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The Effect of Breath Freshener Strips on Two Types of Breath Alcohol Testing Instruments

ABSTRACT: The potential for breath freshener strips to interfere with the accuracy of a breath alcohol test was studied. Twelve varieties of breath freshener strips from five manufacturers were examined. Breath tests were conducted using the infrared based BAC DataMaster or the fuel cell based Alco-Sensor IV-XL, 30 and 150 seconds after placing a breath strip on the tongue. No effect was observed using the Alco-Sensor system. Some of the strips gave a small reading at 30 seconds (less than or equal to 0.010 g/210 L apparent alcohol) using the DataMaster. Readings on the DataMaster returned to zero by the 150 second test. A proper pre-test observation and deprivation period should prevent any interference from breath freshener strips on breath alcohol testing.

KEYWORDS: forensic science, forensic toxicology, breath-alcohol analysis, mouth alcohol, interference, breath strips

Breath testing has long been used in traffic law enforcement as a method of determining a person's alcohol load, either directly in terms of breath concentration, or as an indirect indication of the blood alcohol level (1). Defendants in criminal actions often argue that the reported breath test result varies from their "true" alcohol concentration due to the influence of some internal or external factor. These arguments have varying degrees of merit depending on the technology used to produce the breath test result, the physiology of the defendant, and the legal standards in the jurisdiction. Two factors which have the potential to influence the accuracy of a breath test result are mouth alcohol and interference from substances other than alcohol. The degree of influence of these factors depends on the methods and procedures used to determine the breath alcohol concentration. This study addresses the influence of one of these external factors (the use of breath strips) on the two most common methods of breath alcohol measurement: infrared absorption and the electrochemical fuel cell.

Mouth Alcohol

Breath test results may be elevated by alcohol in the mouth. Residual alcohol can be present in the mouth from consuming an alcoholic beverage, from regurgitation of alcohol from the stomach, or from less obvious sources such as alcohol containing breath sprays, or dental preparations (2). It has even been reported that bread or soda pop can result in mouth alcohol levels (3). Most, if not all, jurisdictions require an observation and deprivation period prior to an evidential breath test to minimize or eliminate the influence of mouth alcohol on the result. Observation times of 15 to 25 min are typical (4). Additionally, breath testing is typically conducted in duplicate with a sufficient separation in time (at least 2 min) and with a requirement for sufficient agreement to also indicate the presence of

mouth alcohol (5). Some research has been conducted into whether certain conditions, such as wearing dentures or denture adhesives (6–9), mouthwash (10), asthma inhalers and decongestant sprays (11), or tongue piercings (12), can cause alcohol to remain in the mouth beyond the typical waiting periods.

Interfering Substances

Because the result of a breath test is reported and used as an alcohol concentration, the instrument should be as specific as possible to ethyl alcohol. Depending on the testing method, however, breath testing instruments are subject to varying amounts of interference from substances other than ethyl alcohol (13–17). These substances can cause erroneously high readings if not detected as interferants. Many instruments have mechanisms intended to detect interfering substances, especially acetone, and alert their presence (18).

Breath Strips

Breath strips are strips of edible film that contain breath freshening ingredients. A strip is placed on the tongue where it rapidly dissolves. They were introduced in the United States by Pfizer in 2001 as Listerine strips, and named as one of Time Magazine's best inventions of 2002. The strips were so successful that other manufacturers rapidly followed suit, including Wrigleys (in both "Winterfresh" and "Eclipse" product lines), Vitech America (maker of Mintz and Squintz), and Altoids. The strips are available in a variety of flavors, most commonly peppermint, spearmint, and cinnamon. Nature's Gate makes all natural mint or anise flavors, both with green tea extract. Private label manufacturers/distributors also market strips through various house brands or their own labels, and some include fruit flavors among their offerings.

The success of breath strips has spurred manufacturers to develop strips as a delivery medium for other products, such as vitamins, dietary supplements, and medicines. The first such strips to reach the market have been for sore throats.

This research was undertaken to determine if the breath freshening strips have any effect on breath alcohol testing, either due to the presence of alcohol or other interfering substance in the strips.

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TABLE 1—Brands/flavors of breath freshener strips tested and their listed ingredients.

Brand/Flavors	Ingredients
Listerine Cool mint Fresh burst	pullulan, flavors, menthol, aspartame, potassium acesulfame, copper gluconate, polysorbate 80, carrageenan, glyceryl oleate, eucalyptol, methyl salicylate, thymol, locust bean gum, propylene glycol, xanthan gum, and colorings (FD&C Green #3, FD&C Yellow #6 depending on flavor)
Wrigley's Thin ice mountain rush Eclipse peppermint Eclipse spearmint Eclipse cinnamon	sodium alginate, maltodextrin, natural and artificial flavors, water, carrageenan, cellulose gel, glycerol, sucralose, hydroxylated soy lecithin, BHT, and colorings (blue 1 lake, red 40 lake, yellow 5 lake, depending on flavor)
Altoids Mint Cinnamon	hydroxypropyl methylcellulose, flavor, maltodextrin, corn starch modified, hydroxypropyl cellulose, triacetin, polysorbate 80, ethyl alcohol, sucralose, titanium dioxide, and potassium acesulfame (and red 40 in cinnamon)
Myntz Mynt Cinnamon	tapioca starch, sodium alginate, (peppermint oil or cinnamon flavor), glycerin, cellulose, carrageenan, glycerol and sucrose fatty acid esters, lecithin (soybean), acesulfame potassium, FD&C blue #1, (and red #3 and yellow #6 in cinnamon)
Nature's Gate – Zap Mint	sodium alginate, menthol, peppermint, spinach extract, tapioca starch, vegetable glycerin, purified water, stevia extract, sorbitan acid ester, ascorbic acid, green tea extract, and carrageenan
Nature's Gate – Zap Anise	sodium alginate, anise, tapioca starch, vegetable glycerin, purified water, stevia extract, sorbitan acid ester, ascorbic acid, green tea extract, and carrageenan

Materials and Methods

Twelve varieties of breath strips from five manufacturers were purchased from local retail stores. Table 1 contains the brands and flavors of the strips that were tested, along with the ingredients listed on the packaging.

BAC DataMaster

The BAC DataMaster is a stationary, infrared based, breath alcohol testing instrument (National Patent Analytical Systems, Mansfield, OH). The instrument monitors the alcohol concentration during the entire breath and will invalidate a sample that shows a drop in concentration during sample collection, which may indicate mouth alcohol. The instrument accepts a sample when the breath flow drops after more than 1.5 L of breath have been introduced. The DataMaster reports alcohol levels in grams of alcohol per 210 L of breath. Factory settings cause the instrument to report levels of less than 0.005 g/210 L as zero. The DataMaster determines the concentration of alcohol by the reduction in infrared energy at 3.44 microns. The drop in infrared light is due to the absorption by alcohol in the breath in the sample chamber. The DataMaster also measures the absorption at 3.37 microns. Other infrared absorbing substances, most notably acetone, will have differing ratios of absorption from ethanol at these two frequencies. The DataMaster is set to subtract up to 0.010 g/210 of acetone without reporting an interferant. More than 0.010 g/210 L of acetone is flagged as an interferant detected.

The calibration of the DataMaster was checked with each test using a known concentration alcohol/water solution in a Guth 34-NP external simulator at 34.0 \pm 0.2 degrees Celsius.

Alco-Sensor IV-XL

The Alco-Sensor IV-XL is a hand held, fuel cell based, breath alcohol testing instrument (Intoximeters, Saint Louis, MI). The fuel cell takes a discrete sample of the breath at the end of an exhalation, so no monitoring for signs of mouth alcohol is possible. The fuel cell is very specific to alcohols. While readings may be had from other alcohols such as methanol or isopropanol, the instrument does not

register readings from other substances in concentrations expected to be present in human breath or normal environments. The Alco-Sensor is equipped with a thermistor to measure breath volume and is programmed to accept a sample when breath flow decreases below a set rate after delivery of more than 1.5 L of breath. The Alco-Sensor reports breath alcohol concentrations in grams of alcohol per 210 L of breath. Factory settings cause the instrument to report alcohol concentrations less than 0.005 g/210 L as zero.

The accuracy of the Alco-Sensors was checked against a dry gas reference both before and after the breath strip tests.

Method

The authors were the subjects for the experiment. Neither subject had consumed alcohol in the last 48 h and both test 0.000 on both testing systems prior to starting the experiment. Each subject placed a breath strip on his or her tongue, waited 30 s, mouth closed, for the strip to dissolve, and then supplied a breath to the breath testing instrument. After an additional two minute wait, the subject supplied a second breath to the instrument. The subject then rinsed his or her mouth with water and proceeded to test the next breath strip. All strips were tested on an Alco-Sensor IV-XL and then the tests were repeated using a BAC DataMaster. Both authors conducted the tests, each using a separate instrument for each series of tests.

The breath strip tests were conducted using the Alco-Sensor IV's in a mode that collected an ambient air blank, followed by a subject sample, a two minute wait, and a second subject sample. Subjects used a new mouthpiece for each brand/flavor of strip tested. The DataMaster tests were conducted using a mode that ran an air blank, internal standard check, calibration check using a known concentration of an alcohol/water solution in an external simulator, an air blank, a pretest subject breath, an air blank, a subject test, an air blank and two minute wait, a second subject test, and a final air blank. As with the Alco-Sensor, a new mouthpiece was used for each brand/flavor of strip.

Results

None of the breath strips gave positive results on the fuel cell based Alco-Sensor instruments at either 30 s or 150 s after ingestion.

Several of the strips gave readings on the DataMaster 30 s after ingestion. Wrigley's Winterfresh Mountain Rush, Eclipse Spearmint, Peppermint, and Cinnamon, Listerine Cool Mint and Fresh Burst, Altoids Peppermint all gave results between 0.006 and 0.009 at 30 s after ingestion. Nature's Gate Mint gave a result of 0.010 at 30 s after ingestion. All results on the DataMaster returned to 0.000 after 150 s. One additional test was conducted using 10 of the Eclipse Cinnamon strips at once. The result at 30 s was 0.007, and at 150 s was 0.000. None of these readings triggered the mouth alcohol detector of the Datamaster.

Discussion

The lack of a response from the fuel cell instrument, coupled with the lack of ethanol in the ingredients of the majority of the strips, makes it apparent that the result on the infrared instrument is due to a substance other than ethanol.

The results of these tests indicate that while there may be a small amount of potential interference with the result of an infrared breath test, the interference from a single strip is quite small and short lived. Therefore, use of a single breath strip more than a few minutes prior to giving a breath sample would not be expected to alter the results. In addition, when properly conducted, a pre-test deprivation and observation period ensures that the subject does not eat, drink, or place anything in his or her mouth for at least 15 min prior to starting an evidential breath test.

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