

Estimation of Blood Alcohol Concentration in Drunk-Driving Incidents Using Alcohol Biomarkers: Toward Application in Cases of Evasion of Alcohol Impairment Detection

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This study aimed to establish a scientific method to determine recent alcohol intake in “evasion-of-detection” drunk-driving cases, in which drivers refuse breath alcohol testing and a considerable delay occurs before compulsory blood collection. A controlled single-dose alcohol administration study was conducted in healthy Japanese adults. Blood and urine concentrations of ethyl glucuronide (EtG) and ethyl sulfate (EtS), non-oxidative metabolites of ethanol, were measured for 24 hours to evaluate their utility as indicators of recent drinking, even when blood ethanol concentrations fall below the limit of detection at the time of sampling. In addition, assuming scenarios where early post-accident breath alcohol concentration (BrAC) measurements are available, we assessed whether multi-point BrAC sampling improves the accuracy of estimating BrAC at the time of the incident. EtG and EtS remained detectable longer than ethanol in the high-dose group, demonstrating their value as biomarkers of recent alcohol ingestion. The two-point BrAC estimation method yielded the smallest error and showed superior accuracy compared with the traditional single-point approach. These findings contribute to establishing reliable evidence of drinking in evasion cases and enhancing the precision of BrAC reconstruction at the time of traffic accidents.