Confectionary containing alcohol and their effect on breath analyzer results: a preliminary study

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SUMMARY
Breath analyzers are commonly used to test alcohol intoxication, most often to detect elevated systemic levels of ethanol by employees during working hours or drink-driving drivers. Many scientific studies describe the effect of inhaled ethanol vapors in the ambient air or the application of mouthwash before the breath test. This preliminary study interprets false positivity of the breath test after consumption over-the-counter confectionery.

Keywords: breath analyzer – alcohol – false positivity – breath-alcohol concentration

Cukrovinky obsahujúce alkohol a ich vplyv na výsledky dychových analyzátorov: predbežná štúdia

SÚHRN
Vodiči, či už pri dopravných nehodách alebo náhodných kontrolách, pri ktorých je detegovaná pozitivita alkoholu v dychu prostredníctvom alkoholového testera, často aplikujú ako výhovorku užitie ústnej vody, či jedla s obsahom alkoholu tesne pred absolvovaním dychovej skúšky. Vzhľadom na uvedené sa autori rozhodli vykonať experiment s cukrovinkami, ktoré obsahujú malé množstvo pridaného alkoholu. Materiálom štúdie bola zdanlivo neškodná cukrovinka (Margot, Orion®), ktorá je voľne dostupná aj pre deti. Vo svojom zložení obsahuje samotný alkohol, nie alkoholovú esenciu či arómu. Po overení nulovej koncentrácie v dychu, boli účastníci výskumu požiadaní o zjedenie malého množstva uvedenej sladkosti (4,5 g). Následne opakovane vykonali dychovú skúšku, kým nebol výsledok absolútne negatívny. Maximálna zaznamenaná hodnota tesne po zjedení bola 0,48 ‰ (muž, 47 rokov, 101 kg) a u žien 0,44 ‰ (16 rokov, 48 kg). Najdlhší interval pozitívnych výsledkov u účastníka bol 1,56 minúty. Dychové skúšky na prítomnosť etanolu v krvi však po 2 minútach vykazovali nulové hodnoty (0,00 g/kg, ‰). Vďaka výsledkom štúdie je možné s určitosťou povedať, že požitie aj malého množstva cukrovinky s obsahom alkoholu dokáže pozmeniť výsledky dychovej skúšky. Zároveň experiment poukazuje na nutnosť opakovania dychovej skúšky na elimináciu všetkých možností skreslenia výsledku.

Kľúčové slová: dychový analyzátor – alkohol – falošná pozitivita – koncentrácia alkoholu v dychu

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A variety of food and soft drinks were tested and found to contain low concentration of alcohol. The potential for these products to generate false positive results on an evidential breath-alcohol analyzers (1). It is well known that alcohol is retained in the mouth for a short period following consumption of alcohol-containing breath sprays, mouthwashes, or alcohol-fortified food (1,2). Other examples of potential confounders are E-cigarette smoking (as the liquid may contain ethanol), use of alcohol-based hand rubs, disinfectants, or cleaners and, oddly, alcohol spill in the car (3,4). Breath-alcohol tests given immediately following the use of these products can cause inaccurate results, and a 15-min alcohol deprivation period is there an appropriate part of any evidential breath-alcohol test (1,2,5). The kinetics of mouth-alcohol elimination can be affected by dental adhesives or even oral jewelry in a pierced tongue (1). In the case of positive breath test result, it is necessary to exclude all possibilities of a distorted result. Recently in expert activities, questions regarding if, how and especially how long, food (most often confectionery for children) can affect the results of alcohol-breath tests, appear more and more often. Previous experiments, developed by authors, described cases in which driver breath out alcohol vapor even after 13 minutes post washing the windscreen by alcohol-contained liquid (6). This fact led to attempt an experiment with over-the-counter confectionery, available also at petrol stations, to measure the alcohol concentration after consumption and their possibility to react with breath analyzers.

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MATERIAL AND METHODS

Material: There were selected only confections, that explicitly contains alcohol, and this added substance was listed on their packaging. One of these sweets (Margot, Orion®) even specified the type of alcohol directly, namely "Rum". Confections containing only alcoholic aromatic essences were excluded from the experiment. Selected sweets underwent laboratory analysis by gas chromatography, and alcohol content was detected in every piece of them.

Analysis of alcohol: In all cases, breath analyzer Dräger 7510 with valid calibration was used, and a total of 205 measurements were made.

Tab. 1. Maximal measured values.

Subject	Age	Sex (male/female)	g/kg, ‰
MH-1	71	M	0,19
MH-2	71	M	0,23
MH-3	71	M	0,31
MH-4	71	M	0,13
MH-5	71	M	0,24
MD-1	46	M	0,14
MD-2	46	M	0,13
MD-3	46	M	0,22
AD	15	F	0,17
VD	14	M	0,19
JD-1	47	F	0,34
JD-2	47	F	0,30
JK	47	M	**0,48**
JK	17	M	0,27
MK	41	F	0,21
AK	15	M	0,23
VK	13	M	0,27
FK	11	M	0,20
MK	8	F	0,28
ĽS-1	44	M	0,27
ĽS-2	44	M	0,23
JS-1	42	M	0,23
JS-2	42	M	0,17
MS-1	40	M	0,21
MS-2	40	M	0,23
MS	33	F	0,17
MS-1	5	M	0,13
MS-2	5	M	0,15
JJ-1	41	F	0,13
JJ-2	41	F	0,15
MM-1	34	F	0,19
MM-2	34	F	0,11
MK-1	38	M	0,15
MK-2	38	M	0,23
MM-1	35	M	0,19
MM-2	35	M	0,19
KH-1	33	F	0,17
KH-2	33	F	0,13
VH-1	10	F	0,17
VH-2	10	F	0,23
MS-1	33	F	0,17
MS-2	33	F	0,13
ĽD-1	46	M	0,19
ĽD-2	46	M	0,19
AB-1	36	M	0,15
AB-2	36	M	0,25
MK-1	30	M	0,29
MK-2	30	M	0,25
ĽJS-1	14	M	0,11
ĽJS-2	14	M	0,11
JOS-1	16	F	0,40
JOS-2	16	F	**0,44**
KOS-1	11	F	0,25
KOS-2	11	F	0,29
FŠ-1	55	M	0,11
FŠ-2	55	M	0,23
ĽS-1	57	M	0,19
ĽS-2	57	M	0,17
JB-1	27	M	0,21
JB-2	27	M	0,27
MP-1	28	F	0,25
MP-2	28	F	0,23
IK-1	26	F	0,19
IK-2	26	F	0,19
JK-1	69	M	0,17
JK-2	69	M	0,13
DB-1	43	F	0,06
DB-2	43	F	0,11

Subjects: The study involved 37 healthy subjects, 22 men and 15 women, with a mean age in range 5 – 71 years and their weight were between 19 kg (boy – 5 years) and 110 kg. All tested persons had a healthy oral cavity, their teeth were caries-free and well-repaired. No participant had dental prosthesis. A 24-hour abstinence from alcohol consumption before the day of the experiment was requested. Exposures were performed only after informed written and oral consent.

Method: After verification of zero concentration of alcohol in the breath, the subjects were asked to chew the experimental sweet carefully. The weight of eaten piece was 4,5 g. Immediately after ingestion, the first breath test was made. The breath analyzer was then reset, and further measurements were repeated up to a result of 0.00 ‰.

RESULTS AND DISCUSSION

The use of breath analyzers is based on a well-established, stable partitioning of ethanol between blood and exhalated air, with a blood:breath ratio of 2100, although the ratio varies somewhat time, with dose, within and between individuals and differs between countries. Each country has its own punishable blood-alcohol concentration and breath-alcohol concentration (3). The easiest way to detect the presence of alcohol in a person´s blood is to use a breath analyzer. While breath analyses are used for regulatory purposes, it is necessary that they correctly reflect the alcohol intake. The results of examination can be distorted by presence of mouthwash in oral cavity, inhalation of ethanol vapors, smoking E-cigarette, using of alcohol-based hand rubs, disinfectants, or cleaners (3). Previous studies of the authors dealt with similar topic, i. e. inhalation of ethanol vapors by vehicle drivers and their subsequent positive breath test results (6,7). This preliminary study builds on previous experiments that pointed to the fact that individuals can breathe out alcohol vapor even after 13 minutes after washing the windscreen by liquid containing alcohol. The highest breath alcohol value in these cases was confirmed 0,71 ‰, although after 2-3 breaths of fresh air the breathalyzer detected 0,00 ‰ (6). In case of inhalation of ethanol fumes with a higher concentration, number measured by alcohol breath analyzer are much higher (7). The application of alcohol containing mouthwash or breath spray can show false positivity even after 16 minutes after application (8).

The authors decided to conduct this experiment with regard to repeated methods of excuses regarding to the consumption of candies containing alcohol and positive results of alcohol breath tests. The alcohol concentration in confectionaries (Margot, Orion®) was set between 0,16% and 0,27% by GC method. After verification of zero concentration of alcohol in the breath, in the first part of the experiment, subjects were asked to chew the experimental sweet carefully. The weight of eaten piece was 4,5 g. Immediately after ingestion, the first breath test was made. The breath analyzer was then reset, and further measurements were repeated up to a result of 0.00 ‰. The second part of the experiment dealt with evaluation of each individual breath test and the recording of the highest value and the longest interval of the alcohol breath presence. The maximal detected value of alcohol was 0,48 ‰ (man, 47 years old, body weight 101 kg) (tab. 1). In the female group, the highest measured positivity was 0,44 ‰ (woman, 16 years old, body weight 48 kg) (tab. 1). The longest time interval of detected positivity was 1,56 min (woman, 42 years old, body weight 58 kg) (tab. 2). According to the experiment´s results, it is an indisputable fact that alcohol-contained sweets can distort

Tab. 2. Development of the longest decline in breath alcohol concentration (woman, 42 years old, body weight 58 kg).

Subject	Age	Sex	Weight (kg)	Time (min)	g/kg, ‰
JS	42	F	58	0,00	0,17
				0,29	0,15
				0,59	0,08
				1,25	0,06
				1,56	0,00

the breathalyzer´s results. In the set of measurements there was not a single case of a negative result of the first measurement. Considering the above results, it is necessary to think about this possibility during the police checks in road traffic. A repeated breath test is a reliable method that eliminates unnecessary discussion. To exclude the presence of alcohol in the blood, it is enough to perform the test after 2 minutes and the result is negative. If the result is not negative even after this period, the positivity of the breath test has a different reason that alcohol-contained candy ingestion.

The aim of this experiment is to supplement facts for the needs of the law enforcement authorities. Knowing them can be helpful as a guide on how to react in similar situations, in countries where a certain blood alcohol level is allowed and especially in countries with strict zero tolerance for alcohol behind the wheel.

CONCLUSION

Every alcohol breath test conducted by the police officer, or another authorized person should by performed consistently and according to applicable regulations. The positive result of the breath test must be repeatedly verified in order to exclude false positivity of the performed test. It is important to think about the possibility that alcohol in the exhaled air does not come from blood, but e. g. from the person´ oral cavity, or was inhaled from the surrounding environment just before the test (therefore breath tests should not be performed in the vehicle cabin). Vehicle drivers sometimes use eating sweets with alcohol flavor as an explanation for a positive breathalyzer test. This experiment confirms the necessity of a repeated breath test at least after 2 minutes. If the test is still positive, the ethanol is not exhaled from the oral cavity, but originates in the lungs and blood.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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