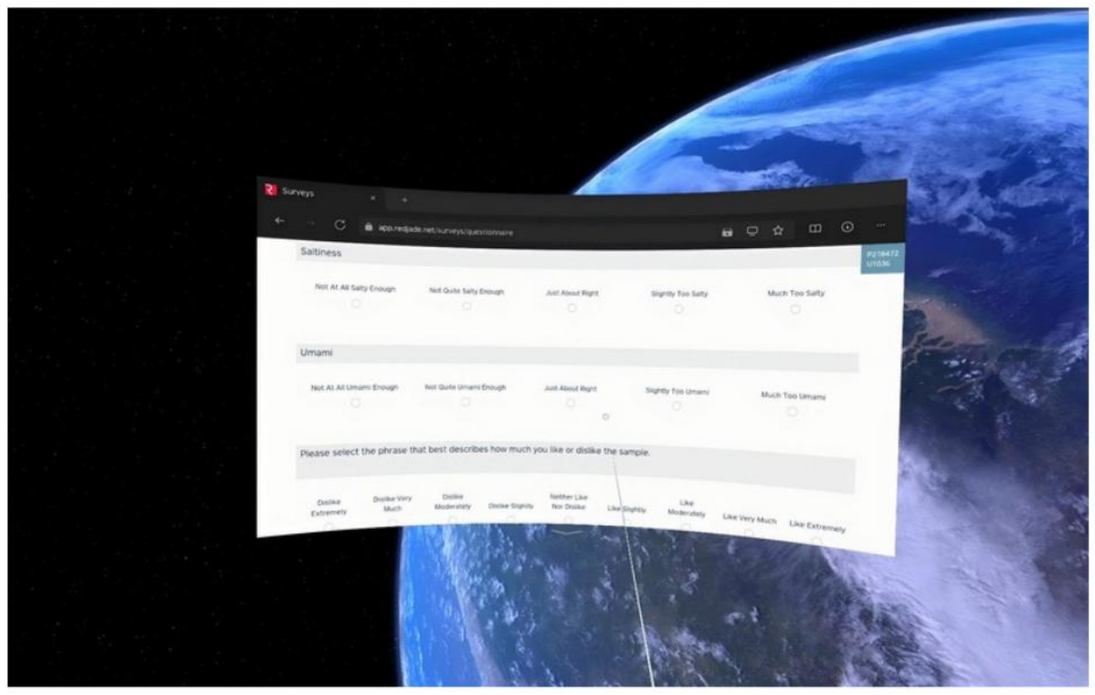

Figure: VR + Microgravity Condition with Jar Questionnaire and Preference Liking.in the VR + Microgravity condition, participants experienced a space simulation using a Pico VR headset while completing an online sensory evaluation questionnaire

Methods

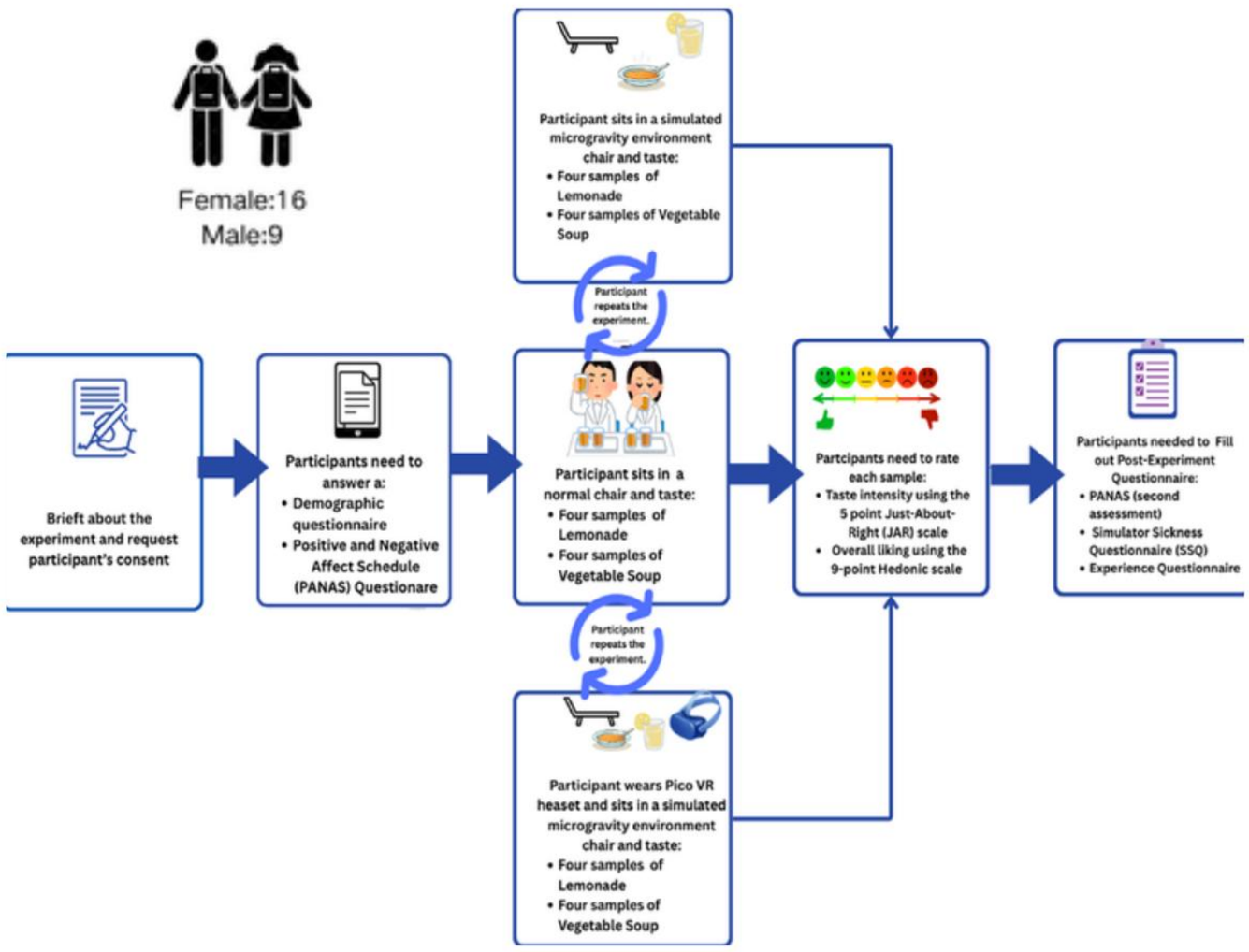

Figure: Experimental Session Flowchart

Figure : Pico neo 3.

Figure : zero gravity chairs

Figure:Laboratory Setup for Experimental Conditions: Microgravity Posture (a), VR MicroG Posture (b), and Normal Posture(c)

Results and discussion

Principal component analysis (PCA) showed that the first two components (F1: 41.98%, F2: 26.27%) explained 68.25% of the total variance, indicating strong explanatory power. As shown in the biplot, overall liking (OAL) scores for both lemonade (LN) and vegetable soup (VS) were significantly lower under microgravity (LN_OALM, VS_OALM), positioned far from the origin on the left side, consistent with sensory suppression effects in space.

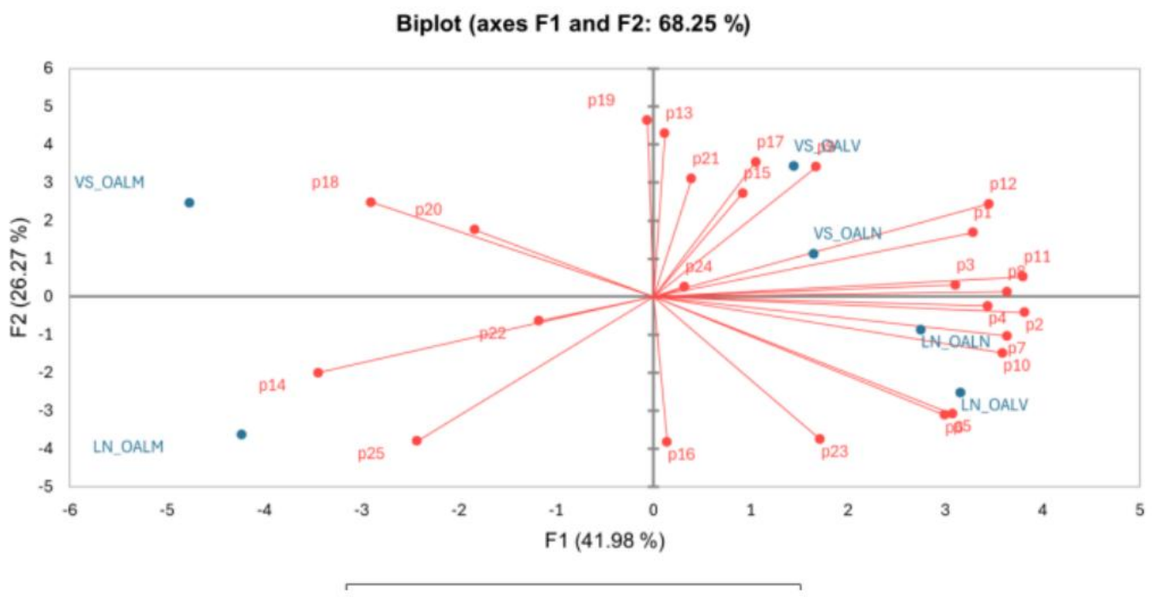

Figure : Internal Preference Mapping of Lemonade and Vegetable Soup Under Normal, Microgravity, and VR+Microgravity Conditions

Under normal gravity, OAL scores (LN_OALN, VS_OALN) shifted to the right, indicating higher acceptance of both beverages. Notably, scores in the VR + microgravity condition (LN_OALV, VS_OALV) appeared near the normal condition, suggesting that VR helped restore sensory liking, acting as a compensatory mechanism.

These results confirm that microgravity impairs taste perception, while VR can mitigate these effects, potentially improving food acceptability in space environments.

References

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Acknowledgments

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