

Modelling the Effect of Alcohol Consumption on the Accelerating and Braking Behaviour of Drivers

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Abstract : Driving under the influence of alcohol impairs the driving performance and increases the crash risks worldwide. The present study investigated the effect of different Blood Alcohol Concentrations (BAC) on the accelerating and braking behaviour of drivers with the help of driving simulator experiments. Eighty-two licensed Indian drivers drove on the rural road environment designed in the driving simulator at BAC levels of 0.00%, 0.03%, 0.05%, and 0.08% respectively. Driving performance was analysed with the help of vehicle control performance indicators such as mean acceleration and mean brake pedal force of the participants. Preliminary analysis reported an increase in mean acceleration and mean brake pedal force with increasing BAC levels. Generalized linear mixed models were developed to quantify the effect of different alcohol levels and explanatory variables such as driver's age, gender and other driver characteristic variables on the driving performance indicators. Alcohol use was reported as a significant factor affecting the accelerating and braking performance of the drivers. The acceleration model results indicated that mean acceleration of the drivers increased by 0.013 m/s², 0.026 m/s² and 0.027 m/s² for the BAC levels of 0.03%, 0.05% and 0.08% respectively. Results of the brake pedal force model reported that mean brake pedal force of the drivers increased by 1.09 N, 1.32 N and 1.44 N for the BAC levels of 0.03%, 0.05% and 0.08% respectively. Age was a significant factor in both the models where one year increase in drivers' age resulted in 0.2% reduction in mean acceleration and 19% reduction in mean brake pedal force of the drivers. It shows that driving experience could compensate for the negative effects of alcohol to some extent while driving. Female drivers were found to accelerate slower and brake harder as compared to the male drivers which confirmed that female drivers are more conscious about their safety while driving. It was observed that drivers who were regular exercisers had better control on their accelerator pedal as compared to the non-regular exercisers during drunken driving. The findings of the present study revealed that drivers tend to be more aggressive and impulsive under the influence of alcohol which deteriorates their driving performance. Drunk driving state can be differentiated from sober driving state by observing the accelerating and braking behaviour of the drivers. The conclusions may provide reference in making countermeasures against drinking and driving and contribute to traffic safety.

Keywords : alcohol, acceleration, braking behaviour, driving simulator

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