

# The Effects of Consumption Levels of Fructose and Fructose Containing Sugars on Circulating Glucose, Insulin, Leptin, and Active Ghrelin.

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## Introduction

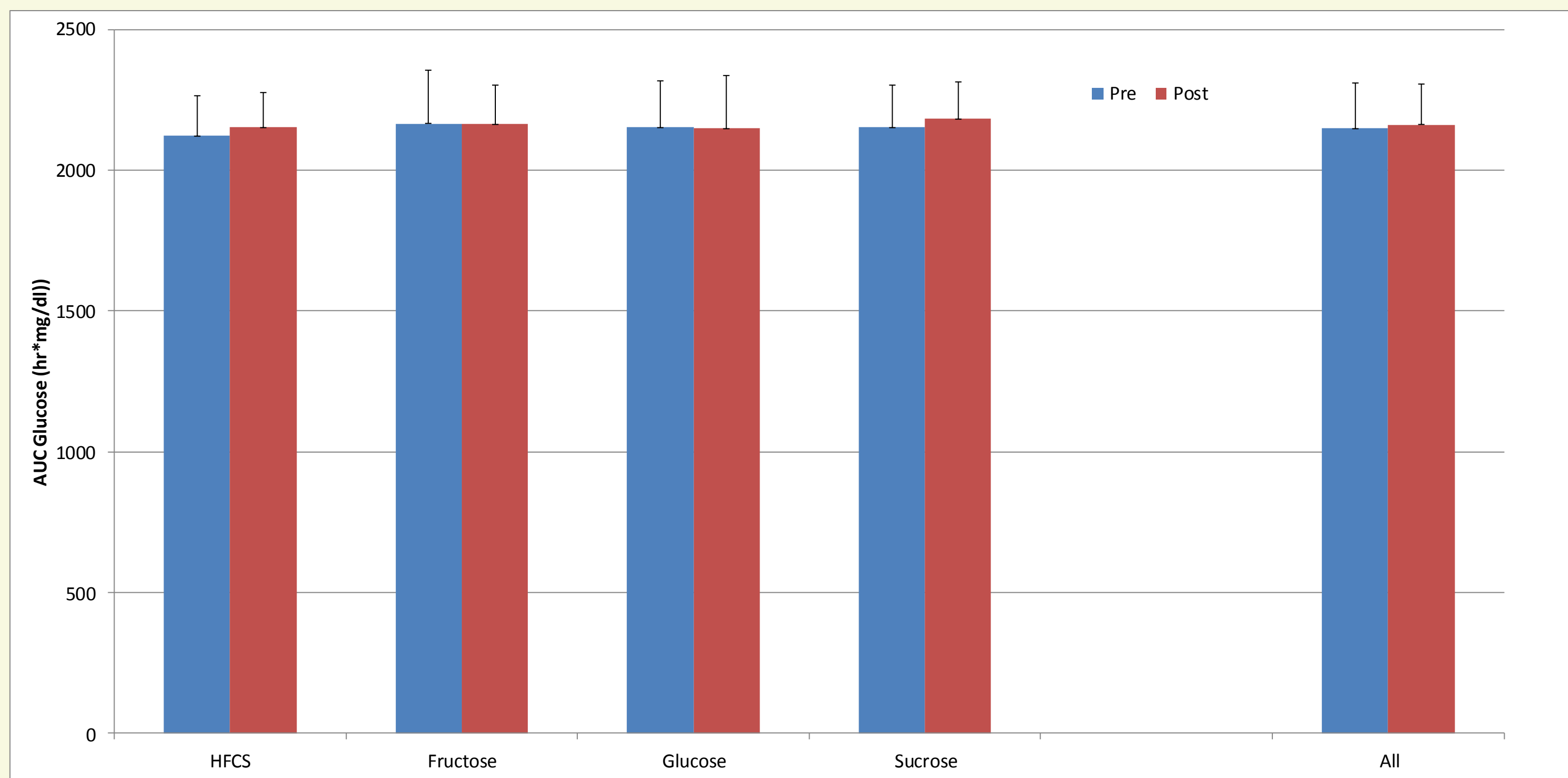
- Fructose has long been known to elicit a blunted glycemic response compared to other sugars.
- Accordingly, fructose elicits a blunted stimulus from the hormonal pathways involved in energy regulation.
- While this may explain how pure fructose could promote weight-gain, such studies used experimental models that do not reflect how fructose is typically consumed, either in the type of sugar consumed or the amount, and so should be interpreted with caution.
- The purpose of the present study was to examine the effect on glucose and energy regulating hormones of fructose consumed at the 50<sup>th</sup> percentile level of American consumption (9% of calories) when consumed as part of a mixed nutrient diet either as pure fructose or, as is typically consumed, in combination with glucose (e.g. HFCS or sucrose).

## Methods

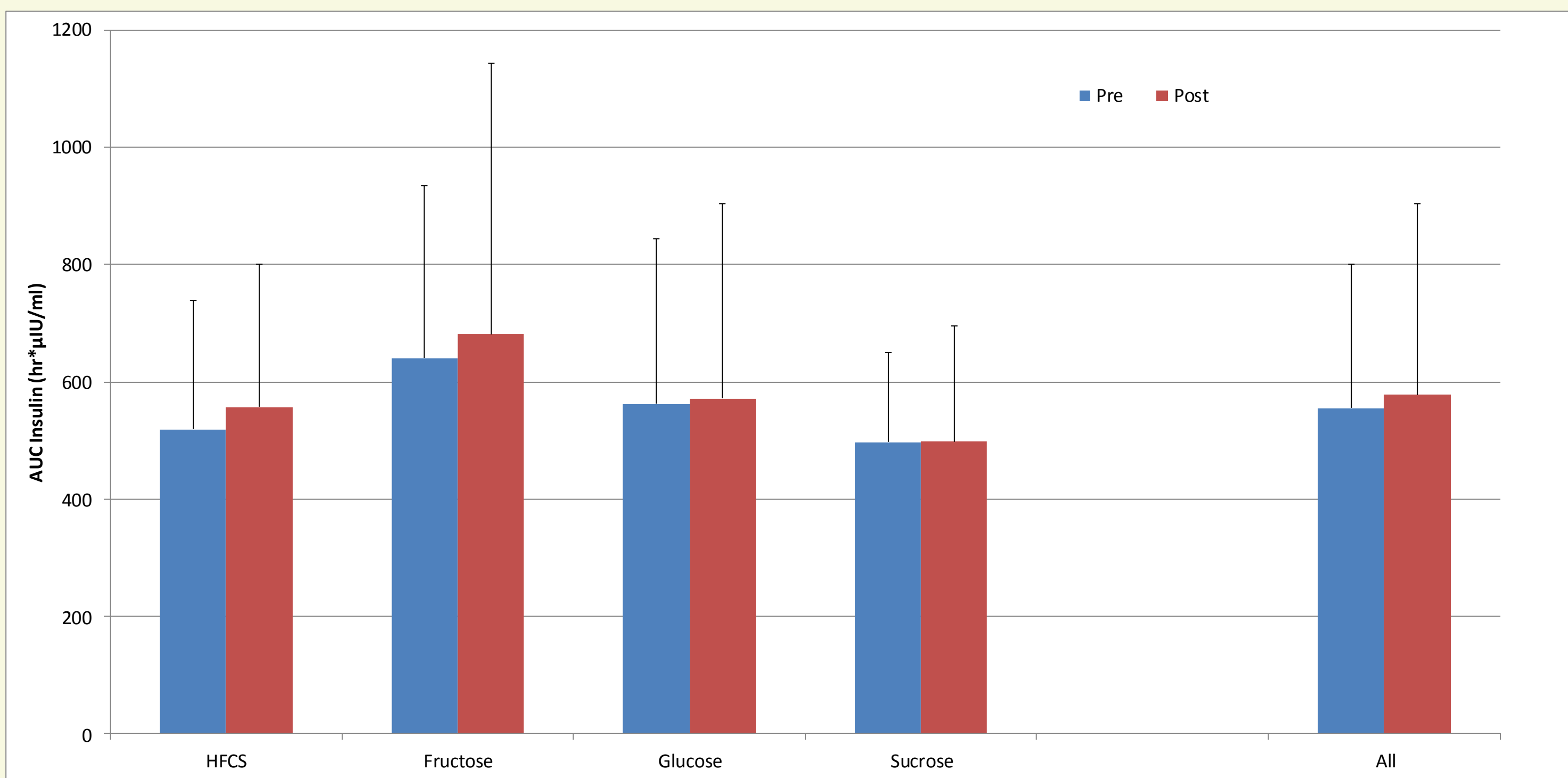
- This ten week study included seventy six weight-stable individuals (no change in weight >3% for 3 months), aged 20-60 years who were either normal weight or overweight, normotensive, normoglycemic and with no other overt health problems.
- Individuals were required to consume sugar-sweetened low-fat milk every day for ten weeks as part of their usual diet.
- The added sugar in the milk represented the 50<sup>th</sup> percentile for sugar consumption in the United States:
- Fructose - added fructose providing 9% of calories required for weight maintenance
- Glucose - added glucose providing 9% of calories required for weight maintenance
- HFCS - added HFCS providing 18% of calories required for weight maintenance
- Sucrose - added sucrose providing 18% of calories required for weight maintenance.
- Energy intake required for weight maintenance was estimated from the Mifflin St Joer prediction including an individualized activity factor based on responses to a physical activity questionnaire.
- Other than milk consumption participants followed no structured dietary program. They were counseled on how to account for the calories in the sweetened milk, but were told to continue to eat to the same level of fullness as prior to enrollment.
- Prior to beginning the intervention, participants undertook a 24 hour visit in the metabolic unit during which they were fed three standardized meals and had blood sampled every half hour from 9am to 12am, and hourly thereafter until 8am. The procedures were repeated after completion of the ten week intervention.

## Results

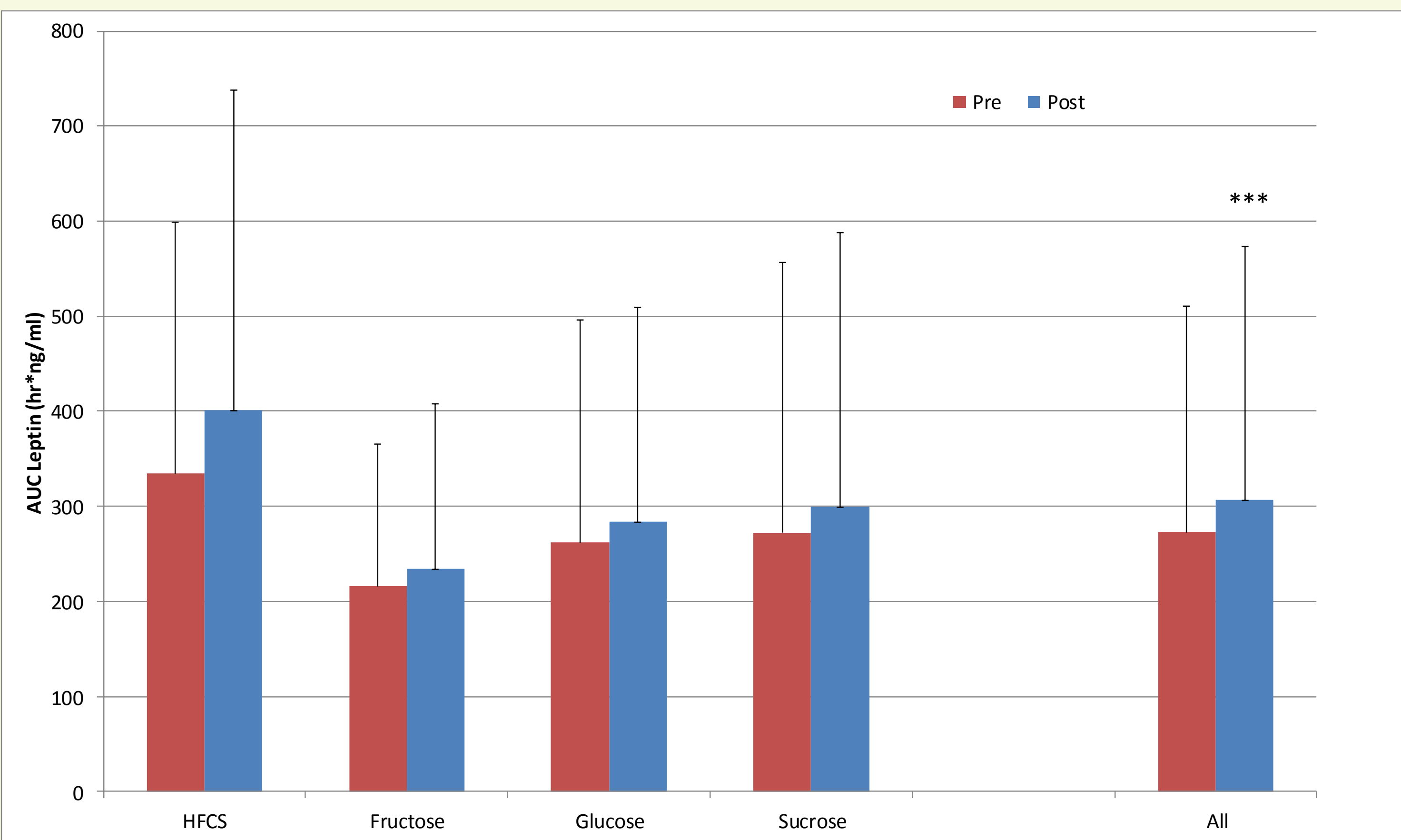
There was a small but significant increase in weight in the entire cohort (162.2 ±27.3 vs 164.1 ± 28.1 lbs, p<0.001), but no effect of the type of sugar consumed.



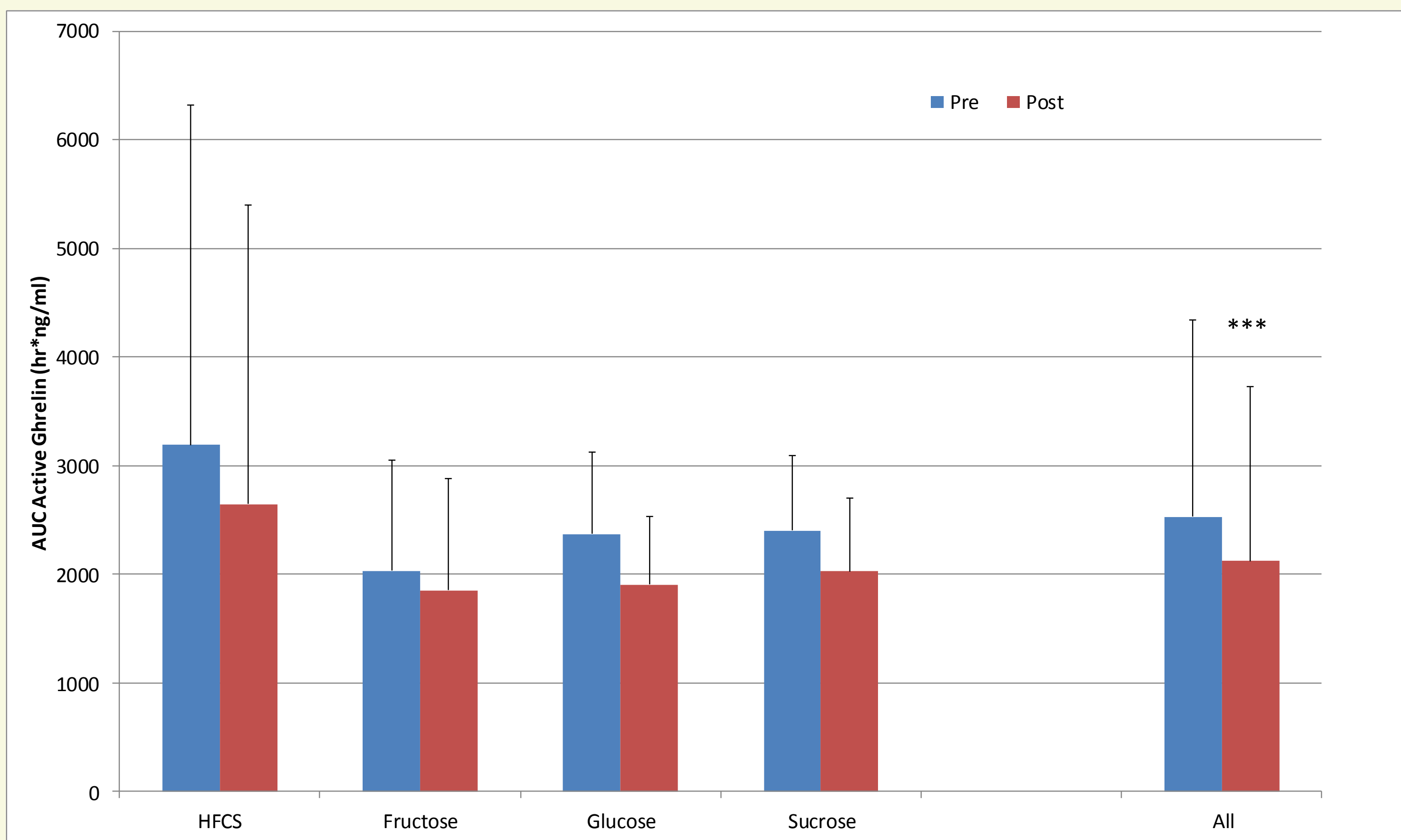
Time p>0.05, Interaction p>0.05



Time p>0.05, Interaction p>0.05



Time p<0.001, Interaction p>0.05



Time p<0.001, Interaction p>0.05

## Discussion & Conclusion

- These data support the conclusion that chronic consumption of sugar of any form may alter the metabolic pathways that regulate appetite. The implications of this warrant further investigation.
- However, these data also show that when consumed at levels typical of the US diet the source of sugar is not important.

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