



K3 Macronutritional Composition Induced Differential Gastrointestinal Absorption Kinetics of Alcohol: A Pharmacokinetic Analysis of Alcohol Absorption in the Postprandial State

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After attending this presentation, attendees will gain an understanding of the variable impact that a meal induces on the absorption rate of alcohol based on the macronutritional composition of the food—the nutritional components of food that provide calories or energy (proteins, fats, carbohydrates).

This presentation will impact the forensic community by providing additional knowledge to be used during interpretation on the rate that alcohol is absorbed in the postprandial state.

The current method of assessing gastrointestinal absorption of alcohol in the postprandial state include both the size of the meal as well as the time lapse since the meal was consumed relative to the ingestion of alcohol. It is hypothesized that an ingestion of alcohol following a meal will display differential gastrointestinal absorption rates dependent upon the macronutritional composition of the meal. It is further hypothesized that the glycemic index (GI)—a measurement of the magnitude and rate at which ingested food causes the level of glucose in the blood to rise—can be utilized as a third parameter in the absorption rate constant when predicting gastrointestinal absorption kinetics.

These hypotheses were investigated in a two-day study distinguished by the prandial state of five healthy, non-alcoholic male volunteers (four Caucasian and one African American) with mean age 24y (range 21y to 27y), mean height 186cm (range 183cm to 190cm), and mean weight 90kg (range 63kg to 114kg) who were on no medication and had no evidence of gastrointestinal disease. Informed consent was obtained through Georgia Public Safety Training Center study protocols for conducting controlled alcohol drinking studies. Volunteers were instructed to restrict any food consumption for at least three hours prior to the study on each day.

Volunteers were administered five separate diluted (diet soda, caffeinated) ingestions of alcohol (40% alc/vol) for a total mean consumption of 0.80g/kg (range 0.68g/kg to 1.00g/kg) ethanol over a course of two hours. Alcohol administration schedule and net weight remained constant for the respective volunteer on each study day. Day one assessed the absorption kinetics in the fasting state for all volunteers. On day two, the volunteers were separated into three groups dependent upon the type of meal administered: Group A) High GI (two volunteers) – 350kcal total [72g carbohydrates (0g fiber), 10g protein, and 2.5g fat]; Group B) Medium GI (one volunteer) – 352kcal total [36g carbohydrates (0g fiber), 43g protein, and 4g fat]; and Low GI (two volunteers) – 349kcal total [0g carbohydrates (0g fiber), 76g protein, and 5g fat]. For each study day, the breath alcohol concentration (BrAC) was recorded on a set schedule (90min, 150min, and 210 min elapsed time from scenario beginning) using the Intoxilizer 5000.

Results of the study revealed that all volunteers displayed similar absorptive kinetics and peak BrAC on study day one in the fasting state (volunteer # [1] 0.099 g/dl, [2] 0.106 g/dl, [3] 0.106 g/dl, [4] 0.124 g/dl, [5] 0.111 g/dl). On study day two, in the postprandial state, all volunteers displayed attenuated, but differential peak BrAC, dependent upon the assigned group. Group A) High GI – volunteers (#[1] and [2]) exhibited a mean decreased peak BrAC of 13% (range 8% to 17%). Group B) Medium GI – the volunteer (#[3]) exhibited a decreased peak BrAC of 32%. Group C) Low GI – volunteers (#[4] and [5]) exhibited a mean decreased peak BrAC of 42% (range 37% to 46%).

The results of this study show that peak BrAC following a meal with low GI will be lower than following a comparable meal with similar calories but higher GI. This finding provides significant insight as to the effect the macronutritional composition of a meal as measured by postprandial glycemia (GI) has on the absorption kinetics of alcohol in the postprandial state. Whereas high GI foods result in faster rates of gastric emptying signified by elevated postprandial glycemia and therefore increased absorption kinetics of alcohol. On the other hand, low GI foods result in slower rates of gastric emptying signified by little or no postprandial glycemic response and therefore slower absorption kinetics of alcohol in the gastrointestinal tract. Current methods of predicting postprandial absorption kinetics would suggest no intergroup variation in day two of the study where obvious variation existed. These results warrant further studies with a larger sample size including gender and ethnic variation to verify these preliminary findings.

Alcohol, Absorption, Glycemic Index