Turkish Journal of Medical Sciences

http://journals.tubitak.gov.tr/medical/

Research Article

Turk J Med Sci
(2014) 44: 720-727

doi:10.3906/sag-1308-24

Effects of some of the regional Turkish fermented foods and medications on respiratory alcohol levels

Cem UYSAL[1,*], Mustafa KARAPİRLİ[2], Mehmet Akif İNANICI[3]
[1]Department of Forensic Medicine, Faculty of Medicine, Dicle University, Diyarbakır, Turkey
[2]Council of Forensic Medicine, Ankara Group Authority, Ankara, Turkey
[3]Department of Forensic Medicine, Faculty of Medicine, Marmara University, İstanbul, Turkey

Received: 06.08.2013 • **Accepted:** 12.11.2013 • **Published Online:** 15.08.2014 • **Printed:** 12.09.2014

Background/aim: Alcohols are used in many areas like medicine and industry. They may be naturally found in some fruits and vegetables secondary to fermentation. According to the traffic law in Turkey, professional drivers are prohibited from driving while they are under the influence of alcohol; nonprofessional drivers are allowed to drive vehicles with a blood alcohol level of up to 50 mg/dL. The aim of this research is to determine whether or not consumed medicine or fermented, nonalcoholic beverages cause false positive results in breathalyzer tests.

Materials and methods: In this research, we used nonalcoholic fermented foods and 6 medicines. After the use of these materials, we measured breath alcohol level at 1, 3, 5, 15, and 30 min with a breathalyzer.

Results: False positive results were obtained only with Dişinol and cologne. Other drugs and nutrients did not cause any false positivity in breathalyzer tests.

Conclusion: At the end of the research, we observed that some substances caused false positive results, even if people did not use any alcohol. If there is any suspicion of the measured values, then measurements should be repeated. If a person cannot be sure of the reliability of the breathalyzer measurements, the person should consult other centers without losing time.

Key words: Ethanol, alcoholmeter, food, medicine

1. Introduction

Alcohols are used in many areas, such as medicine and industry. They may be naturally found in some fruits and vegetables secondary to fermentation (1–3). Ethyl alcohol, a widely seen type of alcohol, can easily spread to the tissues of the human body because of its small size and water solubility (4). Alcohol causes many effects for the body (5).

After its intake, ethanol is directly absorbed by stomach and intestines and reaches the brain within minutes (6,7). The volume of ethanol's distribution in the body is related to its distribution coefficient and blood concentration (8). Ethanol is metabolized at an average hourly rate of 12–20 mg/dL (1,4). The majority of alcohol is metabolized in the liver in 3 ways (9).

Usually laws impose certain restrictions on driving in traffic under the effects of alcohol (1). According to the traffic laws in Turkey, professional drivers are prohibited from driving when they are under the influence of alcohol, while nonprofessional drivers are allowed to drive vehicles at blood alcohol levels of up to 50 mg/dL (10–12).

Some previous studies have shown that the use of certain nonalcoholic beverages or medications may cause positive breath alcohol results in individuals who had not consumed any alcohol in reality (2,13–15).

The aim of this study was to determine whether certain traditional fermented foods and frequently used medications in Turkey could contribute to false positive breath alcohol results and whether these foods and medications could affect the measurements performed with a breathalyzer. The foodstuffs and medications used in our study are readily available in markets and pharmacies.

2. Materials and methods

A total of 33 subjects, including 16 men and 17 women, were selected for this study. Subjects were selected among individuals without any diseases or alcohol intake within the previous 24 h.

* Correspondence: cem.uysal@dicle.edu.tr

By taking into account the fact that certain medications and cosmetic products may affect breath alcohol levels, medications with alcohol (at levels used for treatment) and some cosmetics, including cologne, were included in this study, along with various foodstuffs.

Before the beginning of the study, the subjects were first asked whether they had used any alcohol in the past few days. The subjects were then provided with 100 mL of water to rinse their mouths, and a starting point (or zero point) for the study was thus set. All subjects were, successively, given a glass (approximately 200 mL) of şalgam (fermented turnip juice), boza (a slightly fermented millet drink), kefir (a fermented milk drink), soda, yogurt, and orange juice to drink, and also a pickled cucumber to eat. They were also asked to rinse their mouths with 50 mL of vinegar for 15 s.

Among the medications and cosmetic products used in this study, Basiscreme, cologne, and zinc oxide cream were applied around the lips; Strepsils cough drops and Dişinol (a solution for relieving toothaches that contains phenol and ethyl alcohol) were administered orally; and Siccaprotect was administered in single drops. Cologne (the cosmetic product) was administered by pouring 5 mL on the palms of the hands, while Dişinol was administered by using 1 mL drops on cotton balls. Three-hour intervals were allowed between 2 substances being administered in succession. Measurements were performed at 0, 1, 3, 5, 15, and 30 min following ingestion or administration.

As law-enforcement officers in Turkey mainly use Lion brand breathalyzers, the SD-400P model Lion breathalyzer was used for this study. The Lion SD-400P model breathalyzers were purchased by the Marmara University Scientific Research Committee, which also financed this study. Ethics committee approval for this study was given by the ethics committee of the same university.

The analysis of the substances used in this study, such as yogurt, boza, kefir, orange juice, vinegar, pickled cucumbers, and soda, was performed by the Department of Science Forensic Toxicology Laboratory of the İstanbul University Institute of Forensic Science. The results of the measurements are provided in Figure 1.

The alcohol content of the medications and cologne was determined from their package inserts. Parametric tests were used for individuals whose test results displayed normal distribution, while nonparametric tests were used for individuals whose tests results did not display normal distribution. SPSS 11 was used for statistical analyses.

3. Results

A total of 33 subjects, including 16 men (48.5%) and 17 women (51.5%), participated in this study. Data regarding the average age of the 33 subjects participating in this study are shown according to sex in Table 1.

A total of 14 different substances were used in this study, which included 8 foodstuffs, 5 medications, and a cosmetic product. Among the substances that were used, no alcohol was identified in the breath alcohol measurements performed at 1, 3, 5, 15, and 30 min with the following foodstuffs: boza, kefir, yogurt, şalgam, soda, pickled cucumber, orange juice, and vinegar. Similarly, no alcohol was identified in the measurements performed with the following medications: Strepsils pastilles, Basiscreme, zinc oxide cream, and Siccaprotect.

Alcohol was identified in the breath alcohol measurements performed on individuals administered cologne and Dişinol. These measurements are shown in Table 2.

The breath alcohol levels measured in 33 subjects at 1, 3, and 5 min during the tests performed with cologne and Dişinol are shown according to sex in Tables 3 and 4.

The change in breath alcohol levels over time for cologne and Dişinol (which gave positive breath alcohol results during measurements) is shown in Figure 2a.

The change in positive breath alcohol results obtained during measurements performed with cologne and Dişinol are shown below according to sex in Figures 2b and 2c.

3.1. Statistical analyses

For the breath alcohol level values measured at 1, 3, and 5 min with cologne and Dişinol, testing for adherence to normal distribution was performed using the 1-sample Kolmogorov–Smirnov Test. As the values measured at 1 min displayed normal distribution, the t-test was used as a parametric test; as the values measured at 3 and 5 min did not display normal distribution, the Mann–Whitney U test was used as a nonparametric test.

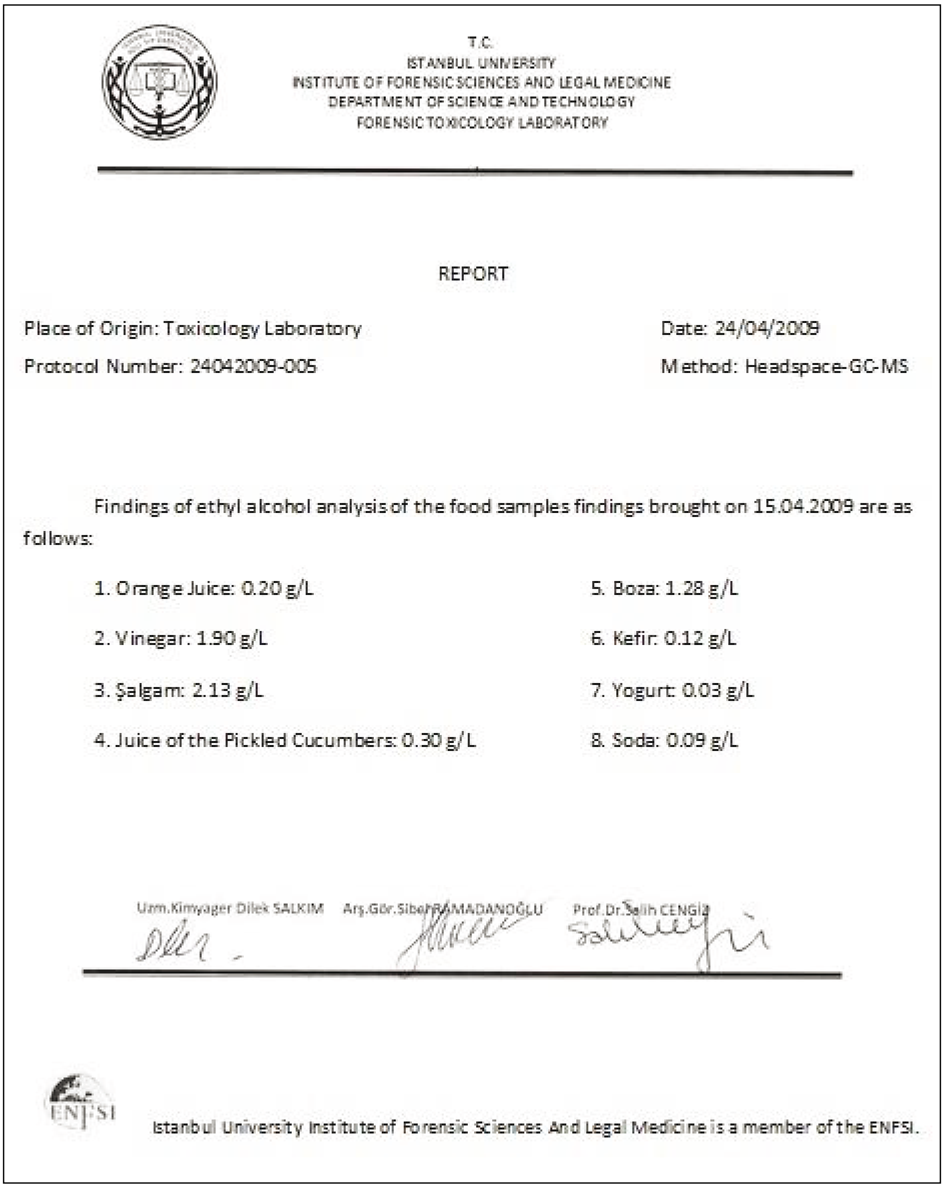
Measurements performed at 1 min revealed results that were statistically significant in favor of cologne ($P = 0.000$). No statistically significant difference was identified between the values measured for cologne and Dişinol at 3 min ($P = 0.301$). When the values measured at 5 min were evaluated, a statistically significant difference was identified in favor of Dişinol ($P = 0.012$). An evaluation of whether there were any differences in the measurements for Dişinol and cologne with regards to sex revealed the following observations.

3.1.1. For men

The test results revealed a statistically significant difference in favor of cologne at 1 min ($P = 0.000$; odds ratio 95% CI = 0.19668–0.45832), no statistically significant difference between cologne and Dişinol at 3 min ($P = 0.141$; odds ratio 95% CI= –0.07347 to 0.01097), and a statistically significant difference in favor of Dişinol at 5 min ($P = 0.021$; odds ratio 95% CI = –0.03791 to –0.00334).

3.1.2. For women

The test results revealed a statistically significant difference in favor of cologne at 1 min ($P = 0.000$; odds ratio 95% CI


T.C.
İSTANBUL UNIVERSITY
INSTITUTE OF FORENSIC SCIENCES AND LEGAL MEDICINE
DEPARTMENT OF SCIENCE AND TECHNOLOGY
FORENSIC TOXICOLOGY LABORATORY

REPORT

Place of Origin: Toxicology Laboratory — Date: 24/04/2009

Protocol Number: 24042009-005 — Method: Headspace-GC-MS

Findings of ethyl alcohol analysis of the food samples findings brought on 15.04.2009 are as follows:

1. Orange Juice: 0.20 g/L
2. Vinegar: 1.90 g/L
3. Şalgam: 2.13 g/L
4. Juice of the Pickled Cucumbers: 0.30 g/L
5. Boza: 1.28 g/L
6. Kefir: 0.12 g/L
7. Yogurt: 0.03 g/L
8. Soda: 0.09 g/L

Uzm.Kimyager Dilek SALKIM — Arş.Gör.Sibel RAMADANOĞLU — Prof.Dr.Salih CENGİZ

İstanbul University Institute of Forensic Sciences And Legal Medicine is a member of the ENFSI.

Figure 1. English translation of the document listing the alcohol content of certain substances used in this study.

= 0.22252–0.52571), no statistically significant difference between cologne and Dişinol at 3 min (P = 0.672; odds ratio 95% CI = –0.03101 to 0.04748), and no statistically significant difference between cologne and Dişinol at 5 min (P = 0.275).

4. Discussion

Alcohol is a substance that begins to affect the coordination and judgment of the user shortly after its intake, secondary to its effects on nervous system. Although alcohol's effects on other organs and systems are significant, its effects on the nervous system are particularly important due to the associated increase in the risk for traffic accidents (1,16,17).

Alcohol may be added as an additive during the bottling of some beverages to increase their fluidity (18). Additionally, fermentation may also increase the alcohol content of foods (19). There are many studies in the literature that have described the alcohol content of foodstuffs (2,13,14). According to the results of tests performed by the Scientific and Technological Research Council of Turkey (TÜBİTAK) Marmara Research Center in Gebze upon the request of the Consumers' Union in Turkey, alcohol was identified in certain foodstuffs (20). Moreover, certain medications may also contain alcohol

Table 1. The mean age of the participants according to sex.

Sex	Minimum age	Maximum age	Mean age	Standard deviation
Male	24	60	38.94	12.79
Female	22	60	39.00	11.69
Total	22	60	38.97	12.04

Table 2. The tests results for the cologne and Dişinol.

			Dişinol*						Cologne*					
Numbered participants	Age	Sex	0 min	1 min	3 min	5 min	15 min	30 min	0 min	1 min	3 min	5 min	15 min	30 min
P - 1	60	Male	0	0.3	0.12	0.05	0	0	0	0.91	0	0	0	0
P - 2	22	Female	0	0.1	0	0	0	0	0	0.3	0.09	0	0	0
P - 3	49	Male	0	0.05	0	0	0	0	0	0.49	0	0	0	0
P - 4	32	Male	0	0.1	0.03	0	0	0	0	0.54	0.11	0	0	0
P - 5	35	Male	0	0.22	0	0	0	0	0	0.24	0	0	0	0
P - 6	50	Female	0	0.1	0.09	0.06	0	0	0	0.62	0	0	0	0
P - 7	39	Female	0	0.37	0	0	0	0	0	0.19	0	0	0	0
P - 8	48	Female	0	0.06	0	0	0	0	0	0.34	0.12	0	0	0
P - 9	53	Female	0	0.11	0.1	0	0	0	0	0.3	0	0	0	0
P - 10	41	Female	0	0.2	0.13	0.07	0	0	0	0.76	0.18	0.04	0	0
P - 11	24	Male	0	0.19	0	0	0	0	0	0.89	0.05	0	0	0
P - 12	60	Male	0	0.24	0.1	0.04	0	0	0	0.34	0	0	0	0
P - 13	33	Female	0	0.08	0.05	0	0	0	0	0.26	0	0	0	0
P - 14	27	Female	0	0.12	0	0	0	0	0	0.38	0	0	0	0
P - 15	55	Male	0	0.08	0.05	0	0	0	0	0.42	0.09	0	0	0
P - 16	35	Male	0	0.21	0.13	0.06	0	0	0	0.43	0	0	0	0
P - 17	37	Female	0	0.09	0	0	0	0	0	0.22	0	0	0	0
P - 18	29	Female	0	0.08	0.07	0.05	0	0	0	0.32	0.13	0.07	0	0
P - 19	27	Female	0	0.09	0.09	0.08	0	0	0	0.34	0.12	0.04	0	0
P - 20	30	Female	0	0.13	0.06	0	0	0	0	0.21	0	0	0	0
P - 21	24	Female	0	0.12	0.06	0	0	0	0	1.04	0.05	0	0	0
P - 22	41	Female	0	0.09	0	0	0	0	0	0.43	0	0	0	0
P - 23	60	Female	0	0.06	0.06	0.06	0	0	0	1.09	0	0	0	0
P - 24	49	Male	0	0.16	0.12	0.05	0	0	0	0.45	0.13	0	0	0
P - 25	43	Male	0	0.22	0.13	0.04	0	0	0	0.35	0	0	0	0
P - 26	27	Male	0	0.26	0.17	0.05	0	0	0	0.56	0.18	0.08	0	0
P - 27	27	Male	0	0.08	0.03	0	0	0	0	0.34	0	0	0	0
P - 28	46	Male	0	0.18	0.13	0	0	0	0	0.38	0.06	0	0	0
P - 29	55	Female	0	0.05	0	0	0	0	0	0.94	0.1	0	0	0
P - 30	26	Male	0	0.18	0.11	0.05	0	0	0	0.23	0	0	0	0
P - 31	31	Male	0	0.16	0	0	0	0	0	0.34	0.08	0	0	0
P - 32	47	Female	0	0.11	0.09	0.09	0	0	0	0.58	0.15	0.04	0	0
P - 33	24	Male	0	0.1	0.08	0.07	0	0	0	1.06	0	0	0	0

*: The measurements are in g/L.

Table 3. Changes of cologne's effects on the breath alcohol level according to sex and time.

	Sex	Minimum alcohol*	Maximum alcohol *	Mean*	Standard deviation*
1 min	Male	0.23	1.06	0.4981	0.2459
	Female	0.19	1.09	0.4894	0.2978
3 min	Male	0.00	0.18	0.0438	0.0585
	Female	0.00	0.18	0.0553	0.0658
5 min	Male	0.00	0.08	0.0050	0.0200
	Female	0.00	0.07	0.0112	0.0218

*: The measurements are in g/L.

Table 4. Changes of Dişinol effects on the breath alcohol level according to sex and time.

	Sex	Minimum alcohol*	Maximum alcohol*	Mean*	Standard deviation*
1 min	Male	0.05	0.30	0.1706	0.0719
	Female	0.05	0.37	0.1153	0.0740
3 min	Male	0.00	0.17	0.0750	0.0584
	Female	0.00	0.13	0.0471	0.0445
5 min	Male	0.00	0.07	0.0256	0.0273
	Female	0.00	0.09	0.0241	0.0346

*: The measurements are in g/L.

(21–23). The human body naturally produces trace amounts of endogenous alcohol, as well (24,25). The alcohol content of the foodstuffs used during our study was determined with samplings performed by the İstanbul University Institute of Forensics (Figure 1).

In their study, Lindinger et al. evaluated the breath of subjects for methanol following their consumption of apples. They found methyl alcohol in the proton-transfer reaction mass spectrometry measurements of the subjects' blood and breath (26). None of the subjects in our study were asked to consume any fruits; however, the subjects were given fruit juices to drink. Orange juice was selected within the context of our study, since it is a juice that people generally prefer to drink in the morning when they are hungry or thirsty. However, no positive breath alcohol results were obtained following the intake of orange juice.

Komagata et al. performed some tests to determine whether breath alcohol levels could be measured following the administration of some certain chemotherapeutics in cancer patients who are free of alcohol. Among them, a breath alcohol level of 15 mg/dL or above was identified in 8 patients (21). Of the 2 products that led to positive breath alcohol results in our study, cologne was applied to the area around the mouth, while Dişinol was administered intraorally. Due to the intravenous administration of cancer drugs in Komagata et al.'s study, positive breath alcohol results were obtained for a longer period of time than in comparison to our study. During the application of cologne in our study, positive breath alcohol results were identified in only 5 subjects at 5 min, while positive breath alcohol results with Dişinol were observed in 14 subjects at 5 min.

In Logan and Distefano's study, subjects were given various soft drinks and certain brands of bread with the crusts removed. Subjects were also asked to keep these foodstuffs in their mouths for 20 s. At the end of the study, false positive breath alcohol results were identified by the breathalyzer following the application and intake of these foodstuffs (14). In our study, subjects were not asked to keep the foods and beverages in their mouths. This is because the soft drinks selected for our study are, in general, rapidly swallowed rather than being kept in the mouth for a certain time. However, in our study, it was ensured that Dişinol was kept in the mouth for a certain period of time, since this medication is normally administered intraorally. No positive breath alcohol results were obtained following the intake of the foodstuffs used in our study. With Dişinol, efforts were made to follow

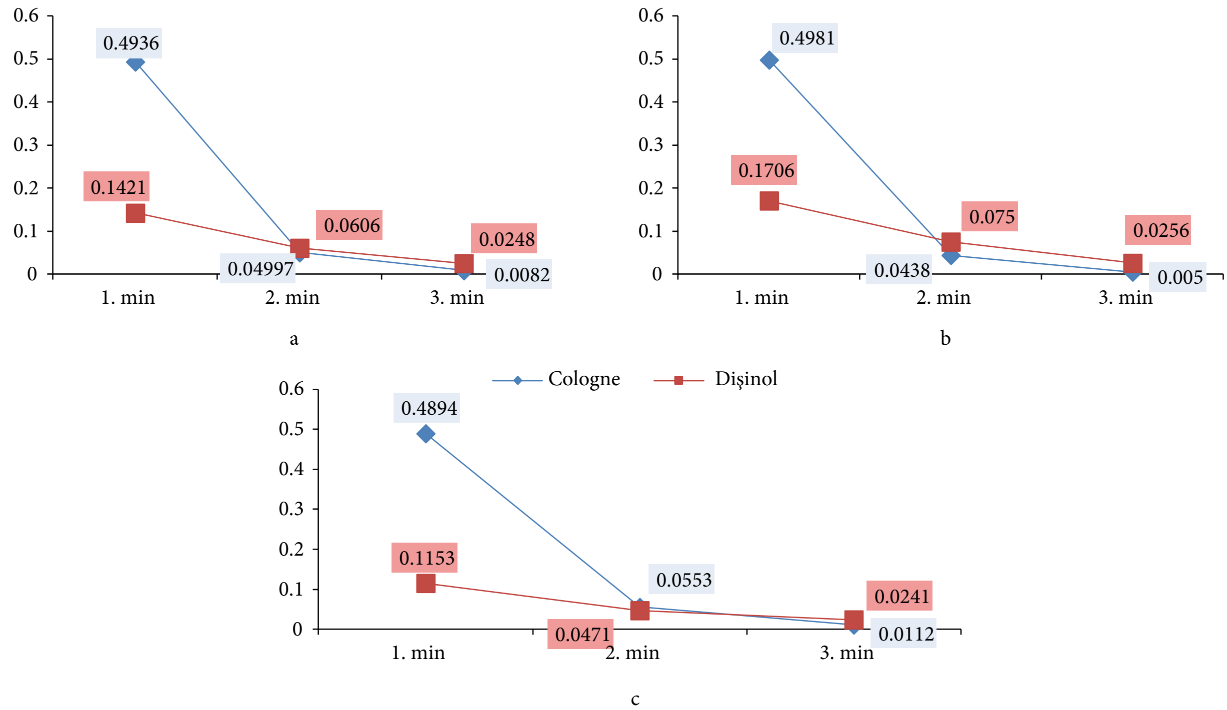


Figure 2. a) Change in breath alcohol levels with administered cologne and Dişinol over time; b) change in positive breath alcohol results among men given cologne and Dişinol; c) change in positive breath alcohol results among women given cologne and Dişinol.

the same method of application as is normally prescribed. Furthermore, among the public, cotton swabs with Dişinol are generally applied intraorally for longer periods than was the case in our study.

In another study, the effects of the alcohol content of commercially available energy drinks in the United States on the subjects' breath alcohol levels were investigated. Positive breath alcohol results were identified among some of the subjects participating in that study, and measurements were repeated following a waiting period of 15 min (2). Within the context of our study, fermented local foodstuffs that are frequently consumed in Turkey were preferred, and no energy drinks were provided to our subjects. However, similar to the energy drinks, the carbonated drinks that we included in our study are also beverages to which trace amounts of alcohol are added in order to increase fluidity during the filling processes. According to the TÜBİTAK study (20), the carbonated drink that we used in our study has the highest alcohol content in comparison to the other carbonated drinks. However, no positive breath alcohol results were obtained following the intake of this carbonated drink.

In contrast to the rapid rise followed by the rapid drop in the positive breath alcohol results obtained during the tests performed with cologne, a slower decrease in positive breath alcohol results was observed during the tests with Dişinol. However, with both Dişinol and cologne administration, a breath alcohol measurement of zero was identified in all subjects following 15 min.

Cologne is a substance that is very commonly used within the Turkish society. Most people keep bottles of cologne in their houses, cars, and work places. For this reason, it is a common practice for people to smell cologne after applying it to their hands. A practice we have noted during the use of cologne in our study, which we had previously not foreseen, was that some of our subjects took a deep breath after applying cologne to their hands and face. This practice led temporarily to measured breath alcohol values of more than 1 ppm. Although positive breath alcohol results were obtained in our study, especially during the application of cologne and Dişinol, these positive results were transient and disappeared after a certain period of time.

The foodstuffs, medications, and cosmetic products used in our study were administered one by one; the combined use and administration of multiple products was not performed for ethical reasons. However, considering the actual practices of professional drivers, such as truck drivers, the combined use of these substances might be possible in certain contexts. For this reason, it was not possible to identify whether these substances had any synergistic effects on one another. Most importantly, it is not known how the use of cologne might affect positive breath alcohol results in individuals who previously consumed small quantities of alcohol. The same is applicable for Dişinol, the second substance we used in our study.

According to the 2008 report of the Turkish Court of Accounts entitled "Accident Prevention Activities" (26), the fact that the devices used in alcohol breath tests are old, are frequently used, and often have calibration problems leads to frequent objections regarding measurements. This report highlighted the importance of the quality of breathalyzers, especially when their frequent use is in question.

In conclusion, the most important result of our study was the observation that positive breath alcohol results were obtained following the application of certain medications (Dişinol and cologne). Another important result was the observation that the other foodstuffs and medications did not contribute to positive breath alcohol results.

It is known that the use of certain medications can lead to measurable breath alcohol levels. Based on our study's results, it is possible to state that alcohol derivatives can enter the body not only through consumption of alcoholic drinks but also through the intake of certain medications and foodstuffs (although we obtained negative breath alcohol results for the foodstuffs used in our study, positive results are seen in the literature). For this reason, individuals who are careful not to consume more than the 50 mg/dL limit when using alcohol might nevertheless be identified as having exceeded the legal limit during controls. Hence, in order to decrease and prevent traffic accidents in Turkey, it is necessary to either reconsider the alcohol content and level of medications or to decrease the permissible blood alcohol levels to less than 50 mg/dL. Based on our study's results and the literature, in the event that a positive breath alcohol result is obtained from a professional driver, a 15-min interval should be allowed before a retest. The driver should also be asked to rinse his/her mouth with a glass of water before the next measurement.

The calibration of breathalyzers should be performed regularly. Cases and measurements that are considered suspicious despite a positive breath alcohol result from a retest performed after 15 min should be transferred immediately to a police station for blood or urine sample tests (27). The data of our study are consistent with the literature (2,14). A general review of the literature also reveals results and observations that support our study (15,21,28,29).

We think that our study will be of assistance in responding to the cases presented to the Fifth Specialized Board of the Institution of Forensic Medicine. However, even if this study does assist in responding to the cases addressed to the Board, we also think that it will not, of its own, serve to fully resolve these cases. We nevertheless think that this important study will serve as a guide for future studies in this area.

Acknowledgment
This project was supported by the Marmara University Scientific Research Projects Unit.

References

1. Baban N, Baban A, Kurt K. Forensic Toxicology. 1st ed. İstanbul, Turkey: The Council of Forensic Medicine Publications; 2003.
2. Lutmer B, Zurfluh C, Long C. Potential effect of alcohol content in energy drinks on breath alcohol testing. J Anal Toxicol 2009; 33: 167–169.
3. Koç S. Alcohol and drug abuse problems associated with forensic medicine. In: Soysal Z, Çakalır C, editors. Forensic Medicine. 1st ed. İstanbul: İstanbul University Medical Faculty Publications; 1999. pp. 1345–1377.
4. Saukko P, Knight B. Forensic aspects of alcohol. In: Saukko P, Knight B, editors. Forensic Pathology. 3rd ed. London, UK: Arnold Publishers; 2004. pp. 552–558.
5. Demircan A, Keleş A, Gürbüz N, Bildik F, Aygencel ŞG, Doğan NÖ, Derinöz O, Akar T. Forensic emergency medicine – six-year experience of 13823 cases in a university emergency department. Turk J Med Sci 2008; 38: 567–575.
6. Hancı İH. Alkol ve Trafik Kazaları. Available at http://www.trafik.gov.tr/SiteAssets/Yayinlar/Bildiriler/word/Prof_Dr_I_Hamit_Hanci.doc. Accessed 4 March 2012 (in Turkish).
7. Polat O, İnanıcı MA, Aksoy ME. Forensic Medicine Lesson Book. 1st ed. İstanbul, Turkey: Nobel Medicine Press; 1997.
8. Fenton JJ. Forensic toxicology. In: Stuart HJ, Jon JN, editors. Forensic Science: An Introduction to Scientific and Investigative Techniques. 2nd ed. Boca Raton, FL, USA: CRC Press; 2003. pp. 51–52.
9. Öztürk F, Vardı N, Cengiz N, Eşfreoğlu M, Otlu A. Microscopy of rat thoracic aorta in chronic ethanol intake. Turk J Med Sci 2002; 32: 117–120.
10. Öztürel A. Adli Vakalarda Alkol Tayini. Available at http://auhf.ankara.edu.tr/dergiler/auhfd-arsiv/AUHF-1973-30-01-04/AUHF-1973-30-01-04-Ozturel2.pdf. Accessed 4 March 2012 (in Turkish).
11. Aşıcıoğlu F, Yapar B, Tütüncüler A, Belce A. Alcohol as the cause of the crime of endangering traffic safety. Adlı Tıp Derg 23; 3: 8–16 (in Turkish with English abstract).
12. WHO. Global Status Report: Alcohol Policy Report, Department of Mental Health and Substance Abuse. Geneva, Switzerland: WHO; 2004. Available at http://www.who.int/substance_abuse/publications/en/Alcohol%20Policy%20Report.pdf. Accessed 15 December 2012.
13. Logan BK, Distefano S, Case GA. Evaluation of the effect of asthma inhalers and nasal decongestant sprays on a breath alcohol test. J Forensic Sci 1998; 43: 197–199.

14. Logan BK, Distefano S. Ethanol content of various foods and soft drinks and their potential for interference with a breath-alcohol test. J Anal Toxicol 1998; 22: 181–183.

15. Gullberg RG. The elimination rate of mouth alcohol: mathematical modeling and implications in breath alcohol analysis. J Forensic Sci 1992; 37: 1363–1372.

16. Lieber CS. Metabolism of alcohol. Clin Liver Dis 2005; 9: 1–35.

17. Paton A. Alcohol in the body. BMJ 2005; 330: 85–87.

18. Goldberger BA, Cone EJ, Kadehjian L. Unsuspected ethanol ingestion through soft drinks and flavored beverages. J Anal Toxicol 1996; 20: 332–333.

19. Şahin İ, Kılıç O. Food Technology. 1st ed. Eskişehir, Turkey: Anadolu University Open Education Faculty Publications; 2008.

20. Consumers Union. Carbonated Drinks and Alcohol. Available at http://www.tuketiciler.org/files/tubitak1.jpg, http://www.tuketiciler.org/files/tubitak3.jpg. Accessed 10 December 2009 (in Turkish).

21. Komagata H, Yoneda S, Sakai H. Breath alcohol concentrations in Japanese outpatients following paclitaxel and docetaxel infusion. Int J Clin Pharmacol Res 2005; 25: 195–202.

22. Wilson DB, Beck TM, Gundlach CA. Paclitaxel formulation as a cause of ethanol intoxication. Ann Pharmacother 1997; 31: 873–875.

23. Webster LK, Crinis NA, Morton CG. Plasma alcohol concentrations in patients following paclitaxel infusion. Cancer Chemother Pharmacol 1996; 37: 499–501.

24. Gatt JA, Matthewman P. Autobrewing: fact or fantasy? Sci Justice. 2000; 40: 211–215.

25. Phillips M, Greenberg J, Martinez V. Endogenous breath ethanol concentrations in abstinent alcohol abusers and normals. Alcohol 1988; 5: 263–265.

26. The Court of Account General Assembly. Turkish Republic Court of Account Performance Audit Report: Traffic Accident Prevention Activities. 1st ed. Ankara, Turkey: Court of Account Publications; 2008.

27. Uysal C. Factors affecting alcohol level in the respiratory air. MD, Marmara University Medical Faculty Department of Forensic Sciences, Istanbul, Turkey, 2009.

28. Lindinger W, Taucher J, Jordan A. Endogenous production of methanol after the consumption of fruit. Alcohol Clin Exp Res 1997; 21: 939–943.

29. Pavlic M, Grubwieser P, Libiseller K. Elimination rates of breath alcohol. Forensic Sci Int 2007; 171: 16–21.