NOTE ON SEED COAT EFFECTS ON COLOR AND FLAVOR OF FABABEAN FLOURS

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Flour from fababeans (*Vicia faba* L. var. minor (Peterm) Beck) offers a new protein source for use in human foods. Nutritional and flavor characteristics[1] appear comparable to soy flour (1). However, foods containing fababean flour have been criticized for the gray color which appears after cooking and for bitter, dried-pea flavor characteristics (2). Fababean flour, a protein concentrate, and a starch-rich fraction have been produced by a dry-milling process which included dehulling, grinding, and air classification (3,4).

Color measurements on cooked pastes from fababean flour fractions indicated that residues of seed coat or hull may contribute to the discoloration (5). This note describes the effect of milling method on color and the effect of hull increments on color and flavor of fababean flour.

MATERIAL AND METHODS

The fababean samples examined represented flour from two varieties and two

[1]M. Vaisey and M. Chan. Unpublished data.

pilot-plant milling procedures: pinmilled flour, courtesy of the Prairie Regional Laboratories, National Research Council, Saskatoon, Canada (mainly var. Ackerperle), and roller-milled flour, courtesy of the Plant Science Department, University of Manitoba ((a) mainly var. Ackerperle, (b) var. Diana). The roller-milling process, recently described by Watson *et al.* (4), enables the production of flour free from seed coat. In addition, a sample of the Diana variety was manually dehulled and ground to 100 mesh ($\leqslant$ 150 μ). Diana seed coats recovered from pinmilling were cleaned, ground to 100 mesh, and used as hull increments.

Pastes were made from 8% fababean flour-in-water slurries cooked 90 sec with intermittent stirring in a household-style microwave oven (Litton, Model 500 PB, 2450 MHz, 1200 Watts). Color measurements were carried out on the cooked pastes within 2 hr of preparation, using a Hunterlab Model D 25 Color Difference Meter. The white tile, with the tristimulus values L = 93.8, a = −1.1, and b = 2.3, was used as standard. Overall color was described as:

TABLE I
Effect of Different Dehulling Procedures on the Color of Cooked Pastes from Fababean Flour (Mean of Three Replications)

Fababean Hull Removal Method (8% Solids w/w)	Hunter Values[x]			
	L	a	b	ΔE
	100=white 0=black	Pos.=red neg.=green	Pos.=yellow neg.=blue	High=more color low=less color
Manual (Diana)	57[a]	−5.5[a]	13.2[a]	38[a]
Roller-mill (Diana)	59[a]	−5.2[a]	12.2[a]	37[a]
Roller-mill (Ackerperle)	59[a]	−5.0[a]	12.3[a]	36[a]
Pinmill (Ackerperle)	51[b]	−2.6[b]	5.9[b]	43[b]
Wheat flour	74[c]	−4.2[c]	11.8[a]	22[c]

[x]Values not bearing the same superscript are significantly different ($P<0.01$), where error variance for L = 0.25 with 8 degrees of freedom; for a = 0.08, 8; for b = 0.69, 8; and for ΔE = 0.53, 8.

TABLE II
Effect of Hull on the Flavor Intensity of Fababean Flour

Sample (2% Solids w/w)	Mean Flavor Intensity[x] (N= Eight Judges × Three Replications) (Higher = Stronger)
Manually dehulled Diana flour	0.62[a]
Pinmilled Ackerperle flour	0.64[a]
Pinmilled Ackerperle flour + 1% 100-mesh hull	0.74[a]
Manually dehulled Diana flour + 1% 100-mesh hull	0.76[a]
100% Hull, raw	2.41[b]
100% Hull, cooked	2.61[b]

[x]Values not bearing the same superscript are significantly different ($P<0.01$) where error variance = 0.151 with 94 degrees of freedom.

$$\Delta E = \sqrt{(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2}$$

in comparison to the white standard.

A taste panel of eight adult females, selected from 12 candidates on the basis of their abilities to discriminate flavor differences among fababean flour fractions (6) and to show scoring consistency, was chosen for sensory work. This panel was trained to use the sensory method of magnitude estimation. All samples were prepared for tasting as 2% flour/water slurries. All slurries were in the raw form except for the 2% hull/water samples, where both raw and cooked samples were tasted. Unpublished work conducted at this laboratory has shown no difference in flavor strength between raw and cooked fababean flour samples.[1] The samples were presented in orders randomized for each judge and the test was replicated

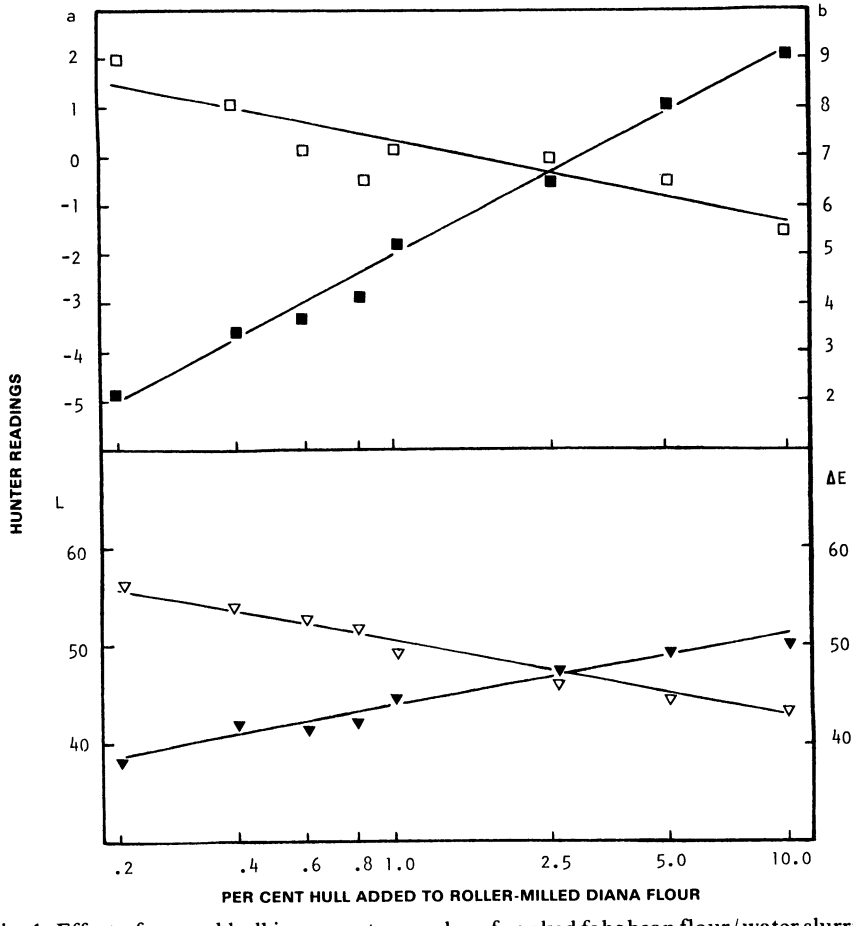

Fig. 1. Effect of ground hull increments on color of cooked fababean flour/water slurries: ■—■ a = −2.10 + 4.23 (log % hull), r = .995; □—□ b = 7.28 + 1.60 (log % hull), r = .884; ∇—∇ L = 50.50 − 7.71 (log % hull), r = .985; and ▼ ▼—ΔE = 43.86 + 7.14 (log % hull), r = .978.

three times. Each flavor score represents how much stronger the overall flavor of the coded sample was judged to be in relation to the flavor strength of an identified reference sample of pinmilled flour. A coded reference was included in the sample series to estimate the "error of expectation" of difference implicit in this method. For statistical analysis, the sensory data were normalized to reduce inter-judge variability.

RESULTS AND DISCUSSION

Table I shows the Hunter values of cooked fababean slurries in response to different dehulling practices. Manually dehulled and roller-milled flour yielded cooked pastes with almost identical color patterns. Pinmilled flour which obviously contained hull remnants showed a lower L-value and more total color represented by a higher ΔE-value. Although the a- and b-values of pinmilled flour were different from the other three samples, the predominant visual difference was increased grayness; the hue of all flours was yellow-green. The Hunter values of unbleached wheat flour are shown for comparison. All the fababean samples differed mainly in the lightness, L-value, and in total color from wheat sample; however, the pinmilled sample was the darkest.

Increasing the amount of ground fababean hull (0.2–10%) in the roller-milled Diana flour increased the discoloration in the cooked pastes (Fig. 1). The Hunter a- and ΔE-values showed linear increases, and the L- and b-values showed linear decreases, when plotted against log hull concentration.

The discoloration of cooked fababean flour pastes might be useful as an indicator of hull remnants. Based on the relationship between the Hunter a-values and the hull increments, the amount of hull remnant in the pinmilled flour (Table I) was calculated to be 0.76%. Using the fiber content as indicator (4), a value of 0.72% would be expected.

Hull residues at levels likely to be encountered in pinmilled flour appeared to have little effect on the flavor of raw fababean flour (Table II). While the flavor score for the manually dehulled flour was the lowest, there were no significant differences in flavor score as hull residue increased due to pinmilling or to the addition of 1% ground hull. Hull/water slurries were significantly stronger in flavor than flour/water slurries, but there was no effect on flavor intensity after cooking.

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