Animal Feed Science and Technology 170 (2011) 136–140

Contents lists available at ScienceDirect

Animal Feed Science and Technology

journal homepage: www.elsevier.com/locate/anifeedsci

Short communication

The effect of feeding solvent-extracted canola meal on growth performance and diet nutrient digestibility in weaned pigs

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ARTICLE INFO

Article history:
Received 17 September 2010
Received in revised form 5 August 2011
Accepted 8 August 2011

Keywords:
Canola meal
Digestibility
Performance
Weaned pig

ABSTRACT

The effects of feeding increasing levels of solvent-extracted canola meal in substitution for soybean meal as an energy and amino acid source were evaluated in 220 weaned pigs with an initial body weight of 8.1 ± 1.8 kg. Five pelleted wheat-based diets containing 0, 50, 100, 150 or 200 g canola meal/kg were formulated to contain 9.74 MJ net energy (NE)/kg and 1.21 g standardised ileal digestible (SID) lysine/MJ NE and were fed for 4 wk starting 1 wk after weaning at 19 days of age. Canola meal was added at the expense of soybean meal and the diets were balanced for NE using canola oil and for amino acids using crystalline lysine, threonine and tryptophan. Increasing inclusion of canola meal reduced linearly ($P<0.05$) the apparent total tract digestibility of energy, dry matter and crude protein and quadratically ($P<0.05$) the digestible energy content of diets. From 0 to 28 days on trial, increasing inclusion of canola meal did not affect body weight gain, feed intake and feed efficiency. In conclusion, up to 200 g solvent-extracted canola meal/kg can replace soybean meal in diets formulated to equal NE and SID amino acid content and fed to weaned pigs without detrimental effects on growth performance.

1. Introduction

Feed is the highest cost of pork production. Higher inclusion of protein feedstuffs other than soybean meal (SBM) into swine diets may reduce feed costs. Solvent-extracted canola meal (CM) is the main co-product of the canola seed crushing industry. Canola meal is lower in dietary energy and amino acid content than SBM and is sold at a discount relative to SBM.

In the past, feeding young pigs diets containing CM caused reduced growth performance compared with pigs fed diets containing SBM (Baidoo et al., 1986, 1987; McIntosh et al., 1986). However, in these previous experiments, diets were not formulated using modern feed formulation methods that are based on net energy (NE) and standardised ileal digestible (SID) amino acids and the CM likely contained more residual glucosinolates than meal produced currently. Indeed in a recent study (Seneviratne et al., 2011), the inclusion of 150 g CM/kg by partially removing SBM did not reduce weight gain of weaned pigs fed diets formulated to an equal NE and SID amino acid content although feed in take was reduced. The growth response of young pigs to CM was thus much better than anticipated based on historical evidence. Higher inclusion levels of CM, thus, required further investigation.

Abbreviations: ADFI, average daily feed intake; ADG, average daily gain; ATTD, apparent total tract digestibility; BW, body weight; CM, solvent-extracted canola meal; CP, crude protein; DE, digestible energy; DM, dry matter; G:F, feed efficiency; Lys, lysine; NE, net energy; SID, standardised ileal digestible; SBM, soybean meal.

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doi:10.1016/j.anifeedsci.2011.08.003

Table 1
Ingredient composition and analysed nutrient content (g/kg diet as fed) of experimental diets.

	Canola meal (g/kg diet)				
	0	50	100	150	200
Ingredient					
Wheat	578.6	572.8	567.0	561.0	555.2
Soybean meal, 460 g CP/kg	200.0	150.0	100.0	50.0	–
Canola meal, 340 g CP/kg[a]	–	50.0	100.0	150.0	200.0
Lactose	50.0	50.0	50.0	50.0	50.0
Canola oil	30.0	35.0	40.0	45.0	50.0
Soy protein concentrate, 560 g CP/kg	50.0	50.0	50.0	50.0	50.0
Herring fish meal, 700 g CP/kg	50.0	50.0	50.0	50.0	50.0
Limestone	9.1	9.1	9.1	9.1	9.1
Celite[b]	8.0	8.0	8.0	8.0	8.0
Mono/dicalcium phosphate	8.2	8.0	7.8	7.6	7.4
Vitamin premix[c]	5.0	5.0	5.0	5.0	5.0
Mineral premix[d]	5.0	5.0	5.0	5.0	5.0
Salt	5.0	5.0	5.0	5.0	5.0
L-Lysine HCl, 780 g/kg	–	0.8	1.5	2.3	3.0
L-Threonine, 990 g/kg	0.4	0.6	0.8	1.1	1.3
DL-Methionine, 990 g/kg	0.4	0.3	0.3	0.3	0.3
L-Tryptophan, 990 g/kg	–	0.1	0.2	0.3	0.4
Choline chloride, 600 g/kg	0.3	0.3	0.3	0.3	0.3
Analysed composition[e]					
Moisture	123	121	119	118	122
Crude protein	225	224	221	217	207
Crude fat	45	53	59	64	67
Crude fibre	22	24	27	29	32
Ash	61	62	62	63	60
Acid detergent fibre	37	45	48	56	59
Neutral detergent fibre	102	128	122	128	129
Gross energy (MJ/kg)	17.0	17.1	17.3	17.3	17.5

[a] Bunge Canada, Fort Saskatchewan, AB, Canada.
[b] Celite 281 (World Minerals Inc., Santa Barbara, CA, USA) used as acid insoluble ash.
[c] Supplied per kilogram of diet: 7500 IU of vitamin A, 750 IU of vitamin D, 50 IU of vitamin E, 37.5 mg of niacin, 15 mg of pantothenic acid, 2.5 mg of folacin, 5 mg of riboflavin, 1.5 mg of pyridoxine, 2.5 mg of thiamine, 4 mg of vitamin K, 0.25 mg of biotin and 0.02 mg of vitamin B_{12}.
[d] Supplied per kilogram of diet: 125 mg of Zn, 50 mg of Cu, 75 mg of Fe, 25 mg of Mn, 0.5 mg of I and 0.3 mg of Se.
[e] Diets were formulated to contain (as fed): 9.74 MJ NE/kg, 11.8 g SID lysine/kg, 4.2 g SID methionine/kg, 7.8 g SID threonine/kg and 2.6 g SID tryptophan/kg.

The hypothesis tested in the present study was that pigs offered diets containing up to 200 g CM/kg and formulated to an equal NE and SID amino acid content would have a growth performance and dietary nutrient digestibility similar to pigs fed diets without CM. The objectives were to determine whether a dose response existed for growth performance and apparent total tract digestibility (ATTD) coefficients of dietary energy and crude protein (CP) of weaned pigs fed diets containing 0 up to 200 g CM/kg.

2. Materials and methods

2.1. Experimental design and diets

The animal procedures were approved 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) and were conducted at the Swine Research and Technology Centre.

In total, 220 pigs (Duroc × Large White/Landrace F_1; Hypor, Regina, SK, Canada) were weaned at 19 ± 1 days of age, selected based on average daily gain (ADG) during the first 7 day post weaning and body weight (BW) on day 7 after weaning (8.1 ± 1.8 kg) and divided within gender into heavy and light BW. One heavy and one light barrow and gilt were placed randomly into one of 55 pens, for 4 pigs per pen. After weaning, pigs were fed commercial phase 1 and 2 diets for 7 days.

A wheat-based control diet and four diets containing 50, 100, 150 or 200 g CM/kg were formulated by replacing SBM with CM (Table 1). Diets without antimicrobials or growth promoters were formulated to provide 9.74 MJ NE/kg and 1.21 g SID lysine (Lys)/MJ NE with other amino acids formulated as an ideal ratio to Lys (NRC, 1998) using established NE (Sauvant et al., 2004) and SID AA (NRC, 1998) values. For CM, a content of 7.33 MJ NE/kg and 1.56 g SID Lys/kg were used for diet formulation, values based on measurements in our laboratory (data not shown). Acid-insoluble ash (Celite 281; World Minerals, Santa Barbara, CA, USA) at 8 g/kg was included in diets as an indigestible marker. Diets were mixed and steam pelleted at 70 °C (70 hp; California Pellet Mill, Crawfordsville, IN, USA).