MENTAL AND PHYSICAL FATIGUE IN ELECTRICAL BRAIN ACTIVITY
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Mental and physical effort both affect information processing in the central nervous system (CNS). Possible changes in event-related potentials (ERPs) due to different fatiguing procedures are explored in the context of mismatch-negativity (MMN; Näätänen, 1992) as a measure of sensory information processed by the brain. MMN is an automatic processing difference between sequentially presented rare (deviant) and frequent (standard) stimuli and is isolated from the auditory N2 wave. Thirteen healthy and fit non-smoking men aged 20.6 ± 2.7 years participated in this study. The subjects had to cycle at 80% of their individual anaerobic heart rate threshold in the physical fatigue condition. To induce mental fatigue, a simple but attention demanding computer-task was executed. Both fatiguing procedures lasted 45-50 minutes and were carried out on separate days in random order. Perceived fatigue and exertion (Borg CR-10 and RPE scales; Borg, 1998) and critical flicker frequency (CFF) threshold were measured before and after and ERPs were recorded during the fatiguing procedures. Results showed that subjects perceived 'moderate/somewhat strong' fatigue and 'somewhat hard' exertion after both sessions. CFF showed CNS fatigue after mental fatigue whereas no change in the threshold was observed in case of physical fatigue. ERPs were analyzed according to the start and end phase of the experiments. First, the N1 wave was analyzed, showing no change in latencies but the main effect of testing time (start or end) on amplitude appeared \[F(1,33)=27.5, p<.0001\]. LSD post-hoc test showed significant decrease in amplitude at the end of both fatiguing procedures (\(p<.05\)). For the processing difference, the MMN was found by subtracting ERP wave of the standard stimulus from the deviant's wave. Individual data analysis for Cz electrode showed an interaction of fatiguing test (mental or physical) and testing time in the latency of the difference wave \[F(1,7)=14.9, p<.05\]. A decreased latency of the peak of the difference wave was present at the end of physical fatigue experiment and increased latency occurred at the end of mental fatigue experiment. Thus, amplitude of N1 and latencies of the MMN wave present evidence for emerging fatigue as a result of mental effort and some activation in case of sustained physical activity. In conclusion, changes in electrical brain activity due to different fatiguing procedures might reflect the use of energetical resources.


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