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Feeding increasing inclusions of canola meal with distillers dried grains and solubles to growing-finishing barrows and gilts

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ABSTRACT

The effect of feeding increasing inclusions of solvent-extracted canola meal (CM) in diets including a relatively high content (150 g/kg) of co-fermented wheat and corn (70:30) distillers dried grains with solubles (DDGS) on diet nutrient digestibility, growth performance, dressing and carcass traits of pigs was evaluated in a commercial-scale study. In total, 550 barrows and 550 gilts [29.9 ± 0.2 kg body weight] housed in 50 pens (22 barrows or gilts) were fed one of 5 dietary regimens over 5 growth phases (3 grower and 2 finisher). Canola meal (0, 60, 120, 180 or 240 g/kg) replaced barley, soybean meal and field pea in diets formulated to equal net energy (NE; 9.7, 9.7, 9.6, 9.4 and 9.4 MJ/kg) and standardized ileal digestible (SID) lysine content (10.9, 9.9, 7.6, 6.7 and 6.2 g/kg). Considering all 5 growth phases, dietary crude protein (CP), crude fibre, acid detergent fibre and neutral detergent fibre increased 13.7, 3.4, 8.2 and 5.8 g/kg, respectively, per each 60 g/kg increase in CM inclusion. Increasing dietary CM inclusion by 60 g/kg decreased ($P > 0.05$) the apparent total tract digestibility coefficient of gross energy, CP, dry matter, organic matter and ash by 0.01, 0.004, 0.02, 0.01 and 0.04, respectively. For the entire trial (d 0 to 90), increasing dietary CM inclusion by 60 g/kg linearly reduced ($P < 0.05$) feed intake (ADFI) by 19 g/d and weight gain (ADG) by 7.4 g/d. Increasing dietary CM inclusion resulted in a quadratic response on G:F (ADG/ADFI; $P < 0.05$). Pigs fed 240 g/kg attained slaughter weight (120 kg) 3 days after pigs fed 60 g/kg CM (linear; $P < 0.05$). Increasing dietary CM inclusion in diets including 150 g/kg DDGS did not affect carcass weight, dressing, backfat thickness, loin depth, estimated lean yield, or index. In conclusion, increasing dietary CM inclusion from 0 to 240 g/kg in grower-finisher diets including 150 g/kg DDGS had only a minor effect on overall growth performance and did not affect carcass traits of barrows and gilts.

Abbreviations: ADF, acid detergent fibre; ADFI, average daily feed intake; ADG, average daily weight gain; BW, body weight; CATTD, coefficient of apparent total tract digestibility; CM, canola meal; CP, crude protein; DDGS, distillers dried grains with solubles; DE, digestible energy; DM, dry matter; GE, gross energy; G:F, feed efficiency (ADG/ADFI); NDF, neutral detergent fibre; NE, net energy; OM, organic matter; SID, standardised ileal digestible.

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1. Introduction

Global supply and demand of protein meals fluctuate affecting feed cost, the main cost of pig production, which greatly impacts pork producers' profitability. Soybean meal is the most popular supplemental protein meal worldwide (Cromwell, 2000). Thus the price of soybean meal is the main factor affecting pricing of supplemental protein meals in cool climate countries like northern Europe and Canada where soy production is limited due to heat units. Pricing of locally grown canola meal (CM), field pea, meat and bone meal, and even distillers dried grains with solubles (DDGS) is set based on their protein content relative to soybean meal. However, the dynamics of protein meals pricing are changing due to the rapid growth of the biofuel industry and expanding canola crushing capacity in northern Europe and western Canada [Canola Council of Canada (CCC), 2009].

Both CM and wheat DDGS are high-protein, high-fibre co-products, which may limit their utilization by monogastric animals (Widyaratne and Zijlstra, 2007). Traditional feed inclusion rates of canola meal in pig diets were set at cautious levels that would not compromise growth performance (Baidoo et al., 1986, 1987a, 1987b; McIntosh et al., 1986). However, greater inclusions are likely possible based on modern NE instead of traditional DE feed formulation. Titration of canola meal inclusions in pig grower-finisher diets was also conducted prior to the expansion of the biofuel industry, when DDGS was not a relevant feed commodity (Beltranena and Zijlstra, 2010). Given the large availability and low cost of both co-products, there was a need to evaluate increasing canola meal inclusions together with a relatively high inclusion of DDGS in modern pig diets.

The null hypothesis of this study was that grower-finisher barrows and gilts fed increasing dietary inclusions of CM and including wheat DDGS would perform, dress and grade similarly to controls fed diets without canola meal. The objective of this study was therefore to evaluate the effects of increasing dietary inclusion of canola meal in grower-finisher diets containing 150 g/kg DDGS on diet nutrient digestibility, growth performance, dressing, and carcass characteristics of barrows and gilts.

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).

2.1. Animals and housing

In total, 1,100 cross-bred pigs [550 barrows and 550 gilts; PIC380 (PIC Canada, Winnipeg, MB, Canada) × Large White/Landrace (Line 277; Fast Genetics, Saskatoon, SK, Canada)] were involved. The study was conducted at a commercial contract pig grower farm that had one barn set up as a test facility (Lougheed, AB, Canada). At approximately 65 d of age, pigs (initial BW 29.9 ± 0.2 kg) were randomly placed into 50 pens by sex, 22 pigs per pen. The pens measured 6.1 × 2.4 m, the flooring was fully-slatted concrete, the siding was concrete panels with open slotting, and the front gate was made of polyvinyl chloride planks 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 dividing wall between pens. One water bowl drinker was located at the back of the pen. The room was ventilated using negative pressure and the temperature was maintained within the thermoneutral zone for the pigs. Artificial light was provided for 14-h (0600 to 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 the 5 dietary test regimens were randomly allocated to be fed to pens of pigs within sex and block, for a total of 10 pens per dietary regimen. The 5 dietary regimens (Tables 1 and 2) were fed to slaughter weight over 5 growth phases (Grower 1: d 0–21, Grower 2: d 22–43, Grower 3: d 44–64, Finisher 1: d 65–79, Finisher 2:d 80 to market weight). The control phase diets did not include canola meal. The 4 test phase diets included 60, 120, 180, or 240 g/kg solvent-extracted canola meal (ADM, Lloydminster, SK, Canada) in substitution for barley, soybean meal and field pea; the latter only in first 2 grower phase diets. Co-fermented wheat and corn DDGS (70:30, respectively; Husky Energy; Lloydminster, SK, Canada) was included at a constant rate (150 g/kg) across all diets within growth phase. Diets were least-cost formulated to provide 9.67, 9.67, 9.63, 9.42, and 9.42 MJ/kg NE and 10.9, 9.9, 7.6, 6.7 and 6.2 g SID lysine/kg for the 5 growth phases, respectively. The ratio of amino acids to lysine was set as per ideal protein (NRC, 1998). Premixes were added to exceed vitamins and trace mineral requirements (NRC, 1998) per growth phase. Pigs had free access to water and the assigned phase diet as a dry mash.

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 at the initiation of feeding the experimental diets (d 0) and on d 21, 43, 68, weekly thereafter, and at slaughter weight. Feed remaining in the pen feeder on weigh days was determined by levelling the