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Conference Abstract

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Cognitive performance of healthy volunteers and professional cyclists during high intensity cycling

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1 Abstract

Are decisions in cycling influenced by the physical load? There is little consensus regarding the relationship between the intensity of acute physical exercise and the quality of decision-making. Theories predict an inverted U-shaped relationship where cognitive performance is optimal during moderate-intensity physical exercise compared to both light and heavy intensities. This aligns with the Yerkes-Dodson law (1908), which posits that the level of arousal is the underlying factor explaining the inverted U-shaped curve. We examined behavioural and computational markers of decision-making during a conflict task across three increasing cycling intensities, up to the heavy domain. Thirty-one healthy volunteers completed the flanker task at light, moderate, and heavy exercise intensities on a stationary bike. In the flanker task, participants respond to a central target (arrow left of arrow right) with a corresponding response key, while ignoring flanking congruent or incongruent arrows. The response keys in this study are mounted on the handlebars. Throughout the experiment, heart rate, oxygen uptake, and rates of perceived exertion were measured and confirmed the prescribed exercise intensities. We used the diffusion model for conflict tasks (DMC, Ulrich et al., 2015) to break down the decision process into biologically plausible and theoretically grounded parameters. DMC analyses showed that drift rate (evidence accumulation) followed the hypothesised inverted U-shaped pattern, peaking at moderate intensity,

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suggesting optimal evidence accumulation at this workload. In a second study, we tested six elite cyclists from Soudal Quickstep – AG insurance Soudal. They performed the same flanker task in three intensities (based on recent physiological exercise tests): 80% of VT1 (moderate), middle of VT1 and VT2 (heavy), and finally, 5% over VT2 (extreme). Results showed increased performance from moderate to high intensity and, contrary to the healthy volunteers, no overall decline in the highest (extreme) intensity. Individual analyses suggest that sprinters (n=2) show further improvement in the highest intensity. This indicates that the detrimental effects of physical load are less pronounced in professional cyclists. Additional data suggest that sprinters show low body awareness (assessed by the MAIA questionnaire) which might shield against the otherwise negative impact of extreme physical load. Our novel method allows to test cyclists' cognitive abilities under varying levels of physical load and might in the future be used to develop cognitive profiles.