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에탄올 섭취 후 초기 아세트알데히드 농도 증가에 의한 소변 산성화

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Ethanol Induced Urine Acidification is Related with Early Acetaldehyde Concentration

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Background: Ethanol is worldwide favored beverage among the young adults, but heavy drinking cause many social problems and medical problems such as liver cirrhosis, central nervous system problem. These toxic effects are mainly caused by acetaldehyde, the metabolite of ethanol. Usual dose of ethanol consumption can cause dehydration and mild metabolic acidosis, there is few experimental human data that explain about the association of blood ethanol and acetaldehyde level and aciduria. We investigated urine electrolyte and pH changes after moderate amount of ethanol ingestion in healthy young men for urine acidification change by ethanol and acetaldehyde level.

Materials and Methods: 30 Healthy young male volunteers were enrolled with informed consent. They ingested 1.3 g/kg of ethanol in fasting state, and blood and urine samples were taken at before ingestion, 1, 3, 5, 7 hours after ethanol ingestion. Snack was supplied after 4 hours of alcohol intake, and 500 mL of free water was allowed. Urine pH was measured by pH meter and blood and urine electrolytes were measured by indirect method. Blood ethanol was measured by enzymatic method and acetaldehyde was measured by spectrophotometer assay.

Results: 30 Volunteers were all males, age was 27.40 ± 2.7 years old, body weight was 72.83 ± 7.9 kg. Their usual limit of alcohol intake by history taking were 78.35 ± 56.7 gram, and average amount of ingested ethanol was 98.63 ± 10.7 gram. Blood ethanol concentrations were 0.131, 0.097, 0.098, 0.027% in 1 hr, 3 hrs, 5 hrs, 7 hrs after drinking respectively, and blood acetaldehyde concentrations were 1.480, 1.734, 1.221, 1.462% in 1 hr, 3 hrs, 5 hrs, 7 hrs after drinking respectively. Urine pH were 6.056 in before ethanol ingestion, and 5.724, 5.598 each of 3 hours and 7 hours after ethanol ingestion, respectively. Post-alcohol ingestion urine pH was significantly decreased ($p=0.002$). Urine sodium and chloride excretions were not changed after ethanol, but urinary potassium excretion was significantly decreased (61.09 ± 25.3 to 40.16 ± 11.9 , $p<0.001$). There was no correlation between urine pH and urine electrolyte excretion. Interestingly, early elevation of serum aldehyde (1 hour after ethanol) and early urine acidification (3 hrs after ethanol) showed strong correlation ($r^2=0.189$, $p=0.021$), and after 7 hrs of ingestion, urine pH was increased ($r^2=0.383$, $p<0.001$). There was no gastrointestinal trouble, neurological problem, and other ethanol induced medical problem.

Conclusion: In conclusion, urine acidification after ethanol ingestion is related with serum acetaldehyde concentration. Early elevation of acetaldehyde could induce urine acidification, but the urine pH was elevated after a few hours, that might make prolonged acidemia.

Key Words: 산혈증, 에탄올, 아세트알데히드
Acidosis, Ethanol, Acetaldehyde