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Feeding *Brassica juncea* or *Brassica napus* canola meal at increasing dietary inclusions to growing-finishing gilts and barrows

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ABSTRACT

Novel *Brassica* (*B.*) *juncea* has a thinner seed coat and therefore lower fibre content than conventional *B. napus* canola meal (CM) and could potentially be fed at greater dietary inclusions to pigs. In a 2 × 2 × 3 factorial arrangement, 528 barrows and 528 gilts [33.6 kg body weight] housed in 48 pens (22 barrows or gilts) were fed either *B. juncea* or *B. napus* CM at 100, 200 or 300 g/kg of diet with up to 200 g/kg wheat DDGS to slaughter weight (120 kg). Compared with *B. napus*, *B. juncea* CM had 32 g/kg greater CP, 12 g/kg lower crude fat, 86 g/kg lower ADF, and 91 g/kg lower NDF content. However, aliphatic glucosinolate content was 2.7 times greater in *B. juncea* (11.76 μmol/g) than *B. napus* CM (4.34 μmol/g). For the entire trial (d 0–72), daily weight gain (ADG) was not affected by canola species, but feed disappearance (ADFI) was 45 g/d lower ($P = 0.06$) and feed efficiency 7 g/g greater ($P < 0.05$) for pigs fed *B. juncea* than *B. napus* CM. Carcass traits were not affected by canola species except dressing, which was 1% lower ($P < 0.05$) for pigs fed *B. juncea* than *B. napus* CM. For the entire trial, increasing CM inclusion from 100 to 300 g/kg of diet decreased ADFI ($P < 0.001$) by 184 g/d, decreased ADG by 32 g/d ($P < 0.05$), but increased feed efficiency ($P < 0.001$) by 14 g/g. Dietary CM inclusion level did not affect farm ship live weight to slaughter, carcass backfat thickness, lean yield, or index. Nonetheless, carcass weight was 0.9 kg lower ($P < 0.05$), dressing was 1% lower ($P < 0.001$), loin depth was 1.3 mm lower ($P < 0.01$), and days to slaughter was 2.3 days greater for pigs fed 300 compared with those fed 100 g CM/kg diet. In conclusion, growing-finishing pigs can be fed diets including *B. juncea* CM the same as conventional *B. napus* CM without decreasing growth performance or carcass traits. Feeding growing-finishing pigs a diet with 300 vs. 200 or 100 g/kg CM with up to 200 g/kg of wheat DDGS resulted in decreased weight gain and a minor decrease in carcass weight, dressing and loin depth, but increased feed efficiency.

Abbreviations: AA, Amino acids; ADF, acid detergent fibre; ADFI, average daily feed disappearance; ADG, average daily weight gain; *B.*, *Brassica*; BW, body weight; CF, crude fibre; CM, canola meal; CP, crude protein; DDGS, distillers dried grains with solubles; DM, dry matter; G:F, feed efficiency (ADG/ADFI); NDF, neutral detergent fibre; NE, net energy; SID, standardised ileal digestibility; TDF, total dietary fibre.

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1. Introduction

Conventional solvent-extracted canola meal (mostly *Brassica* [*B.*] *napus*) can substitute soybean meal in growing-finishing pig diets to reduce feed cost (Woyengo et al., 2014). However, *B. napus* canola meal (CM) contains more fibre and therefore a lower energy value than soybean meal (Newkirk, 2009). Other alternative feed ingredients like distillers dried grain with solubles (DDGS) and wheat millrun, also high in both fibre and protein content, are increasingly common in swine diets. Reducing the fibre content of canola meal would permit feeding greater inclusions in growing-finishing pig diets in combination with high inclusions of other alternative feed ingredients to complement dietary amino acid balance and further reduce feed cost (Hickling, 2007).

Compared with conventional CM, yellow-seeded *B. juncea* CM contains more protein and phosphorus and less fibre due to a thinner seed coat (Khajali and Slominski, 2012). Nutrient digestibility of *B. juncea* CM is greater than that of *B. napus* CM likely because of its lower fibre content (Bell et al., 1998; Trindade Neto et al., 2012). Therefore, dietary inclusions of *B. juncea* CM could potentially be higher than conventional CM in swine diets. However, glucosinolate content of *B. juncea* is 2–3 times greater than that of *B. napus* CM. It contains more 3-butenyl (gluconapin), a glucosinolate with a more bitter taste than those in conventional CM (Bell et al., 1998; Landero et al., 2013). Therefore, the advantage of reduced fibre content may be compromised by decreased palatability of *B. juncea* CM. To date, no research has evaluated the effects of feeding *B. juncea* CM on growth performance, dressing, and carcass characteristics of growing-finishing pigs, and no comparison has been made to *B. napus* CM.

The hypothesis tested in our study was that barrows and gilts fed increasing dietary inclusions of either *B. juncea* or *B. napus* CM and high levels of DDGS would have similar growth performance, dressing and carcass traits if fed diets formulated to equal net energy (NE) and standardised ileal digestible (SID) amino acid (AA) content. The objectives of the study were therefore to compare the growth performance, dressing, and carcass characteristics of growing-finishing barrows and gilts fed 100, 200 or 300 g/kg *B. napus* or *B. juncea* CM in diets with up to 200 g/kg wheat DDGS.

2. Materials and methods

The animal use and study procedures were reviewed by the University of Alberta Animal Care and Use Committee for Livestock, and followed principles established by the Canadian Council on Animal Care (CCAC, 2009). The study was conducted at a commercial farm that had a growing-finishing pig barn set up as a test facility (Lougheed, AB, Canada).

2.1. Animals and housing

In total, 1056 cross-bred pigs [528 barrows and 528 gilts; PIC380 (PIC Canada, Winnipeg, MB, Canada) × Large White/Landrace (Line 277; Fast Genetics, Saskatoon, SK, Canada)] were involved. At approximately 65 d of age, pigs (initial BW 33.6 ± 1.1 kg) were randomly placed into 48 pens by sex, 22 pigs per pen. The flooring of each pen (6.1 m × 2.4 m) was fully slatted concrete, the siding was concrete panels with open slotting, and the front gate was made of polyvinyl chloride planking hinged at both ends. Each pen was equipped with 1 wet-dry feeder (model F1-115, Crystal Spring Hog Equipment, St. Agathe, MB, Canada) with two opposing feeding places located halfway along a sidewall. An additional water bowl drinker was located on the opposite sidewall towards the back of the pen. The room was ventilated using negative pressure and the temperature was maintained within the thermoneutral zone for pigs. Artificial light was provided for 14-h (0600–2000 h), followed by 10-h of darkness per day in the windowless barn.

2.2. Experimental design and diets

Pens were blocked by area of the barn and within block, pens of barrows or gilts were randomly allocated to be fed one of two CM species (*B. juncea* or *B. napus*), at one of three dietary inclusion levels (100, 200 or 300 g/kg), in a 2 × 2 × 3 factorial arrangement resulting in 16 pens per CM inclusion and 24 pens per species and sex. Test phase diets were fed on a budget basis to slaughter weight over 5 growth phases (Grower 1: d 0–16, Grower 2: d 17–37, Grower 3: d 38–52, Finisher 1: d 53–68, Finisher 2: d 69–balance). Both canola seed species were processed similarly at Bunge (Altona, MB, Canada) emphasising desolventizing at <100 °C. Wheat DDGS (Husky Energy; Lloydminster, SK, Canada) was included at a constant inclusion level across diets within growth phase (200 g/kg in Grower 1 and 2, 150 g/kg in Grower 3 and Finisher 1, and 50 g/kg in Finisher 2). Canola meal, either from *B. juncea* or *B. napus*, was substituted for wheat and crystal amino acids (Tables 1 and 2). Diets were formulated to provide 9.4 MJ/kg NE and 1.0, 0.9, 0.8, 0.7 and 0.7 g SID lysine/MJ NE for the 5 growth phases, respectively. The ratio of other amino acids to lysine was set as per ideal protein (NRC, 1998). Premixes were added to exceed vitamins and trace mineral requirements (NRC, 1998). Pigs had free access to water and the assigned phase diet in mash form.

2.3. Measurements and calculations

A robotic feeding system (Feed Logic, Feed Logic Co., Willmar, MN) delivered and electronically tracked the amount of assigned diet fed to each pen. Pigs were weighed on a pen basis at the initiation of feeding the experimental diets (d 0)