Increasing dissolved oxygen concentrations in alcohol may reduce negative side effects

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Oxygen for ethanol oxidation is supplied through breathing, the stomach, and the skin. There is a great deal of genetic and environmental variability in the pharmacokinetics of alcohol absorption, distribution, metabolism, and elimination. A new study has found that increasing dissolved oxygen concentrations in alcohol may help to reduce alcohol-related side effects and accidents.

Results will be published in the May 2010 issue of *Alcoholism: Clinical & Experimental Research* and are currently available at Early View.

"Ethanol is oxidized to acetaldehyde, then further oxidized to water and carbon dioxide in the body after consumption," explained Kwang-il Kwon, a professor in the college of pharmacy at Chungnam National University and corresponding author for the study. "These oxidation reactions occur primarily via hepatic oxidation and are governed by the catalytic properties of alcohol-metabolizing enzymes, including the microsomal ethanol oxidizing system (MEOS), alcohol dehydrogenase (ADH), and aldehyde dehydrogenase (ALDH). Ethanol oxidation by ADH, ALDH, and MEOS requires oxygen, and a higher oxygen uptake increases the rate of ethanol oxidation."

"Several studies have indicated that high-oxygen water can enhance the survival ability of mice, fatigue recovery, and anoxia endurance function," added Hye Gwang Jeong, a professor in the department of toxicology in the college of pharmacy at Chungnam National University. "It can also increase energy storage. However, the influence of dissolved

oxygen concentration on alcohol pharmacokinetics has not previously been described. This manuscript is the first to investigate the influence of dissolved oxygen concentrations on the pharmacokinetics of alcohol in healthy human subjects."

Kwon and his colleagues performed three experiments with 49 healthy volunteers (30 men, 19 women), with a mean age of 27.2 years. Experiment one compared 8 ppm and 20 ppm dissolved oxygen concentrations in 240 ml of 19.5 percent alcoholic beverage. Experiment two compared 8 ppm and 20 ppm dissolved oxygen concentrations in 360 ml of 19.5 percent alcoholic beverage. Experiment three compared 8 ppm and 25 ppm dissolved oxygen concentrations in 360 ml of 19.5 percent alcoholic beverage.

Results showed that elevated, dissolved oxygen concentrations in alcoholic drinks can accelerate the metabolism and elimination of alcohol. For example, the time to reach 0.000 percent blood alcohol concentration (BAC) for the 240 ml of 19.5 percent alcoholic beverage with 20 ppm dissolved oxygen concentration was 20.0 min faster than with 8 ppm (257.7 min). The time to reach 0.000 percent BAC for the 360 ml of 19.5 percent alcoholic beverage with 20 ppm (334.5 min) and 25 ppm (342.1 min) dissolved oxygen concentration was 23.3 min and 27.1 min faster than with 8 ppm, respectively.

"The oxygen-enriched alcohol beverage reduces plasma alcohol concentrations faster than a normal dissolved-oxygen alcohol beverage does," said Kwon. "This could provide both clinical and real-life significance. The oxygen-enriched alcohol beverage would allow individuals to become sober faster, and reduce the side effects of acetaldehyde without a significant difference in alcohol's effects. Furthermore, the reduced time to a lower BAC may reduce alcohol-related accidents."

Both Kwon and Jeong noted that alcoholic drinks with a higher oxygen concentration already exist in Korea, but they lack scientific support. "It seems that these drinks can maintain a high dissolved-oxygen concentration for about 10 to 20 days before the stopper is removed, and for 70 minutes after removing the stopper, respectively, at room temperature," said Kwon. Both scientists suggested that future studies look closer at dissolved-oxygen concentrations on specific enzymes of alcohol metabolism, such as ADH, ALDH, and MEOS.

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