NOTE

Soluble and Insoluble Fiber in Soda Crackers

GUR RANHOTRA and JANETTE GELROTH[1]

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ABSTRACT

On a 4% moisture basis, soda crackers made with pastry flour contained 2.7 ± 0.2% total dietary fiber (TDF), and those made with bread flour contained 3.7 ± 0.4% TDF. About half of the TDF in crackers was soluble fiber. Although soluble fiber increased appreciably during cracker making, the increase in insoluble fiber was modest and observed only in crackers made with bread flour. Crackers made with pastry flour showed a decrease in insoluble fiber during cracker making.

In contrast to water-insoluble fiber, soluble fiber is reported to reduce elevated levels of blood cholesterol, triglycerides, and glucose (Anderson 1986). Peas, beans, fruits, and vegetables are good sources of soluble fiber, but most grain-based foods usually are not. For wheat-based products, this may be more true for less-refined products. Refined products are low in total dietary fiber (TDF), but a good portion of their TDF may be soluble fiber. We recently reported this finding for white bread (Ranhotra and Gelroth 1988) and undertook this study to investigate whether it applies to other refined products.

MATERIALS AND METHODS

Flours from 10 varieties of wheat (four from soft wheat and six from hard wheat) were used to make soda crackers. The process involved fermenting a sponge for 19 hr, mixing it with the dough ingredients, resting the dough for 4 hr, sheeting the dough, cutting crackers, and baking (12 min; 400° F). Baked crackers were finely ground and frozen until needed for analysis. TDF in test flours and yeast (the only sources of fiber in the formula) and in the resultant crackers was determined by the method of Prosky et al (1985), which was modified to allow separate determination of soluble and insoluble fiber. Modification steps included: a) filtration (coarse porosity crucible with 0.5-g Celite) of the sample solution immediately after all enzyme treatments to separate out the insoluble fiber, b) adjusting filtrate volume to 100 ml with water, c) addition of four volumes of 95% ethanol preheated to 60° C to the filtrate solution to precipitate the soluble fiber (wait 1 hr), and d) filtration (coarse porosity crucible with 0.5-g Celite) of the soluble fiber solution. Prosky's method was then followed with respect to ash and protein determinations for the separated soluble and insoluble residues. Moisture was determined by the standard AACC (1983) method.

RESULTS AND DISCUSSION

On a fresh-baked basis (moisture, 4 ± 2%), the TDF content of crackers averaged 2.73 g (using pastry flour) or 3.68 g (using bread flour) per 100 g (Table I). Crackers made with bread flour were consistently higher in TDF, perhaps reflecting the differences in the extraction rates of the two flours. About half of the TDF in both types of crackers was soluble fiber. This somewhat exceeds the amount of soluble fiber (as percent of TDF) reported for white bread (Ranhotra et al 1987, Ranhotra and Gelroth 1988).

Test flours averaged 2.48 g (pastry flour) or 2.77 g (bread flour) TDF/100 g, about two-fifths of which was soluble fiber (both flours). Yeast contained 37.7% TDF, which was virtually all (97%) insoluble fiber. Thus, yeast contributed little soluble fiber to the crackers.

Based on its amount in the crackers, flour (yeast included) contributed an average of 2.55 g (pastry flour) or 2.75 g (bread flour) TDF/100 g (Table II). Crackers, however, contained an average of 2.73 g (pastry flour) or 3.68 g (bread flour) TDF/100 g (Table I). This represents an increase of 6.7% (pastry flour) or 34.0% (bread flour) in TDF during cracker making (Table III), most likely as resistant starch (Berry 1986) and Maillard reaction products.

The two flours differed not only in the magnitude of increase in TDF during cracker making but also in the makeup of TDF. Whereas soluble fiber increased in both types of crackers, the insoluble fiber increased only in crackers made with bread flour (Table III). In crackers made with pastry flour, insoluble fiber actually decreased during cracker making. This is graphically

TABLE I
Total, Soluble, and Insoluble Fiber in Soda Crackers[a]

Flour Type	Crackers		
	Total Fiber (g/100 g)	Soluble Fiber (% of total)	Insoluble Fiber (% of total)
Pastry			
1	2.77	47.3	52.7
2	2.63	53.6	46.4
3	2.54	47.2	52.8
4	2.97	53.0	47.0
Average	2.73	50.3	49.7
SD	0.19	3.5	3.5
Bread			
1	3.60	46.8	53.2
2	4.43	50.6	49.4
3	3.40	42.8	57.2
4	3.50	42.6	57.4
5	3.23	49.8	50.2
6	3.91	35.6	64.4
Average	3.68	44.7	55.3
SD	0.43	5.6	5.6

[a]On fresh-baked (average moisture, 4 ± 2%) basis.

TABLE II
Content of Soluble and Insoluble Fiber in Soda Crackers[a]

Flour Type	Soluble Fiber (g/100 g)		Insoluble Fiber (g/100 g)	
	From Flour[b]	In Crackers	From Flour[b]	In Crackers
Pastry				
Range	0.85–1.22	1.20–1.57	1.38–1.71	1.22–1.46
Average	1.00	1.37	1.55	1.35
SD	0.17	0.16	0.14	0.10
Bread				
Range	0.79–1.37	1.39–2.24	1.50–1.84	1.61–2.52
Average	1.07	1.64	1.68	2.03
SD	0.22	0.31	0.12	0.30

[a]On fresh-baked (average moisture 4 ± 2%) basis.
[b]Including yeast.

[1]American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

TABLE III
Percent Change in Fiber During Cracker Making

Flour Type	Fiber		
	Soluble	Insoluble	Total
Pastry			
1	54.1	−14.6	8.2
2	56.7	−22.3	6.5
3	15.4	−13.0	−1.6
4	28.7	0.7	13.8
Average	38.7	−12.3	6.7
SD	20.0	9.6	6.5
Bread			
1	38.8	27.3	32.5
2	63.5	25.9	42.4
3	22.7	6.0	12.5
4	88.6	28.0	48.3
5	72.0	− 6.9	20.7
6	52.8	46.5	48.1
Average	56.4	21.1	34.0
SD	23.6	18.8	15.1

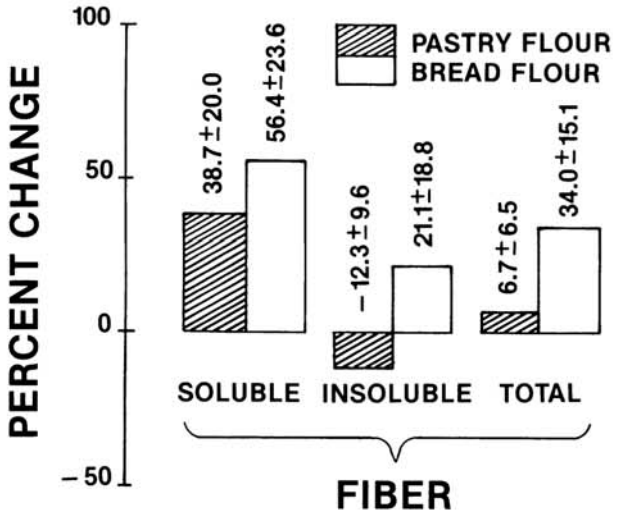

Fig. 1. Percent change (increase or decrease) in fiber during cracker making.

illustrated Figure 1. The nature of this change remains to be elucidated, but the contrasting behavior of two types of flours is an interesting observation.

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