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Article

Can Handling E85 Motor Fuel Cause Positive Breath Alcohol Test Results?

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Hand-held breath alcohol analyzers are widely used by police in traffic stops of drivers suspected of driving while intoxicated (DWI). E85 is a motor fuel consisting of 85% ethanol and 15% gasoline or other hydrocarbons, and is available at nearly 2,600 stations in the USA. We sought to determine whether handling E85 fuel could produce measurable breath alcohol results using a hand-held analyzer and to see if this would be a plausible explanation for a positive breath alcohol test. Five healthy adult subjects dispensed or transferred 8 US gallons of E85 fuel in each of four scenarios. We measured breath alcohol concentration in g/210 L of exhaled breath using the BACTrack S50 at 0, 2, 4, 6, 8, 10, 15 and 20 min after each fuel-handling scenario. Most of the subjects had no detectable breath alcohol after handling E85 motor fuel. Transient elevations (0.02–0.04 g/210 L) in breath alcohol measurement occurred up to 6 min after handling E85 in a minority of subjects. We conclude that it is unlikely that handling E85 motor fuel would result in erroneous prosecution for DWI.

Introduction

Driving while intoxicated (DWI) remains a major cause of morbidity and mortality from motor vehicle crashes. In 2011, 9,878 Americans died in alcohol-related crashes, and alcohol-related crashes resulted in 31% of US traffic deaths (1). The legal definition of DWI throughout the USA is a blood alcohol concentration (BAC) of >0.08%, and some jurisdictions define other violations with lower BACs.

Breath testing is widely used during road-side traffic stops of suspected drunk drivers. Breath alcohol devices, commonly called Breathalyzers after an early leading brand of devices, noninvasively estimate BACs, using a blood-to-breath alcohol ratio of 2100:1.

People accused of DWI sometimes attempt to cast doubt on the accuracy of breath testing, or attempt to explain an elevated reading. Explanations such as residual alcohol in the oropharynx from ethanol-containing mouthwash or alcoholic beverage consumed immediately prior to the stop have been disproven (2, 3).

An unexplored potential confounder is E85 fuel, which is 85% ethanol. Ethanol-based fuels have been promoted as a cleaner fuel with neutral effect on global carbon dioxide emissions. They are widely used in Brazil, Sweden and the USA, with ~2,500 E85 stations in the USA. Over half of these stations are in seven states in the upper Midwest (IA, IL, IN, MI, MN, MO and WI) (4).

It is unclear whether handling E85 fuel can falsely elevate BrAC. The current study seeks to determine whether handling E85 fuel produces measurable BrAC and, if so, the duration of this effect.

Methods

We recruited five medically healthy subjects (three males and two females; aged 24–26) in an IRB-approved study conducted at the I-55 Motor Plaza in Pevely, Missouri. This is a semirural area where a vapor recovery hose over the nozzle is not required. The study was reviewed and approved by the Washington University Human Research Protection Office (IRB protocol #201110232).

We used a new BACTrack S50 hand-held breath alcohol analyzer (KHN Solutions, San Francisco, CA, USA) for all measurements. The BACTrack S50 is a hand-held analyzer with a semiconductor sensor powered by two AA batteries with a detection range of 0.00–0.40 g/210 L and a reported accuracy of ±0.01 g/210 L at 0.02 g/210 L within the operating temperature range of 10–40°C. It is among the devices on the NHTSA Conforming Products list of acceptable screening devices. The device is calibrated by the manufacturer. We report all results in g/210 L of exhaled breath alcohol in increments of 0.01 g/210 L. Each subject affirmed a minimum of 24 h of abstinence from drinking alcoholic beverages and abstained from eating, drinking or smoking for at least 20 min prior to each test. Each subject was first tested with the hand-held analyzer to confirm a BrAC of 0.00 g/210 L. Each subject also handled a minimum of 8 US gallons (30 L) of E85 fuel under each of four scenarios: from (i) fuel pump to car, (ii) pump to two high-density polyethylene gas containers, (iii) gas can to another gas can and (iv) gas can to car. We selected these scenarios to include each likely variation of fuel-handling explanations. Each fuel-handling scenario occurred separately. However, a subject could complete more than one fueling scenario after confirming that the BrAC was 0.00 g/210 L before commencing a second scenario.

We also measured BrAC at 0, 2, 4, 6, 8, 10, 15 and 20 min after each fuel-handling procedure. Trials occurred on different study days between June and October 2011. Ambient temperatures varied between 15 and 35°C, well within the operating temperature specified by the manufacturer.

Results

After Scenario 1, (transfer from the pump to car), no subjects had any detectable breath alcohol at any time from 0 through 20 min.

After Scenario 2, (transfer from the pump to container), a single subject had a value of 0.02 g/210 L immediately after completing the transfer, but all subjects had no detectable alcohol from 2 through 20 min.

After Scenario 3 (transfer from between containers), one subject had a value of 0.04 g/210 L and another had a value of 0.02 g/210 L immediately after completing the transfer, but all subjects no detectable alcohol from 2 min through 20 min.

Scenario 4 (transfer from the container to car) was the only scenario with detectable alcohol beyond 0 min. One subject had a value of 0.00 g/210 L at time 0, 0.02 g/210 L at 2 min, 0.00 g/210 L again at 4 min, and then 0.01 g/210 L at 6 min. Another subject had a single value of 0.01 g/210 L at 4 min. All other readings were 0.00 g/210 L.

Figure 1 illustrates the observed BrACs from 0 through 20 min after handling E85 in all four scenarios.

Discussion

Our results are somewhat similar to those found in studies of the effect of various orally consumed or administered products on BrAC. Modell *et al.* (2) conducted a small study to evaluate the effect of three different brands of mouthwash. They showed a transient elevation of BrAC >0.08 g/210 L that fell below the legal limit within 6 min. Current police procedures require a 15-min wait after a traffic stop before conducting breath testing. Thus, the study concluded that mouthwash did not pose a realistic threat to the use of breath alcohol analyzer results under normal circumstances.

Wigmore and Leslie (3) studied subjects after either swishing the mouth for 10 s or swallowing 10 mL of gin diluted to 20% v/v alcohol. They observed measurable breath alcohol results in 90% at 5 min after rinsing, 66% at 5 min after swallowing, 62% at 10 min after rinsing and 30% at 10 min after swallowing. Logan *et al.* (5) studied BrAC in three subjects at 0 and 15 min after using various asthma inhalers and nasal decongestant sprays. Except for Primatene Mist (a now-discontinued epinephrine inhaler with 34% ethanol), all had no measurable BrAC at 0 or 15 min. The Primatene Mist resulted in an immediate BrAC of up to 0.12 g/210 L, which rapidly fell to 0 in <5 min. Ignacio-Garcia *et al.* (6) similarly studied 69 subjects using various inhalers, although only 10 subjects used one of two alcohol-containing inhalers. Of these, only one subject had a measurable BrAC of 0.07 at 1 min and all had no measurable BrAC at 5 min.

Moore and Guillen (7) personally tested BrAC at 30 and 150 s after using various breath freshener strips, with two different breath analyzers. The breath strips had no effect on the fuel cell-based Alco-Sensor IV-XL. The infrared-based BAC DataMaster transiently measured BrAC up to a maximum of 0.01 g/210 L at 30 s after one breath strip, but returned to 0 by 150 s.

It is possible but unlikely that the gasoline portion of the fuel had any contribution to the transient BrAC measurements in our study. In 1981, Cooper (8) described a single subject who had a single BrAC measurement of 0.19 g/210 L using an infrared-based Omicron Intoxilyzer 4011 1 min after a 5-min period of 'intermittent inhalation of gas fumes'. This returned to zero 2 min later. The same subject then inhaled gas fumes again for 15 min and had an apparent BrAC of 0.01 g/210 L 4 min later and 0 after another 6 min (10 min after the end of the exposure). A letter to the editor by Dalley (9) described a person who reportedly rinsed his mouth with 8 mL of gasoline. One minute later, he had an apparent BrAC of 0.005 g/210 L using the infrared-based Intoxilyzer 3000 with a return to 0 at 15 min.

A limitation of the study is that we used a hand-held screening device that may not be similar to instruments used by police departments for obtaining evidence in DWI traffic stops and arrests.

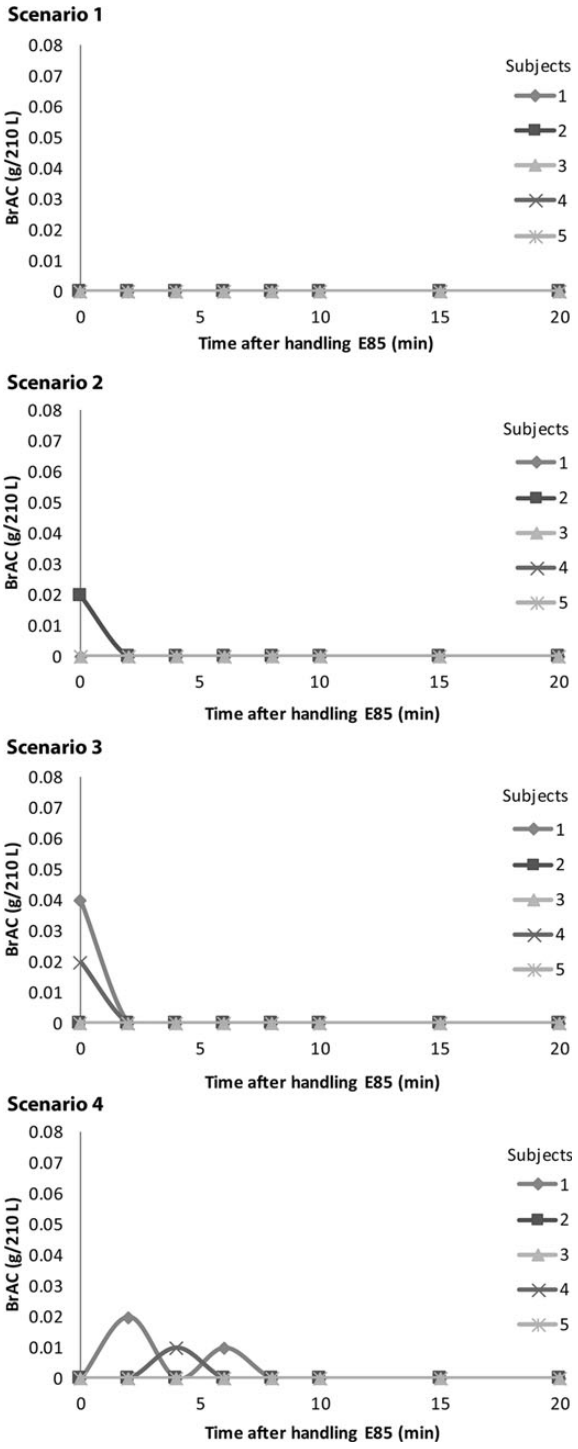

Figure 1. Breath alcohol measurements (g/210 L) from 0 through 20 min after each of four E85 fuel-handling scenarios: from (i) fuel pump to car, (ii) fuel pump to gas can, (iii) one gas can to another and (iv) gas can to car.

Conclusion

Handling E85 motor fuel produced low, transient elevations in breath alcohol measurement up to 6 min in a minority of subjects. Because standard police procedures include waiting 15–20 min after a traffic stop before administering a breath alcohol test, it is unlikely that handling E85 motor fuel prior to arrest would result in erroneous prosecution for DWI.

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