Effect of Microgravity on Behavioral and Neuronal Performance

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INTRODUCTION:
Physical exercise is of particularly importance for astronauts under the extreme conditions of spaceflight in order to counteract the deconditioning of the musculoskeletal and the cardiovascular systems. As previous research indicates, exercise might in addition maintain mental fitness and therefore contribute to mission safety and success. Nevertheless, so far it has not been distinguished between a primary effect of weightlessness and a secondary effect of isolation and confinement while living in space. When isolating the gravitational effects in short periods of weightlessness (22sec) during parabolic flight manoeuvres, previous research has shown reaction time to be enhanced. The more the complexity of the task increased, the better the cognitive performance was in 0G.
The aim of this study was to compare behavioral performance (reaction time) and neuronal performance (event related potentials analysis, ERP) in a complex task within 1G and 0G.

METHODS:
17 participants were presented a complex arithmetic task in combination with an auditory-oddball task during the 1G and 0G-phases in a parabolic flight. Reaction time (behavioral) as well as event related potentials (neuronal: ERP, N200 and P300) were assessed.

RESULTS:
Results revealed a reduced reaction time (p < .05) for solving the mental arithmetic task during 0G. No differences in reaction time could be obtained between 1G and 0G for the simple oddball paradigm.

CONCLUSION:
Previous studies have demonstrated no or a small negative impact, of space flight on cognitive performance (1), albeit were not able to distinguish between primary effects of weightlessness and secondary effects of stress and confinement. Data presented here suggest that microgravity is more likely to enhance neuro-behavioral performance. It is assumed that the weightlessness induced fluid shift to the brain is positively affecting neuro-behavioral performance (2).

REFERENCES:
(1) Kohn F.P.M. and Ritzmann R. Eur Biophys J 2018