NUTRITIVE PROFILE OF YELLOW-SEEDED CANOLA/RAPESEED

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ABSTRACT

Nutritive characteristics of the meals derived from yellow-seeded strains/cultivars (34 different samples) of *Brassica* species (incl. *B. napus*, *B. juncea*, *B. rapa*, and *B. carinata*) were determined. The evaluation included detailed chemical analyses (protein, dietary fiber, carbohydrate, minerals, phenolics) as well as in vitro digestibility estimates of protein and extract viscosity measurements. On average, in comparison to brown-seeded type, yellow-seeded canola/rapeseed was shown to contain more protein (44.5% vs 42.7%), more sucrose (8.7% vs 7.5) and less dietary fiber (27.7% vs 33.6%). It may be surmised that future cultivars of yellow-seeded canola will have improved nutritive value.

INTRODUCTION

Canola meal is a high quality protein supplement but its use in diets for livestock and poultry is limited by its low available energy and low digestible protein contents (Bell, 1993). Efforts to breed for yellow-seed coat in canola are, therefore, justified as a means to improve the meal quality without compromising oil content in the seed. This could be achieved by increasing seed protein and decreasing seed fiber, with a resultant potential improvement in the available energy and amino acid contents of the meal.

Earlier research which involved a number of *B. rapa* (=*campestris*) samples showed limited advantage of the yellow-seeded characteristic with regard to dietary fiber content and nutritive value of the meal (Slominski et al., 1994). The first commercial meal from fully yellow-seeded *B. rapa* (cv. Parkland) which was low in protein and high in fiber contained only similar metabolizable energy (TMEn) and amino acid (AA) digestibilities in comparison to conventional canola meal (Table 1).

Table 1. Quality Characteristics of Commercial Canola Meals

Type of meal	Protein	Dietary	TMEn	Digestibility (%)	
	(%)	fiber (%)	(MJ/kg)	DM	AA
Brown-seeded	37.9	32.2	9.71	63.5	81.2
Yellow-seeded	36.7	32.9	9.57	64.5	82.4

A relatively new initiative in plant breeding has been the development of a canola quality type of *B. juncea*. Under western Canadian conditions, *B. juncea* suffers less from heat and drought stress, matures earlier and yields more oil than *B.napus* (Rakow and Raney, 1993). Another advantage of *B. juncea* is its pure yellow seedcoat. It is only recently that plant breeders have been able to incorporate the yellow-seed character into the agronomically important *B. napus* canola. Because of these developments, a comprehensive evaluation of the nutritive profiles of the meals derived from a number of yellow- and brown-seeded *Brassica* genotypes has been undertaken. The evaluation involved the analysis of protein, dietary fiber, carbohydrates (ie. sucrose, oligosaccharides) and ash. The seed samples represented brown- and yellow-seeded cultivars/strains of *B. napus* (3 brown and 3 yellow), *B. juncea* (1 brown, 16 yellow), *B. rapa* (2 brown, 6 yellow) and *B. carinata* (1 brown, 1 yellow). Further evaluation for soluble dietary fiber, digestible protein, soluble phenolics, and extract viscosity was conducted on selected *Brassica* seed meal samples.

EXPERIMENTAL

In contrast to our earlier work (Slominski et al., 1994), recent results demonstrated more favourable characteristics for yellow-seeded canola/rapeseed in comparison to brown-seeded counterparts (Table 2).

Table 2. Protein, Carbohydrate and Dietary Fiber Content of Meals Derived from Brown- and Yellow-Seeded *Brassica* Species (% of Dry Matter).

Species/ seed color	Number of samples	Protein[3]	Sucrose	Oligo-saccharides[1]	Dietary fiber[2]
Brassica napus					
Brown	3	42.6[b]	8.3[a]	3.0[a]	34.1[a]
Yellow	3	46.3[a]	9.7[a]	3.3[a]	27.5[b]
Brassica rapa					
Brown	2	40.5[a]	7.1[b]	2.5[a]	35.0[a]
Yellow	6	41.1[a]	9.9[a]	2.6[a]	28.5[b]
Brassica juncea					
Brown	1	41.4	7.0	2.0	35.1
Yellow	16	44.9	8.3	2.0	27.8
Brassica carinata					
Brown	1	48.8	6.1	1.7	27.6
Yellow	1	52.6	6.8	1.6	21.9

[1]Includes raffinose and stachyose; [2]Includes non-starch polysaccharides, lignin, polyphenols, cell wall protein and ash; [3]N x 6.25; [a,b]Values within *B. napus* or *B. rapa* species with no common superscripts differ significantly ($P<0.05$).

On average, yellow-seeded canola/rapeseed was shown to contain more protein (44.5% vs 42.7) and sucrose (8.7% vs 7.5%) but similar amounts of oligosacharides (2.3% vs 2.5%) and minerals (6.9% vs 7.0%). Total dietary fiber averaged 28% for yellow-seeded samples (Min 22%, Max 32%) and 33% for brown-seeded canola (Min 28, Max 36%) and was negatively correlated with protein content. In this regard, the highest correlation coefficients were found for *B. napus* (Fig. 1) and *B. juncea* (Fig. 2).

Fig. 1. Fiber vs. Protein Regression of *Brassica napus*

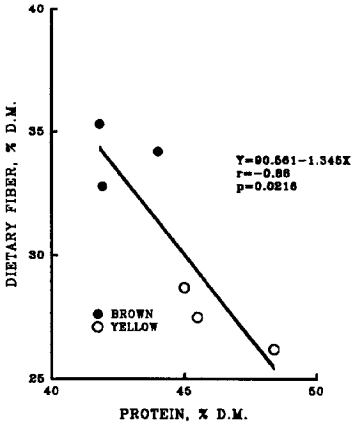
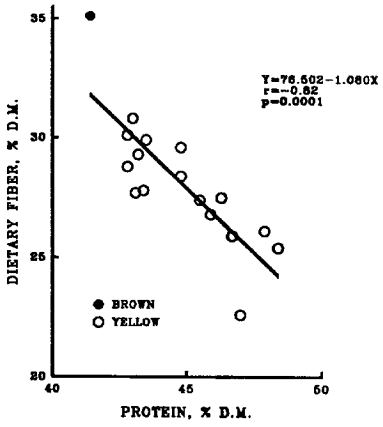


Fig. 2. Fiber vs. Protein Regression of *Brassica juncea*



Lower fiber content in yellow-seeded samples as compared to brown-seeded samples was reflected in lower content of lignin and polyphenols (4.3% vs 8.2%) and wall-inserted protein (2.3% vs 3.3%) and minerals (0.7% vs 2.4%) associated with the cell walls. The soluble dietary fiber content, as determined under the simulated environment of the gastrointestinal tract, averaged 1.9% (Min 1.2%, Max 2.6) and represented a small proportion (4-8%) of the total dietary fiber present in the samples. It should be noted that the soluble fiber values determined for the *Brassica* seed meals are similar to that of wheat and are much lower than those of barley or rye. Digestible protein content averaged 61% (Min 47.1 %, Max 73.7 %) with no differences between brown- and yellow-seeded samples. No relationship ($r=0.11$) was evident between total dietary fiber content and in vitro protein digestibility. In addition, digestible protein was not correlated with water-soluble fiber ($r=0.04$) or soluble phenolics ($r=-0.08$). Thus, it could be suggested that the major effect of dietary fiber on the nutritive worth of canola meal may be due to a nutrient dilution rather than an antinutritive effect, per se. Extract viscosity, however, was negatively correlated with digestible protein content ($r=-0.62$) but it is unclear which component(s) of canola meal contributed to this relationship since water-soluble fiber showed no correlation with extract viscosity ($r=-0.06$).

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