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PERSPECTIVES

Want to win a bowling game? Beware of even one glass of alcohol!

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Linked articles: This Perspectives article highlights an article by Tyson *et al.* To read this paper, visit https://doi.org/10.1113/JP280395.

Most of us already experienced the consequences of alcohol consumption, if only by observing it. Most of the time, alcohol consumption will only have a transient impact on behaviour, impairing sensory, cognitive and motor performances even for moderate doses of alcohol consumption. Unfortunately, regular and heavy alcohol consumption is also known as one of the most common, severe forms of addiction and a major concern for public health policies. Although there is a consensus that alcohol consumption may impair human performance in a wide range of activities, the level at which this becomes significant is still largely debated. However, this is an important question in, for instance, the debate between supporters of a zero tolerance *versus* a maximum alcohol consumption rule for driving a car, or for many other human activities. In this issue of *The Journal of Physiology*, Tyson and his colleagues address this important question in their paper (Tyson *et al.* 2020) investigating the influence of ultra-low blood-alcohol concentrations on human sensorimotor control (BAC $<$ 0.02%, corresponding to one drink for a body mass of 90 kg).

Over the last few decades, eye movement studies have contributed to major breakthroughs in our understanding of a wide range of brain functions and pathologies. Indeed, many brain areas play a key role in the control of eye movements. As a consequence, brain pathologies tell us a lot about the control of eye movements (Ramat *et al.* 2007) but conversely eye movements are excellent biomarkers for detecting many brain pathologies or assessing their progression in the case of neurodegenerative diseases, which is of great help to clinicians in their practice (e.g. Deravet *et al.* 2020). Initially, eye movement studies were mostly used to investigate pathologies related to the cerebellum and brainstem but in recent years more elaborate paradigms also allow their use for disorders involving higher-level structures, up to the cerebral cortex, associated with cognitive or psychiatric disorders (Shaikh & Zee, 2018). Therefore, nobody should be surprised that alcohol consumption also impairs eye movements, since many brain areas are involved in their control. This explains why oculomotor performance is largely used to assess the influence of ethanol on sensorimotor functions (Maurage *et al.* 2020). This is the direct consequence of the widespread influence of alcohol on neural activity in the brain, affecting sensory, cognitive and motor functions. In particular, given the central role of vision and eye movements in a large range of activities associated with perception and action, it is of particular interest to investigate the influence of alcohol on eye movements, even at ultra-low doses.

Several previous studies have documented the influence of alcohol consumption on eye movements at moderate blood-alcohol concentration (BAC $>$ 0.05% for most studies). For saccadic eye movements, their rate, peak velocity and latency are impaired whereas for smooth pursuit eye movements steady-state gain and latency are affected. In the paper by Tyson *et al.* (2020), ultra-low blood-alcohol concentrations (BAC $<$ 0.02%) were tested. The authors demonstrate for the first time that several eye movement impairments previously reported were significant at much lower BAC levels. In addition, they documented new oculomotor impairments that were overlooked in previous studies, like the effects on eye acceleration, speed noise or direction asymmetry. Importantly, the authors report that the deficit in smooth pursuit eye movements, characterized by reduced smooth eye displacements, is fully compensated by the saccadic system. This occurs at the expense of a larger contribution of visually disruptive catch-up saccades as well as decreased dynamic visual acuity between saccades, during visual tracking under the influence of alcohol. Therefore, the overall performance of oculomotor tracking of moving targets is clearly impaired at ultra-low blood-alcohol levels (BAC $<$ 0.02%). Interestingly, the pupil response to light seemed not to be affected at ultra-low levels (no effect up to BAC $>$ 0.065%).

This study sheds new light on the influence of alcohol on human behaviour by reporting a very robust and significant effect of alcohol at ultra-low blood-alcohol levels on eye movements. If you still needed one, this is an argument that should convince you that driving after drinking is not a good idea and that if you plan to play a bowling game even one beer is enough to significantly degrade your performance and make you lose.

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Additional information

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