Effect of Caffeine on Plasma Glucose and Insulin Response to Mixed Meal Tolerance Test in Type II Diabetes

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MATERIALS AND METHODS

It was a double-blind, placebo-controlled cross-over study. Study group comprised of 14 habitual coffee drinkers (11 men & 3 women, age 61 ± 9 years) who had at least a 6-months history of type II diabetes. Their daily caffeine intake from all beverages averaged 526 ± 144 mg/day. Mean fasting plasma glucose level was 7.5 ± 1.6 mmol/L. All subjects were using oral hypoglycemic agents except three, they managed with diet and exercise. None required exogenous insulin therapy. They were free of major medical disorders, no such medications that affect glucose metabolism. All of them were non-smokers. Caffeine and placebo treatment were given in identical capsules. Each capsule containing either 125 mg anhydrous caffeine plus dextrose or dextrose only. The total caffeine dose (375 mg/day) was given in a divided schedule. Informed consent and screening data were collected about caffeine consumption before testing. The subjects also completed a 7-day diary of caffeinated beverage consumption, recording the serving size and time of day for beverage. They were studied on two different morning within a two week period, following overnight fast and caffeine abstinence. They took diabetes medications according to their usual treatment regimen. After 30 minute quiet rest, baseline fasting blood samples were drawn from forearm vein. Subjects ingested two capsule (caffeinated or placebo) with water. After 60 minute interval for caffeine absorption, a second set of blood sample was drawn. Subjects then ingested an additional one capsule (caffeinated or placebo) intended to maintained drug levels. Then they consumed a commercial meal that contained 75 gram of carbohydrate for mixed-meal tolerance test. Additional blood samples were drawn 1 and 2 hour after the meal. Plasma glucose levels were measured using Beckman Glucose Analyzer II. Plasma insulin levels were measured by A double-antibody radioimmunoassay (Linco Research, St Charles, MO).

STATISTICAL ANALYSIS

To test the effects on responses to the MMTT, the incremental areas under the MMTT 2-h time curves (AUC2h) for glucose and insulin with the trapezoidal rule, using the post drug fasting value and the value 1 and 2 h after meal were calculated. Incremental areas were compared by a repeated-measures ANOVA. Data was
administration (3.87 ± 0.30 mmol .1-1 . 2h-1 ) was 21% larger than the AUC2h after placebo (3.2 ± 0.36 mmol .1-1 . 2h-1 ). Average insulin AUC2h in caffeine condition (66.73 ± 10.49. µU-1 . ml-1. 2h-1) was 48% larger than that in the placebo condition (45.17 ± 5.98µU-1 . ml-1. 2h-1).

Acute administration of caffeine impaired post-prandial glucose metabolism in diabetic patients. In contrast to non-diabetic subjects, this study showed exaggerations of both glucose and insulin responses when caffeine was ingested with CHO. Daily consumption of caffeinated beverage with meals could produce higher average glucose levels that increase the risk of diabetes complications. Caffeine abstinence may have beneficial effect that compare favorably with oral agents used to control postprandial glucose. Despite these limitations, the result of this study raise concern about the potential hazards of caffeine for patients with type II diabetes and for individuals who are pre-diabetic.

REFERENCES

RESULTS
Concentration-time curve for plasma glucose and insulin levels are shown in figure below. Effects of caffeine versus placebo on plasma glucose (A) and insulin (B) time curves with fasting and during the 2-h MMTT shown in figure.

Curves illustrate that caffeine increases glucose & insulin during MMTT Caffeine not affect fasting levels of plasma glucose or insulin. ± Caffeine ± Placebo

Comparisons of the AUC2h values demonstrated significant caffeine effects for both plasma glucose (P = 0.04) and plasma insulin (P = 0.01) responses to the MMTT. Average glucose AUC2h after caffeine administration (3.87 ± 0.30 mmol .1-1 . 2h-1 ) was 21% larger than the AUC2h after placebo (3.2 ± 0.36 mmol .1-1 . 2h-1 ). Comparisons of the AUC2h values demonstrated significant caffeine effects for both plasma glucose (P = 0.04) and plasma insulin (P = 0.01) responses to the MMTT. Average glucose AUC2h after caffeine administration (3.87 ± 0.30 mmol .1-1 . 2h-1 ) was 21% larger than the AUC2h after placebo (3.2 ± 0.36 mmol .1-1 . 2h-1 ).Average insulin AUC2h in caffeine condition (66.73 ± 10.49. µU-1 . ml-1. 2h-1) was 48% larger than that in the placebo condition (45.17 ± 5.98µU-1 . ml-1. 2h-1).