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Evaluation of methanol content of illegal beverages using an easy modified chromotropic acid method

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Objectives: The selling, buying and drinking of alcoholic beverages is a punishable crime in some Islamic countries, particularly for Muslims. This illegal trade in alcohol is a source of methanol outbreaks that can be life threatening. Forensic toxicology laboratories are responsible for analyzing potentially adulterated alcohols on request. Methanol is an impurity that can be found in illegal beverages. There is no easy and cheap method to determine methanol content of suspected beverages in many developing countries. Having access to such a method may reduce the frequency of methanol poisoning. We aimed to evaluate methanol and ethanol concentrations of some suspected alcoholic beverages in the Iranian black market using gas chromatography. As a second aim, we evaluated the efficacy of a newly designed kit for the detection of methanol content of such samples, comparing with the gold standard method of GC.

Methods: A gas chromatography apparatus (Shimadzu 148, Japan) was used to determine the methanol concentration of samples of the illegal suspected beverages. These samples had been referred to the forensic toxicology laboratory of Guilan province, Iran by police during 14 months from March 2017 to May 2018. At the same time, a newly developed modified chromotropic acid method was also used for the same purpose. In the next step, samples whose methanol content was undetectable by GC but detectable by the new kit were re-checked using a newer YL 6100 GC device (South Korea)

Results: Of 1221 referred samples, 145 (11.9%) had no ethanol content, while in three samples (0.25%) methanol was high enough (700000, 870000, and 920000 mg/L) to cause severe methanol toxicity in consumers. The median [IQR] ethanol content of the suspected samples was 9% [3.7, 32.75]. In total, methanol was detected in 128 (10.48%) samples by GC (range 8.5 to 920000 mg/L) and 160 samples (13.1%) with designed calorimetric kit with 100% sensitivity [95% CI of 97.17-100], 97.07% specificity [95% CI of 95.89-97.99] and 100% negative predictive value.

Conclusion: Local black market stock of alcoholic beverages is not safe. The new colorimetric method can detect methanol content of beverages precisely. The kit could successfully determine samples without methanol content. Application of the new modified chromotropic acid method is practical, rapid, easy, and accurate to confirm lack of methanol in suspected alcoholic drinks.