Feeding hogs extruded and expeller-pressed *B. juncea* canola cake

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Take Home Message

Brassica juncea is a yellow-seed canola cultivar with a thinner seed coat and therefore lower fibre. However, _B. juncea_ has more than double the glucosinolate content of conventional canola (_B. napus_). Glucosinolates are bitter tasting compounds that may reduce feed intake. We thought that extrusion prior to expeller-pressing (EEP) could reduce their antinutritional effects. We therefore fed increasing levels (0, 5, 10, 15 or 20%) of extruded and expeller-pressed _B. juncea_ cake to hogs from 38 kg to market weight. Each 5% increase in EEP _B. juncea_ canola cake inclusion linearly reduced feed intake by 46 g/d, weight gain by 8 g/d, carcass weight by 440 g, and loin depth by 0.6 mm, but did not affect feed:gain, dressing percentage, backfat thickness, lean yield, or carcass index. Extrusion prior to expeller pressing did not lessen the bitterness of a specific glucosinolate (3-butenyl) that is particularly high in _B. juncea_ canola. We therefore recommend feeding hogs not more than 5 to 10% _B. juncea_ cake, depending on cake cost. In contrast to these results, we have previously fed hogs up to 30% conventional, solvent-extracted canola meal without reducing growth performance or carcass traits.

Why *B. juncea* canola?

Yellow-seeded *Brassica juncea* has recently been labelled the third canola specie in Canada. *B. juncea* has agronomic advantages over conventional, dark-seeded *B. napus*. It matures earlier, is more thermo-tolerant and disease resistant, and it can be combined straight without the pods shattering. It is best suited for the warmer, lower rainfall, Brown and Dark Brown soils of the Prairies, where currently little canola production exists. *B. juncea* has a thinner seed coat and therefore lower fibre content than *B. napus*. Lower fibre content means one could feed greater inclusions to pigs. However, *B. juncea* has at least double the glucosinolate content of *B. napus* canola. Glucosinolates are bitter compounds that may reduce feed intake, and affect thyroid, liver, and kidney functions.

Extrusion and expeller-pressing

Extrusion compresses feedstocks using a large screw within a cylindrical barrel through a die-end nozzle. The decreasing channel width between the screw and barrel combined with narrowing of the screw thread creates shearing force, high pressure, and generates heat to partially cook feedstuffs. Shearing disrupts cell wall structures (fibre) that trap nutrients, increasing protein denaturation, fat solubility, and mineral availability. Extrusion therefore improves the digestibility of feedstuffs protein, fat, and phosphorus for animals. Extrusion of canola seed prior to expeller pressing could further heat up and cook glucosinolates rendering them harmless. Expeller pressing canola seed is similar to conventional processing of canola meal, except that the last

step, solvent-extraction, is not carried out. If seed is expeller-pressed rather than solvent-extracted, oil remains in the cake increasing its feed energy value. Greater oil content in expeller canola cake implies less need for costly fat or liquid oil supplementation in feeds to meet the energy requirements of pigs. We therefore thought that expeller-pressing combined with prior extrusion (EEP) of *B. juncea* canola seed might be beneficial for swine feeding.

Nutrients in EEP *B. juncea* canola cake

The *B. juncea* canola seed was sourced from southern Saskatchewan with the help of Viterra. The seed was extruded and expeller-pressed at Apex Nutri-Solutions Inc., Edgbert, AB. The ground cake was then trucked to Sunhaven Feed Mill at Irma, AB where

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Figure 1. Increasing extruded and expeller-pressed B. juncea canola cake inclusion in hog diets from 38 kg until slaughter weight (120 kg) linearly decreased overall daily feed disappearance and weight gain, but did not affect feed:gain.

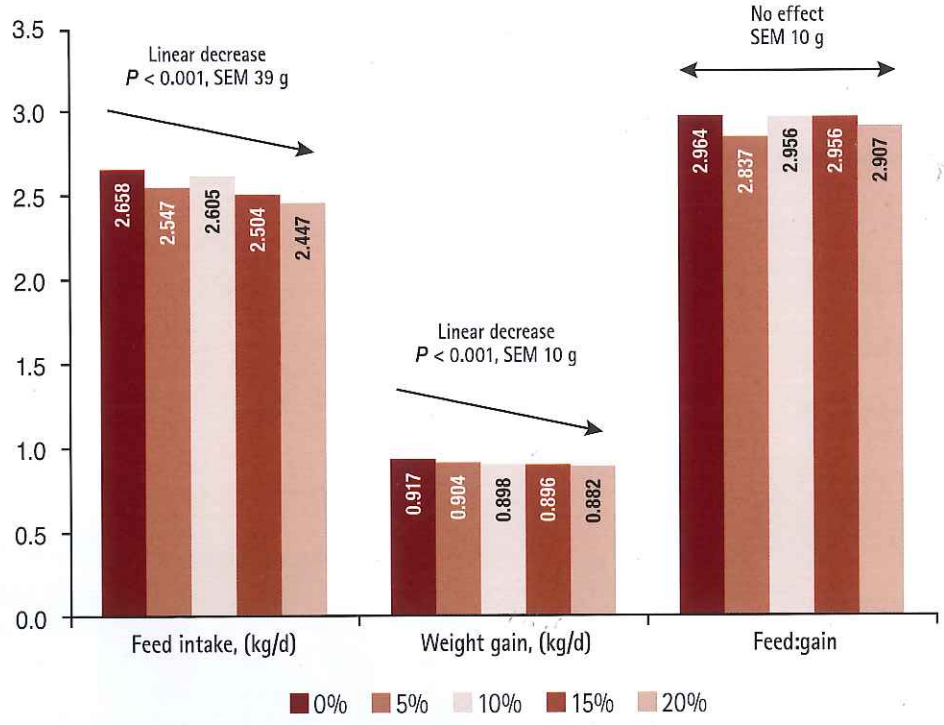

Table 1. Farm ship weight, carcass characteristics and days on trial of hogs fed increasing inclusions of extruded and expeller-pressed *B. juncea* canola cake with 17% remaining oil.

	EEP *B. juncea* canola cake (%)						*P*-value
	0	5	10	15	20	SEM	Linear[a]
Farm ship weight, kg	123.7	122.1	122.8	122.3	121.9	0.6	0.02
Warm carcass weight, kg	96.3	94.0	94.8	94.2	94.0	0.9	0.04
Dressing	0.79	0.78	0.78	0.78	0.78	0.7	0.65
Backfat, mm	16.3	15.8	16.2	16.2	15.8	0.3	0.49
Loin depth, mm	60.5	60.9	60.3	58.6	58.8	0.6	<0.01
Lean yield, g/kg	616	619	617	616	618	2.0	0.98
Index	109.5	109.7	109.0	109.0	110.2	0.5	0.69
Days on trial	95.4	94.7	95.7	97.4	96.8	0.6	<0.01

[a] If the *P*-value is less than 0.05, it means that there was a linear increase or decrease with each 5% canola cake inclusion.

the test diets were mixed. The EEP *B. juncea* canola cake fed provided 34% crude protein, 17% fat, and 6% fibre. Lysine content was 1.72% with lysine availability of 1.57%. The total glucosinolate content was considered high (10.9 vs. 5 µmol/g in conventional meal), 9.7 µmol/g being 3-butenyl.

Growing-finishing pig trial

We were interested in comparing the growth performance, carcass characteristics, and jowl fatty acid profile of hogs fed 0, 5, 10, 15 and 20% EEP *B. juncea* canola cake under commercial conditions. In total, 880 pigs with an initial body weight of 38 kg were housed in 40 pens, 22 pigs per pen, and had free access to 1 of 5 mash feed regimens until slaughter (120 kg). Test diets were best-cost formulated to provide 2.3 Mcal/kg NE and 4.2, 3.8, 3.6, 2.9 and 2.9 g standardized ileal digestible (SID) lysine/Mcal NE for Grower 1 (d 0 – 14), Grower 2 (d 15 – 35), Grower 3 (d 36 – 56), Finisher 1 (d 57 – 74), and Finisher 2 (d 75 to market weight) phases, respectively. Grower 1 and 2 diets included 25% and Grower 3, Finisher 1 and 2 diets included 20% of wheat distillers dried grains with solubles (DDGS). Increasing EEP *B. juncea* canola cake inclusions substituted lentil, soybean meal and barley grain in diets that were balanced for energy and amino acids for each growth phase.

Trial results

Increasing EEP *B. juncea* canola cake inclusion in the feed linearly reduced pig body weight at d 14, 35, 56, 74 and 85. Pigs fed 20% of EEP *B. juncea* canola cake were 2.7 kg lighter than controls at d 85. For the entire trial, each 5% increase in dietary EEP *B. juncea* canola cake inclusion linearly reduced feed intake by 46 g/d and weight gain by 8 g/d, but did not affect feed:gain (Figure 1).

Each 5% increase in dietary EEP *B. juncea* canola cake inclusion linearly reduced carcass weight by 440 g and loin depth by 0.6 mm, but did not affect dressing percentage, backfat thickness, lean yield, or carcass index (Table 1). Pigs fed 20% EEP *B. juncea* canola cake reached slaughter weight 1.4 d after controls fed no canola cake.

Canola seed is high in unsaturated oil. Feeding unsaturated fats to pigs reduces the firmness of pork fat. Soft pork fat causes miscuts during pork deboning and reduces the quality of processed pork products (i.e., oily sausage, mushy patties, stretchy raw bacon that shrinks too much at cooking). Therefore, pork fat quality should be considered when feeding high oil feedstuffs to hogs. In our experiment, increasing EEP *B. juncea*

canola cake inclusion linearly reduced saturated fat content, whereas it increased mono- and polyunsaturated fat content in jowl fat. Iodine value, an indicator of overall fat firmness (lower values are better and indicate more firmer fat in the carcass), increased linearly with increasing of EEP *B. juncea* canola cake inclusion, but it did not exceed the 70-75 g/100 g fat that it is still considered as acceptable pork fat firmness.

Cost vs. benefit analysis

At the same cost per kg of cake, increasing EEP *B. juncea* canola cake feed inclusion increased average diet cost. However, feed cost per kg of body weight gain was lower for all diets including EEP *B. juncea* canola cake versus the control diet. Gross revenue margin per hog after subtracting feed cost was highest feeding diets containing 5% EEP *B. juncea* canola cake.

Conclusions and recommendation

The results of this commercial-scale trial indicate that feeding increasing inclusions of up to 20% of EEP *B. juncea* canola cake to hogs linearly reduced overall growth performance. The reduction in weight gain observed could be explained by reduced feed intake. Thus, it cancelled out the beneficial effects from reduce fibre and increased feed energy due to the 17% remaining oil content in EEP *B. juncea* canola cake. Because backfat and lean yield were not affected, we attributed the reduced feed intake to a specific glucosinolate that tested high in EEP *B. juncea* canola cake. This glucosinolate (3-butenyl) is known to be bitterer than others found in conventional *B. napus* canola. Extrusion prior to expeller pressing of *B. juncea* canola cake did not lessen the negative effects of glucosinolates on hogs.

Increasing feed inclusions of EEP *B. juncea* canola cake increased unsaturated fatty acids in jowl fat, but did not compromise pork fat firmness. Due to the reduced feed intake, weight gain, and carcass weight, we recommend feeding not more than 5 to 10% extruded and expeller-pressed *B. juncea* canola cake to hogs, depending on cake cost. In contrast to these results, we have previously shown that hogs perform fine when fed up to 30% conventional, solvent-extracted canola meal (Western Hog Journal 2011, Vo. 32, No. 3 pp. 39-43).

Acknowledgments

We thank Calvin Boese and his team at Apex Nutri-Solutions Inc. for extruding and expeller pressing the seed. Special thanks to John and Neil Burden and Tanya Hollinger for caring for the pigs. We thank Sunhaven Farms for the use of their hogs, providing the feed, and mixing the test diets. Funding was provided by the Canadian Swine Research and Development Cluster (CSRDC) established within the Growing Canadian Agri-Innovation Program – Canadian Agri-Science Cluster Initiative of Agriculture and Agri-Food Canada. ■