

## Halal Food and Metrology: Ethyl Alcohol Contents of Beverages

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**Abstract:** In this study, ethyl alcohol contents of different kinds of beverages, vinegars, vegetables and fruits collected from Turkish markets were investigated using HS-GC-FID method. While the ethanol contents of fruits, vinegars and beverages were found to vary between  $0.32 \times 10^{-4}$ -0.35% (w/w), apple vinegar and concentrated orange syrup were determined to contain as high as 0.44 and 0.68 % (w/w) ethanol, respectively. The grape juice (called as “şıra” in Turkish), acquired from a restaurant in Istanbul, consisted of 2.11% ethanol, and its level reached to 5.60 % in 10 days. As these findings are very critical for Muslim consumers and for the Halal Community, there is an urgent need to survey these kinds of products in the market.

**Keywords:** Metrology, halal food, alcohol contents, beverages.

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### 1. Sample Source

In continuation of our work on halal food [1], 41 different kinds of beverages, vinegars, vegetables and fruit samples were obtained from local markets in Istanbul.

### 2. Previous Studies

In our previous study, the amount of ethanol in fruits, non alcoholic beverages, commercial alcoholic drinks and the origin of meat products were evaluated [1].

### 3. Present study

All the samples, collected from the local market, were analyzed as reported below [1]. “Standard ethanol solutions of 1, 10, 50, 100, 500, 1000, 5000, 10000 ppm were prepared in distilled water. *n*-propanol was used as an internal standard (IS). 1.9 mL of sample was injected with 100  $\mu$ L of internal standard (*n*-propanol) into a 5 mL headspace vial and the vial was placed in the headspace sample tray for headspace GC-FID measurements. Malt drink, energy drink, grape juice, şıra, grape vinegar, apple vinegar, orange juice, compote, pomegranate sauce, sour cherry juice, ice tea (peach), lemon souce, kephir, cabbage, salgam, boza and cranberry juice, and pineapple, pear, orange, lemon and apple fruits were collected from markets and analyzed. Boza was diluted with distilled water to decrease the viscosity of the samples. Experiments were performed using Thermo Scientific Trace GC ULTRA gas chromatography FID system, having HS 2000 headspace auto sampler. The analysis program and conditions were determined to be as follows: 2 ml of sample volume, 10 min of incubation time, 100 °C of the vial oven temperature for each analysis and 100 °C of transfer line and needle temperatures. A VF wax column (60 m x 0.25 mm,  $\phi$  with 0.25  $\mu$ m film thickness) was used with

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<sup>Ψ</sup> A part of this study was presented in the 2. International Halal and Healthy Food Congress - 2013

**Table 1.** Ethanol content of beverages and fruits.

No	Name	Ethanol % (w/w)	U <sub>95</sub> (k=2)
1	Malt drink	0.21 x 10 <sup>-3</sup>	0.36 x 10 <sup>-5</sup>
2	Malt drink-1 (peach)	0.04	0.68 x 10 <sup>-3</sup>
3	Malt drink-2 (pineapple)	0.32 x 10 <sup>-4</sup>	0.54 x 10 <sup>-6</sup>
4	Energy drink-1	0.72 x 10 <sup>-2</sup>	1.24 x 10 <sup>-4</sup>
5	Energy drink-2	0.38 x 10 <sup>-3</sup>	0.65 x 10 <sup>-5</sup>
6	Grape juice-1	0.94 x 10 <sup>-3</sup>	0.16 x 10 <sup>-4</sup>
7	Grape juice-2	0.84 x 10 <sup>-2</sup>	1.43 x 10 <sup>-4</sup>
8	Şıra-1	0.29 x 10 <sup>-3</sup>	0.49 x 10 <sup>-5</sup>
9	Şıra-2 (1 <sup>st</sup> day)	2.11	0.36 x 10 <sup>-1</sup>
10	Şıra-2 (10 <sup>th</sup> day)	5.60	0.96 x 10 <sup>-1</sup>
11	Şıra-3	0.39 x 10 <sup>-2</sup>	0,66 x 10 <sup>-4</sup>
12	Şıra-4	0.32 x 10 <sup>-3</sup>	0,55 x 10 <sup>-5</sup>
13	Grape vinegar	0.38 x 10 <sup>-2</sup>	0.65 x 10 <sup>-4</sup>
14	Apple vinegar-1	0.44	0.75 x 10 <sup>-2</sup>
15	Apple vinegar-2 (Homemade)	1.45 x 10 <sup>-2</sup>	0.25 x 10 <sup>-3</sup>
16	Apple juice	0.02	0.31 x 10 <sup>-3</sup>
17	Orange juice	0.42 x 10 <sup>-3</sup>	0.71 x 10 <sup>-5</sup>
18	Orange syrup (concentrated)	0.68	0.12 x 10 <sup>-1</sup>
19	Compote	0.33x 10 <sup>-2</sup>	0.56 x 10 <sup>-4</sup>
20	Peach nectar-1	0.10 x 10 <sup>-2</sup>	0.17 x 10 <sup>-4</sup>
21	Peach nectar-2	0.23	0.39 x 10 <sup>-2</sup>
22	Pomegranate sauce	0.13 x 10 <sup>-2</sup>	0.22 x 10 <sup>-4</sup>
23	Sourcherry juice-1	0.60 x 10 <sup>-2</sup>	1.02 x 10 <sup>-2</sup>
24	Sourcherry juice-2	0.81 x 10 <sup>-2</sup>	1.39 x 10 <sup>-4</sup>
25	Ice tea (peach)	0.08	0.13 x 10 <sup>-2</sup>
26	Lemon souce	0.62 x 10 <sup>-2</sup>	1.07 x 10 <sup>-4</sup>
27	Kephir-4	0.34 x 10 <sup>-2</sup>	0.58 x 10 <sup>-4</sup>
28	Kephir-5	0.44 x 10 <sup>-2</sup>	0.76 x 10 <sup>-4</sup>
29	Kephir-6	0.35	0.60 x 10 <sup>-2</sup>
30	Cabbage	0.09	0.14 x 10 <sup>-2</sup>
31	Salgam-1	0.17	0.28 x 10 <sup>-2</sup>
32	Salgam-2	0.18	0.29 x 10 <sup>-2</sup>
33	Salgam-3	0.25	0.42 x 10 <sup>-2</sup>
34	Boza	1.74 x 10 <sup>-2</sup>	0.29 x 10 <sup>-3</sup>
35	Cranberry juice	0.19 x10 <sup>-1</sup>	0.33 x 10 <sup>-3</sup>
36	Pineapple 1 <sup>st</sup> day	0.48 x 10 <sup>-2</sup>	0.82 x 10 <sup>-4</sup>
37	Pineapple-10 <sup>th</sup> day	0.99	0.17 x 10 <sup>-1</sup>
38	Pear (fresh)	0.19 x 10 <sup>-1</sup>	0.33 x 10 <sup>-3</sup>
39	Orange (fresh)	0.21 x 10 <sup>-1</sup>	0.36 x 10 <sup>-3</sup>
40	Lemon (fresh)	0.82 x 10 <sup>-2</sup>	0.14 x 10 <sup>-3</sup>
41	Apple (fresh)	0.76 x 10 <sup>-3</sup>	0.13 x 10 <sup>-4</sup>

hydrogen gas at 1 mL/min (20 psi) flow rate. The GC oven temperature was kept at 50 °C for 2 min and programmed to 240 °C at an increase rate of 20 °C/min and kept constant again at 240 °C for 2 min. The split ratio was adjusted to 1:20 and the injection volume was 0.35 mL. *n*-Propanol was used as the internal standard for the quantification of ethanol in the samples [1].

Method validation and uncertainty calculations were performed according to the literature, based on EURACHEM Guide, 2004 (EURACHEM/CITAC, 2004) [2, 3].

Ethanol is a naturally forming substance, resulting from the anaerobic fermentation of sugar by yeasts. In this study, fresh fruits with high sugar content such as apple, orange, pineapple, pear, lemon, cabbage and vinegar were also investigated together with soft drinks in Turkish Market for their ethanol contents. Most of the soft drinks, including fruit juices were determined to contain trace of naturally forming alcohol. Ethanol contents of the fruits increased day by day due to the anaerobic fermentation of their sugars. While fresh pineapple was analyzed to have  $0.48 \times 10^{-2}$  (w/w) ethanol, when it is stored at +4 °C for ten days, its ethanol content increased dramatically to almost 1 % (w/w). Therefore, it is suggested that fruits, with high content of sugars, should be consumed freshly.

Similarly, various grape juice samples, which are called as “şıra” in Turkish, were analyzed for their ethanol contents, which were found to be in the range of  $0.29 \times 10^{-3}$ ,  $0.39 \times 10^{-2}$  and  $0.32 \times 10^{-3}$  % (w/w). The ethanol content of a “şıra” sample, produced locally by a restaurant in Istanbul, was determined as 2.11 % (w/w), which was also increased to 5.60 % (w/w) after being kept at room temperature for 10 days. This result is very critical for şıra consumers.

Former studies and this study revealed that the ethanol contents of kephir and boza, similarly, increase as the length of storage increases before consumption.

In conclusion, 41 different beverages, vinegar, vegetables and fruits were analyzed for their ethanol content applying HS-GC-FID technique and uncertainty results ( $U_{95}$  ( $k=2$ )) were calculated and presented in table 1. These results indicated that the level of natural ethanol contents of soft drinks, fruits and fruits products need to be investigated by authorities of the halal food society, before the products reach halal consumers. Moreover, halal consumers should be informed about the alcohol contents of halal products on their labels.

## References

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\*\*\* “...” Shows, the information obtained from the literature

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