No Effect of the Type of Sugar on Ectopic Fat Storage

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Introduction

•The accumulation of ectopic fat in non-adipose tissues has been shown to be a key factor in the development of abnormal glucose metabolism and the subsequent development of type II diabetes.

•The lipemic effects of dietary fructose are well documented, but as dietary sugars are typically a mixture of glucose and fructose – sucrose and high fructose corn surup (HFCS) - this may not reflect a real world consequence of dietary sugar consumption.

•The purpose of this study was to investigate the effect of addition of commonly consumed fructose containing sugars to the usual diet for ten weeks on liver and muscle fat content and compare that to a glucose control.

Methods

•Forty-eight weight-stable individuals (no change in weight >3% for 3 months) who were either normal weight or over weight 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 50th 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.

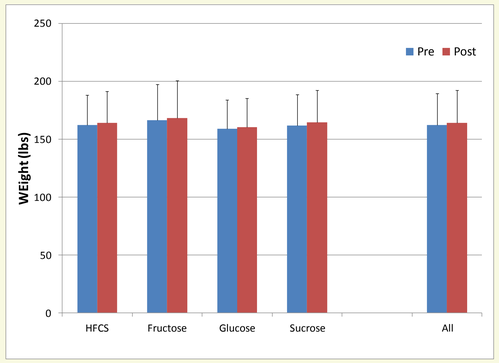
•Other than milk consumption participants followed no structured dietary program. They were counseled on how to account for the calories in the sweetened milk, but were told to continue to eat to the same level of fullness as prior to enrollment.

•Three-day food diaries and NDSR were used to evaluate dietary intake at baseline and after ten-weeks.

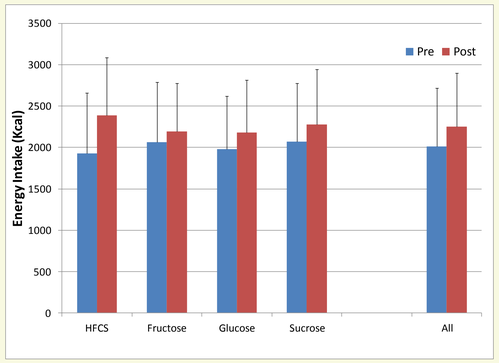
Muscle fat was measured by MRI and liver fat content was measured by MRS (Siemens 3T Skyra).

•Subjects and research staff were blinded to which sugar was consumed.

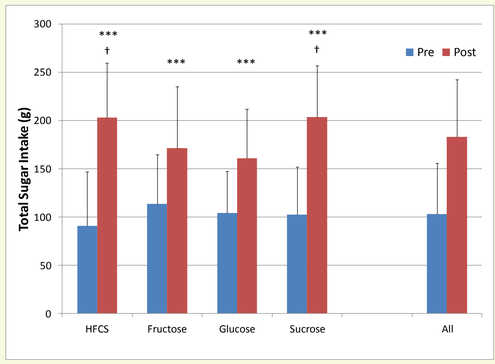
Results



Time p<0.001
Interaction p=0.118



Time p<0.001
Interaction p=0.053



Time p<0.001
Interaction p<0.001

Within Group Different than Pre, p<0.05 *, p<0.01 **, p<0.001 ***
Change from baseline greater than in Fructose and Glucose, p<0.05 †

		HFCS	Fructose	Glucose	Sucrose	All	Time p	Interaction p
Liver Fat (%)	Pre	2.78 ± 1.28	4.30 ± 4.14	4.30 ± 3.36	5.19 ± 8.94	4.12 ± 5.38	0.002	0.609
	Post	3.55 ± 2.75	4.55 ± 4.83	5.49 ± 4.99	6.10 ± 9.49	4.91 ± 6.10		
Vastus Lateralis (g/100ml)	Pre	2.64 ± 0.93	2.69 ± 1.08	2.66 ± 0.54	2.74 ± 0.86	2.69 ± 0.85	0.006	0.614
	Post	2.86 ± 1.31	2.93 ± 1.16	3.07 ± 0.71	3.37 ± 1.41	3.07 ± 1.19		
Gluteus Maximus (g/100ml)	Pre	3.59 ± 1.52	3.81 ± 0.77	3.54 ± 0.90	3.54 ± 1.21	3.61 ± 1.15	<0.001	0.417
	Post	4.24 ± 2.08	4.05 ± 1.23	4.57 ± 1.16	4.21 ± 1.73	4.26 ± 1.62		

Discussion & Conclusion

•These data suggest that short-term changes in overall body composition are also reflected in the fat content of the liver and muscles, even when the changes are small.

•Furthermore, in the context of overall fat gain, whether or not the sugar contained fructose had no impact on the magnitude of change.

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