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A driving simulator study on the impact of a blood alcohol concentration of 0,2 g/L and 0,5 g/L on driving behaviour.



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Boets, S., Teuchies, M., Desmet, C. & Van Belle, G. (2020) De impact van alcohol op het rijden bij jonge/nieuwe bestuurders. Een rijdsimulatorstudie naar de invloed van een bloedalcoholconcentratie van 0,2 g/L en 0,5 g/L op het rijgedrag. Brussel, België: Vias institute – Kenniscentrum Verkeersveiligheid.

Boets, S., Teuchies, M., Desmet, C. & Van Belle, G. (2020) L'impact de l'alcool sur la conduite chez les jeunes/nouveaux conducteurs. L'influence d'une alcoolémie de 0,2 g/L et de 0,5 g/L sur la conduite: une étude sur simulateur. Bruxelles, Belgique : Institut Vias – Centre Connaissance de Sécurité Routière.

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Summary

Introduction

Driving a car is a complex task that goes far beyond merely driving the vehicle. The driver must also keep an eye on other traffic in order to be able to anticipate dangerous situations and to observe important information such as road signs and signposts. There are also many factors that can increase the risk of an accident while driving. One of the most important factors is the drinking of alcohol. Research shows that alcohol plays a role in 25% of fatal road accidents.

Research has shown that the risk of an accident after drinking alcohol can be more than 100 times higher than for a sober driver. In combination with other tasks such as navigating, driving a car becomes more inaccurate from a blood alcohol concentration (BAC) of 0,3 g/L (promille, ‰). Younger, inexperienced drivers in particular run a higher risk of being involved in an accident, even at low alcohol doses. For young, inexperienced drivers, the accident risk after alcohol consumption increases more than for older, more experienced drivers.

The legal limit for driving after drinking alcohol is set in Belgium at 0,5 g/L or 0,22 mg/L breath alcohol concentration (BrAC). A reduced limit of 0,2 g/L only applies to professional drivers.

Alcohol has a major influence on a wide range of skills, including several that are essential for safe driving. Attention is also influenced by alcohol. This means that drivers become slower in recognizing potentially dangerous situations such as crossing pedestrians and oncoming traffic. They also react more slowly to red traffic lights or braking in front of them. In summary, processes that are automated because they are well-trained at a BAC of 0,5 g/L may deteriorate, while processes that require the driver's attention may deteriorate from 0,2 g/L onwards.

A maximum limit of 0,2‰ currently applies to novice drivers in 24 European countries: Austria, Croatia, Cyprus, Czech Republic, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland (ETSC, 2018)¹. In addition to our country, there are only four European countries that have not yet lowered the limit for inexperienced drivers: Bulgaria, Denmark, Finland and the United Kingdom. Lowering the legal limit for inexperienced drivers to the level of professional drivers ($\leq 0,2$ g/L) was already one of the proposals made during the States General for Road Safety in Belgium in 2015.

Study

The aim of the present study was to provide more insight into the effects of 0,2 and 0,5 promille alcohol in the blood on different driving parameters and on visual attention in the central and peripheral visual field, among new young drivers (18 years and less than 3 months driving licence B) and experienced young drivers (21 years and 3 years driving licence B). The present study is a partial replication of a driving simulator study conducted by Ifsttar in France in 2014.

Interactions between alcohol level (BAC 0,2 g/L, 0,5 g/L and placebo), group (driving experience/age) and divided attention (single/double task) were investigated. The hypotheses were that BAC level and group would interact in the sense that alcohol would have a greater negative impact on new drivers; and that BAC level, task (divided attention) and group would interact and reduce driving performance, especially for new drivers.

In the current study, 52 subjects were tested, including 22 18-year-old new drivers and 30 21-year-old experienced drivers. The study was carried out in a lab-experimental setting with a driving simulator. There were three alcohol levels (1 control condition: BAC 0 (placebo) and 2 experimental conditions: 0,2 and 0,5 g/L BAC) of which the participants were unaware, and three experimental tasks (2 single tasks: a number task and a driving task, and 1 double task: combination of both). Driving task data, number task data and questionnaire data were collected from all subjects. In addition to within-subject comparisons of the experimental and control conditions, the two subject groups were also compared.

Results

¹ ETSC (2018) Blood Alcohol Content (BAC) Drink Driving Limits across Europe. Last updated: December 2018. Retrieved from: <https://etsc.eu/blood-alcohol-content-bac-drink-driving-limits-across-europe/>

The analyses showed that alcohol can negatively influence both lateral driving performance and visual attention in a BAC of 0,5 g/L - and this specifically in 18-year-old new drivers, and not in 21-year-old experienced drivers. New drivers in this context were less able to maintain a central runway position (edge significant) (Figure 1) and detected significantly fewer visual stimuli in the environment than if they had not drunk alcohol or with a BAC of 0,2 g/L (Figure 2).

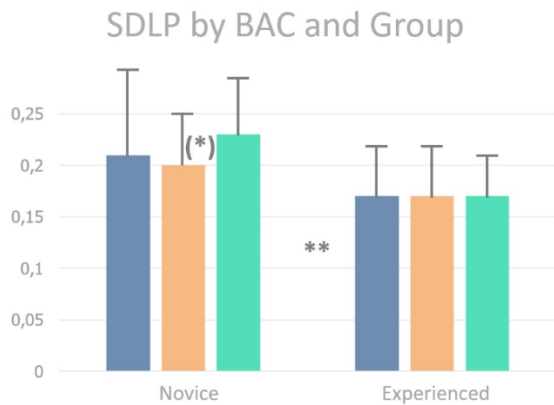


Figure 1 Standard deviation of lateral position by BAC and group – Mean/SD (metres) (n=52)
 ** (p≤.01); (*) (.05<p<.07)

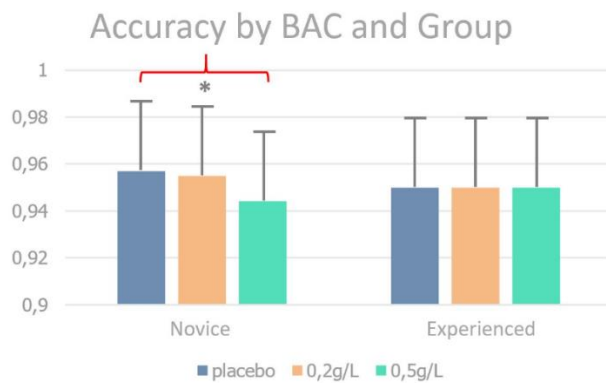


Figure 2 Accuracy by BAC and group - Mean/SD (%; 0-1) (n=52)
 * (p≤.05)

There were several significant differences between the two groups (18-year-old new vs. 21-year-old experienced drivers), always to the detriment of the new drivers. The analyses showed that new drivers - over all alcohol conditions and tasks - had a significantly greater variation in lateral road position, significantly less ability to maintain a constant distance from the vehicle in front, significantly slower reactions to the speed adaptation of the vehicle in front, and also significantly slower reactions to visual stimuli in the environment. New drivers who had not drunk alcohol, were even significantly less able to maintain a constant distance from a vehicle in front and reacted more slowly to visual stimuli in the environment (non-significant trend) than experienced drivers in the 0,5 g/L BAC condition. There was one significant interaction between the two groups with the type of task, where new drivers reacted significantly slower to visual stimuli in the single-task condition than experienced drivers in the divided attention condition.

Conclusions

Alcohol (BAC 0,5 g/L), divided attention and lack of driving experience are independently related to reductions in driving performance. The hypothesis that there is an interaction between alcohol and driving experience that leads to a greater deterioration in driving performance of new drivers was confirmed for two relevant driving safety skills. New drivers have a significantly less stable track position than experienced drivers and this decreases further at a BAC of 0,5 g/L. In addition, new drivers detect significantly fewer visual stimuli in the central and peripheral environment at a BAC of 0,5 g/L compared to when they have not drunk.

Recommendations

The results of this study are in line with the European Commission's recommendation (since 2001) to lower the legal BAC limit for driving to 0,2 g/L for novice drivers. This measure is supported by a broad evidence base (to which this study makes a limited contribution). Dupont et al. (2010)² summarise their detailed analysis as follows: *"Inexperienced drivers appear to be particularly sensitive to the effects of alcohol, which specifically affects those skills that are insufficiently developed in them. ... They have an increased basic risk of an accident and an increased rise of that risk due to the consumption of alcohol. ... For this group, it is therefore to be expected that the effect of lowering the legal limit will be positive. Estimates and evaluations concerning the (expected) reduction of victims carried out in other countries are difficult to compare with the situation in*

² Dupont, E., Martensen, H., & Silverans, P. (2010) Abaissement du taux d'alcool autorisé pour les conducteurs novices et les conducteurs de grands véhicules: 0,2‰. IBRS, l'Observatoire pour la Sécurité Routière, Bruxelles, Belgique. [Lowering the permitted alcohol level for novice drivers and drivers of large vehicles: 0,2‰. BRSI, Road Safety Observatory, Brussels, Belgium] Retrieved from: <https://www.vias.be/publications/Verlaagde%20alcohollimiet%20voor%20onervaren%20bestuurders%20en%20voor%20bestuurders%20van%20grote%20voertuigen/Abaissement%20du%20taux%20d%E2%80%99alcohol%20autoris%C3%A9%20pour%20les%20conducteurs%20novices%20et%20...%20de%20grands%20v%C3%A9hicules.pdf>

Belgium, but still suggest a positive (or at least non-negative) effect of the measure in our country.” For this reason, Vias institute included 'Zero tolerance for drink-driving for novice drivers' in its Memorandum 2019, as the first of 10 concrete measures to improve road safety in Belgium (Vias, 2019)³.

³ Institut Vias (2019) Mémorandum 2019. Retrieved from:
https://www.vias.be/publications/Memorandum%202019/Memorandum_2019_FR.pdf

