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Nucleosides, Nucleotides and Nucleic Acids

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713597286>

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To cite this Article Moriwaki, Y., Ka, T., Takahashi, S., Tsutsumi, Z. and Yamamoto, T. (2006) 'Effect of Beer Ingestion on the Plasma Concentrations and Urinary Excretion of Purine Bases: One-Month Study', *Nucleosides, Nucleotides and Nucleic Acids*, 25: 9, 1083 – 1085

To link to this Article: DOI: 10.1080/15257770600893990

URL: <http://dx.doi.org/10.1080/15257770600893990>

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EFFECT OF BEER INGESTION ON THE PLASMA CONCENTRATIONS AND URINARY EXCRETION OF PURINE BASES: ONE-MONTH STUDY

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□ *To investigate the effect of long-term beer ingestion on the plasma concentrations and urinary excretion of purine bases, 5 healthy males participated in the present study, during which they ingested beer every evening for 30 days. Blood and 24-hour urine samples were collected in the morning one day before and 14 and 30 days after the initiation of the beer ingestion. During the beer ingestion period, the plasma concentration and the urinary excretion of uric acid were increased significantly, while uric acid clearance was not decreased. Further, purine ingestion was not significantly different throughout the study. These results suggest that production of uric acid by ethanol ingestion was the main contributor to the increased plasma uric acid. Therefore, patients with gout should be encouraged to avoid drinking large amounts of beer on a daily basis.*

Keywords Uric acid; Hypoxanthine; Xanthine; Beer

INTRODUCTION

Ethanol increases ATP degradation in the liver, leading to an increased production of uric acid,^[1–3] while large amounts of ethanol increase the blood concentration of lactic acid, which inhibits uric acid excretion in the kidney.^[4] In addition, beer contains considerable amounts of various purines, which also contribute to hyperuricemia. However, understanding of the mechanism(s) of ethanol-induced hyperuricemia is mainly based on data obtained from short-term experiments.^[1–3] Accordingly, we investigated the effect of one-month moderate beer ingestion on the plasma concentrations and urinary excretion of purine bases.

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SUBJECTS AND METHODS

After 3 weeks of abstinence, 5 healthy males ingested beer containing 5% ethanol and 56 mg/L of purines (20 ml/kg body weight) in one-hour period every night for 30 days, along with their regular diet. At 8:00 am before beer ingestion, blood and 24-hour urine were collected, and body weight was measured. The same measurements with the same protocol were performed at 14 and 30 days after beer ingestion. Based on replies to a questionnaire, the intake of calories, carbohydrates, lipids, and purines was analyzed by a dietician. The plasma concentrations of purine bases, ethanol, and acetic acid, lactic acid, pyruvic acid, and NH_3 levels in blood were determined as described previously.^[3]

RESULTS

The plasma concentration of uric acid was increased to $370 \pm 70 \mu\text{mol/l}$ ($P < 0.05$) at 14 days and to $369 \pm 71 \mu\text{mol/l}$ ($P < 0.05$) at 30 days, respectively, after beer ingestion, as compared with the reference value ($315 \pm 58 \mu\text{mol/l}$). The 24-hour urinary excretion of uric acid was significantly increased to $4.11 \pm 0.80 \text{ mmol/day}$ ($P < 0.05$) at 14 days and $4.31 \pm 0.64 \text{ mmol/day}$ ($P < 0.05$) at 30 days, respectively, after beer ingestion, as compared with the reference value ($3.57 \pm 0.41 \text{ mmol/day}$). However, urinary oxypurine excretion did not increase significantly during the beer ingestion experiment.

The plasma concentrations of ethanol and acetic acid were below the detection limits throughout the experiment. Further, the blood concentrations of lactic acid, pyruvic acid, and NH_3 did not change before and after beer ingestion. The quantity of ingested nutrients as well as calories were not significantly different throughout the study. Uric acid clearance and mean body weight were not changed significantly during the study.

DISCUSSION

In this study, the plasma uric acid concentration and 24-hour urinary uric acid excretion were increased at 14 and 30 days after beer ingestion. In contrast, uric acid clearance did not change significantly throughout the beer ingestion experiment. The concentration of lactic acid in blood was within normal values, and those of ethanol and acetic acid in plasma were below the detection limits, suggesting that a transient increase in the concentration of lactic acid in blood via the metabolism of ethanol does not have a significant effect on the urinary excretion of uric acid. Further, since there was no change in food intake or mean body weight throughout the study, it is suggested that the production of uric acid (ingested purines and ATP degradation by ethanol) caused by beer ingestion played a major role

in the increases in plasma concentration and urinary excretion of uric acid. However, in the present study, the plasma concentration and the 24-hour urinary excretion of oxypurines were not increased at 14 and 30 days after beer ingestion. These results suggest that the effect of beer on the plasma concentrations and urinary excretion of oxypurines are limited and for a short duration. It was concluded that moderate amount of daily beer ingestion increased the plasma concentration and urinary excretion of uric acid. Therefore, patients with gout should be encouraged to avoid drinking large amounts of beer on a daily basis.

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