Null Results in Brief

Effects of a Low Fat, High Fiber-Complex Carbohydrate Diet on Components of the IGF Axis Measured in Plasma: A Controlled Feeding Study in Men

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Background

Higher concentrations of insulin-like growth factor-I (IGF-I), lower concentrations of IGF binding protein-3, and higher IGF-I to IGF binding protein-3 molar ratio have been associated with an increased risk of colorectal and prostate cancer in men. Few studies have evaluated the association between the IGF-I axis and modifiable dietary factors.

Methods

We examined the effect of two dietary patterns on the IGF-I axis in a crossover feeding study that was conducted on 42 men, ages 19 to 56 years, at the U.S. Department of Agriculture in 1986. A description of the methods for this study and previous findings have been published elsewhere (1-3). Men were randomly assigned to either an experimental diet (low fat, high fiber carbohydrate: 18.9% and 67.3% energy from fat and carbohydrate; average 61.6 g fiber) or a control diet (high fat, low fiber carbohydrate: 40.7% and 45.8% energy from fat and carbohydrate; average 27.6 g fiber) for 10 weeks. After a 2-week washout period, participants were crossed over to the other diet. Compared with the control diet, the experimental diet included greater quantities of protein (average 130 vs. 117 g), calcium (average 1,473 vs. 878 mg), and zinc (average 10.1 vs. 7.1 mg). The proportion of fat and protein from vegetable sources was higher in the experimental diet, while the proportion from animal sources was greater in the

control diet. In both diets, one third of the dietary fiber came from fruits and vegetables, legumes, and cereals each. The average numbers of daily servings of fruits and vegetables, legumes, and cereals and grains were 7.9, 3.0, and 5.3 (total 16.2 per day), respectively, for the experimental diet and 4.7, 0.6, and 1.4 (total 6.7 per day), respectively, for the control diet. The total daily caloric intake was adjusted to maintain subjects' body weight during the study.

Insulin-like growth factor-I (IGF-I) and IGF binding protein-3 (IGFBP-3) were measured in duplicate on stored plasma samples collected at the end of each feeding period. IGF-I was measured using the American Laboratory Products Co. (Windham, NH) IGF-I kit with the IGF-I (IGFBP-blocked) RIA method. IGFBP-3 was measured using the Diagnostic Systems Laboratory (Webster, TX) IRMA assay. We calculated the molar ratio of IGF-I to IGFBP-3 as an indicator of the bioactive IGF-I using the following equivalents for conversion: 1 ng/mL IGF-I = 0.130 nmol/L IGF-I; 1 ng/mL IGFBP-3 = 0.036 nmol/L IGFBP-3.

Generalized estimating equations were used to test for a treatment effect between randomized groups. Carryover effects from the first to the second feeding period was evaluated using cross-product terms for diet feeding order (control → experimental or experimental → control) and diet (experimental or control) and stratification of results by diet feeding order. In addition, Wilcoxon rank sum tests were used to test for a

Table 1. Plasma concentrations and differences [mean (SE)] of IGF-I, IGFBP-3, and molar ratio IGF-I to IGFBP-3 ratio following consumption of the control and experimental diets

Analyte	Control	Experimental	Difference*	P
IGF-I (ng/mL)	202.8 (7.6)	213.4 (8.0)	10.5 (4.7)	0.03
IGFBP-3 (ng/mL)	4128.7 (124.2)	4264.4 (116.3)	97.3 (68.8)	0.16
IGF-I to IGFBP-3	0.180 (0.006)	0.183 (0.006)	0.0046 (0.0036)	0.20

*Difference calculated using generalized estimating equation models.

Table 2. Plasma concentrations and mean differences [mean (SE)] of plasma IGF-I by diet feeding order

Analyte	Period	Diet Feeding Order				P for interaction*
		Diet	Control → Experimental ($n = 19$)	Diet	Experimental → Control ($n = 23$)	
IGF-I (ng/mL)	1	Control	214.9 (14.5)	Experimental	211.3 (8.5)[r]	
	2	Experimental	215.9 (14.6)	Control	193.6 (7.3)[p]	
		Difference§	1.05 (20.1)	Difference§	18.1 (5.2)	
		P	0.89	P	0.0005	0.07

*Interaction between diet and diet feeding order.
[r]Period 1, mean (SE) difference between experimental and control for IGF-I = −3.63 (15.8); Wilcoxon rank sum P = 0.89.
[p]Period 2, mean (SE) difference between experimental and control for IGF-I = 22.5 (14.9); Wilcoxon rank sum P = 0.29.
§Difference between experimental and control calculated using generalized estimating equations.

difference in plasma concentrations between the two groups of subjects during the first feeding period.

Results

Overall, compared with the control diet, the experimental diet appeared to significantly increase IGF-I levels (Table 1). No overall effect was observed for IGFBP-3 or the IGF-I to IGFBP-3 ratio. There was a suggestion of a carryover effect on IGF-I, however, such that higher concentrations of IGF-I with the experimental diet were observed only among men who consumed the experimental diet first and the control diet second (P for interaction = 0.07; Table 2). There was no difference in IGF-I concentrations between subjects fed the experimental and those fed the control diets when the analysis was limited to period 1 (Table 2).

Discussion

Although the experimental diet compared to the control diet increases IGF-I concentrations overall, the effect was restricted to the subjects who were fed the control diet after the experimental diet. As no differences were observed when the IGF-I diet comparisons were limited to period 1, the two dietary interventions may not effect IGF-I concentrations differently.

Conclusion

Although the experimental diet increased IGF-I overall, the inconsistencies with respect to the feeding order and period make definitive conclusions problematic. In addition, our findings do not support the concept that these diets cause differences in circulating IGFBP-3 concentrations or IGF-I to IGFBP-3 molar ratio.

References

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