

Exercise-induced changes in cerebral oxygenation and cognition in the human prefrontal cortex

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An increasing number of human studies have suggested a beneficial influence of aerobic exercise on blood concentrations in the motor region of the brain. We have also found that exercise with moderate intensity increases cerebral oxygenation of the prefrontal cortex (PFC). This increase may be related to an improvement in cognitive performance; however, it is still unclear whether the exercise-induced hemodynamics affect to the cognitive function during and after exercise.

Purpose. The purpose of this study was to investigate the effect of exercise-induced changes in cerebral oxygenation on cognition in the human prefrontal cortex.

Methods. Healthy individuals performed a 9 min modified Flanker test (FT) and a 15 min serial calculation test (UKT) before, during and after exercise. The exercise condition was set at 55% of VO_{2max} . During the exercise, the participants took the Flanker test 20 min after the start of exercise. Haemoglobin concentration changes such as oxyHb, deoxyHb and totalHb were measured in the PFC using a multichannel functional optical topography. The number of calculations were counted from the UKT. The reaction time (RT) and the number of errors were analyzed in the FT.

Results and discussion. The oxyHb increased during exercise, while deoxyHb decreased. The number of calculations in the UKT increased after the exercise. In FT, the reaction time (RT) decreased during exercise and the number of errors did not change. This indicates that exercise changes oxygenated haemoglobin in the PFC and some cognitive performance. Further study needs to understand how an increase of oxyHb after exercise is related to improved cognitive performance during and after exercise with moderate exercise.