DIETARY COMPOSITION AFFECTS THE LEVELS OF STARCH AND PROTEIN REACHING THE HUMAN COLON

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Low intakes of starch and high intakes of protein are associated with an increased risk for colon cancer (Cassidy et al. 1994). One mechanism for this effect involves metabolism of protein by colonic bacteria to toxic by-products, a process that may be attenuated by fermentation of undigested starch (ie resistant starch, RS). The balance between RS and protein in the colon may thus be important for maintaining a 'healthy' colon. In this study we measured the levels of starch and protein which escaped digestion in the small intestine from five diets given to seven human volunteers with an ileostomy. Diets were:- Diet 1: a simulated 'typical' Australian diet; Diet 2: Diet 1 but conforming to the Australian Dietary Guidelines; Diet 3: Diet 2 with additional RS (eg from wholewheat bread, muesli and legumes); Diet 4: Diet 1 but with animal protein replaced by soy protein; and Diet 5: a vegan diet (Haddad 1994). Diets were fed for two consecutive days and effluent was collected (and frozen immediately) every 2 h for 24 h during the second day.

		Diet *					P value
		1	2	3	4	5	
starch fed	(g/24h)	86 ± 6a	154 ± 14	192 ± 24ab	99 ± 9b	145 ± 20	0.002
protein fed	(g/24h)	74 ± 6	63 ± 5	66 ± 9	73 ± 6	65 ± 9	0.741
starch excreted	(g)	3.49 ± 0.63a	6.69 ± 0.52	16.55 ± 4.83ab	3.64 ± 0.81b	9.56 ± 1.14	0.011
protein excreted	(g)	12.60 ± 2.10	12.56 ± 2.09	17.12 ± 2.41	16.18 ± 3.04	16.05 ± 2.60	0.499
insoluble protein	(g)	2.88 ± 0.83a	4.33 ± 0.99	9.02 ± 1.83a	3.65 ± 1.24	6.12 ± 1.44	0.026
soluble protein	(g)	9.71 ± 1.39	8.23 ± 1.11	8.10 ± 0.75	12.53 ± 1.81	9.93 ± 1.20	0.184
starch:soluble protein excreted		0.40 ± 0.12 a	0.85 ± 0.09b	2.00 ± 0.51abc	0.30 ± 0.08c	0.96 ± 0.05	0.003
no. of subjects		5	5	5	3	4	

*mean ± SEM, one-way ANOVA, shared postscripts represent significant differences

The above results show that levels of starch escaping digestion in the small intestine (ie RS) can be manipulated by including more starch in the diet (Diet 2) or by choosing foods high in RS (Diet 3). Levels of total and soluble protein escaping digestion did not differ between diets, but insoluble protein escaping digestion was highest on the high RS diet (Diet 3). Soluble protein is more fermentable than insoluble protein (Macfarlane and Allison 1986) and is thus more likely to generate toxic by-products through bacterial activity. Although levels of soluble protein did not differ between diets, in Diet 3 (high in RS), the ratio of starch to soluble protein excreted was significantly higher than in Diets 1, 2 and 4. This ratio, by determining relative levels of fermentative by-products, may be a critical factor in determining colon cancer risk. This study demonstrated that manipulation of dietary starch intake (both total and type) rather than protein intake allows the easy manipulation of this ratio.

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