

Calorie Control Council Response to Couchepin *et al*

“Markedly blunted metabolic effects of fructose in healthy young female subjects compared with male subjects”

Couchepin C, Le KA, Bortolotti M, da Encarnacao JA, Oboni JB, Tran C, Schneiter P, Tappy L. Diabetes Care. 2008 Jun;31:1254-6.

Background

This study originates from the Department of Physiology, Lausanne University School of Biology and Medicine, Lausanne, Switzerland in the laboratory of Luc Tappy.

Hypothesis

The effects of short-term fructose overfeeding on fasting lipid metabolism and insulin sensitivity in human subjects may be sex-dependent.

Justifications

- High fructose intake has been associated with adverse metabolic effects (1).
- Several reports show in rats that fructose has a more pronounced adverse metabolic effect in males than females.
- In humans, only males show fructose-induced hypertriglyceridemia.

Experimental Design

Fasting metabolic profile and hepatic insulin sensitivity were assessed by means of a hyperglycemic clamp (technique for measuring β -cell insulin secretion) in 16 healthy young male and female subjects after a 6-day fructose overfeeding.

Author Conclusions

- Fructose overfeeding increased fasting triglyceride concentrations by 71 vs. 16% in male vs. female subjects, respectively.
- The following metabolic markers were increased after fructose over-feeding in male subjects: endogenous glucose production (+12%), alanine aminotransferase (+38%), and fasting insulin (+14%). Fasting plasma free fatty acids and lipid oxidation were inhibited in males. All markers were not significantly affected by fructose in female subjects.
- Short-term fructose overfeeding produces hypertriglyceridemia and hepatic insulin resistance in men, but these effects are markedly blunted in healthy young women.

Critique

- Contraceptive hormones are well known to influence metabolic processes and women who are hormonally active are often barred from such studies. By allowing women on hormonal contraception to participate in the study, the authors have added a level of complexity to the data analysis.

This is a rare paper in which the authors admit that they feeding an excess of fructose to the study subjects – the term overfeeding is used several times in the paper. The

isocaloric diet, with an advertised 10% mono and disaccharides might be expected to contribute 100 cal in the form of fructose. The overfeeding is accomplished by supplementing test subjects with 3.5 g fructose/kg fat-free mass/day — this contributes about 843 cal for males and 735 cal for females. Fructose supplementation in this paper thus contributes about 32% of total calories for men and 29% for women, nearly four-times the amount consumed by the typical adult and nearly twice the amount consumed by the 90-percentile of sweetener users (2).

References

1. Havel PJ. Dietary fructose: implications for dysregulation of energy homeostasis and lipid/carbohydrate metabolism. *Nutr Rev.* 2005 May;63:133-57.
2. Park YK, Yetley EA. Intakes and food sources of fructose in the United States. *Am J Clin Nutr.* 1993 Nov;58:737S-47S.