Feeding lower than typical nutrient dense diets based on barley or wheat grain to weaned pigs

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Take Home Message

Weaned pigs fed barley-based diets grew 41 grams per day (g/day) faster and converted feed into gain six per cent more efficiently than those fed wheat-based diets. Diet nutrient density had no effect on growth performance, but lower than typical nutrient density reduced feed cost and cost per kilogram of gain. Producers could therefore consider lower nutrient density and including more barley in nursery diets as long as pigs are able to maintain feed intake.

Feeding low or high nutrient diets

Energy is the most expensive component of feed. Cereal grains, protein and fat sources provide most of the energy in diets accounting for approximately 90 per cent of feed cost. Thus, reducing oil (primary source of fat) inclusion and swapping wheat for barley grain (primary source of starch) may reduce nursery feed cost. As nutrients in diets are formulated in relation to energy, a further reduction in nutrient density and feed cost could be attained reducing the inclusion of specialty protein ingredients in nursery diets.

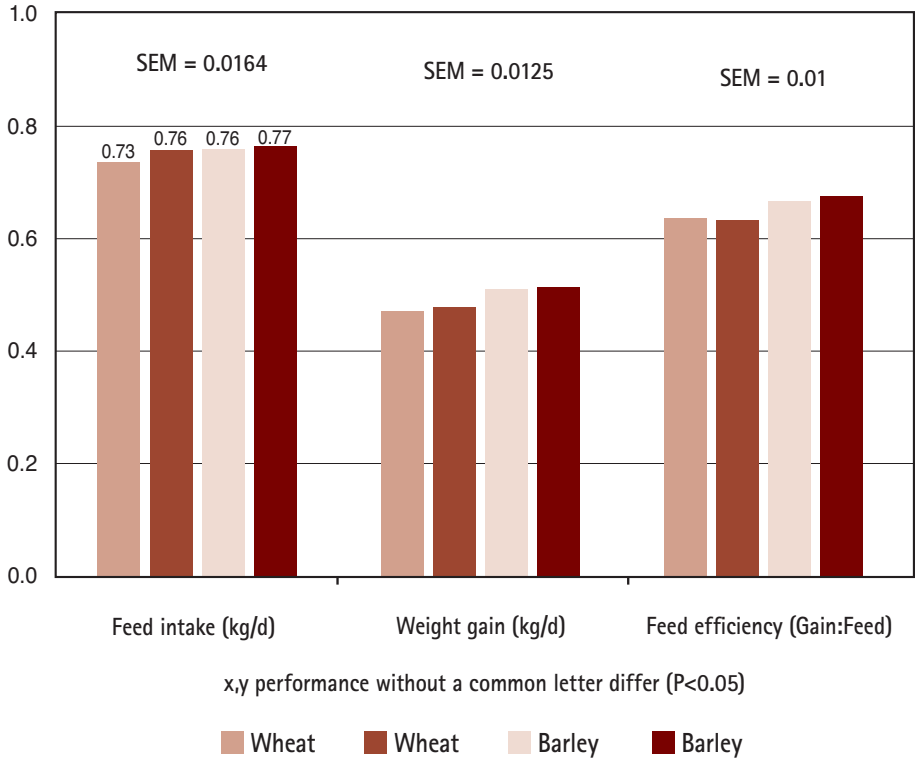
Barley is the third-most produced cereal grain in Canada after wheat and corn, with 65 per cent consumed domestically as feedstuff. Barley grain is the major dietary energy source for growing-finishing pigs and for beef cattle in western Canada, but concerns exist about feeding barley grain to weaned pigs. Its dietary energy value is lower than wheat or corn grain as it contains more fibre that may affect feed intake and thereby the growth of young pigs. However, previous studies showed that pigs can maintain or increase growth performance when barley replaced wheat, corn or oat groats. In the past, pig diets were not formulated using the net energy (NE) system that accounts for the greater heat production of pigs consuming fibrous feedstuffs. Nor were diets formulated based on standardised ileal digestible (SID) amino acids that better accounts for what pigs really absorb subtracting what gut microbes use up. Because of the potential for feed cost savings, we wanted to evaluate feeding lower than typical nutrient dense diets based on barley or wheat grain to

nursery age pigs to look at effects on nutrient digestibility and growth performance. Diets were formulated based on net energy and standardized ileal digestible amino acids.

Diets and nutrient profile of barley and wheat

Four diets providing either reduced (2.3) or typical energy (2.4 Mcal NE/kg) level based on either barley or wheat grain were formulated. The two dietary energy concentrations were achieved by reducing canola oil inclusion. Differences in nutrient density within diets of equal energy level were achieved reducing the inclusion of soy protein concentrate and fish meal. All four diets provided 4.5 g SID lysine per Mcal NE and other key amino acids were balanced to lysine. Diets were mixed and steam pelleted. Hard Red Spring wheat (58 per cent starch, 12 per cent protein) and hulled, six row barley (49 per cent starch, 14 per cent protein) were fed.

Figure 1. Growth performance of piglets fed low and typical nutrient density diets based on barley or wheat grain.



Weaned pig trial

The trial was conducted at the Swine Research and Technology Centre, University of Alberta in Edmonton. In total, 208 pigs (Duroc × Large White/Landrace F1; Hypor, Regina, SK) with an initial weight of 8.5 kg were involved in this three-week trial that started two weeks after weaning. After weaning at 20 ± one days of age, pigs were fed sequentially commercial pre-starter and starter diets (Hi-Pro Feeds, Sherwood Park, AB) for two and 12 days, respectively, before feeding the test diets. Pigs were housed in nursery rooms in pens containing two barrows and two gilts each. Pigs had free access to feed and water during the entire 21-day study. Pigs, feed added and feed remaining were weighed weekly. Feces were collected the last two days on test to calculate digestibility of key nutrients.

Trial results

All pigs remained on test and signs of diarrhea were not observed. Compared with wheat-based diets, feeding barley-based diets reduced the digestibility of dry matter, gross energy and protein somewhat (2.7, 3.0, 4.4 per cent, respectively) most likely due to the greater fibre content of barley grain. Hull fibre cannot be digested by the pig's own gut enzymes, thus reduces the digestibility of other nutrients and increases protein excretion in feces. Soluble fibre in the kernel may also reduce nutrient absorption by physical preventing contact between gut enzymes and nutrients.

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Compared with typical nutrient density, feeding low density diets reduced the digestibility of dry matter, gross energy and protein similarly (2.6, 1.8, 2.3 per cent, respectively). This finding is explained by the reduced fat and increased fibre content of the low density diets.

For the entire 21-day trial, pen daily feed intake did not differ between pigs fed wheat or barley-based diets. However, feeding barley increased weigh gain by 41 g/day and feed efficiency (gain/intake) by six per cent compared with wheat grain. Dietary nutrient density did not affect feed intake, weight gain or feed efficiency. Final body weight of pigs was greater for pigs fed barley than wheat-based diets, but was not affected by nutrient density. In contrast to most barley studies, feeding barley grain in the present study increased weight gain mainly due to increased feed efficiency. This result may be partially attributed to properly formulating the diets based on net energy and standardized amino acids. Otherwise, the effect of fibre on extra heat production and reduced amino acid digestibility would have been neglected.

Cost vs. benefit

Prices per metric tonne were as follows: Wheat $199, barley $165, soybean meal $562, soy protein concentrate $1,500, herring meal $2,650, canola oil $1,100, limestone $109, mono-/di-calcium phosphate $965, L-lysine-HCl $2,150, L-threonine $3,050, DL-methionine $5,850, L-tryptophan $14,000. Dietary inclusion of barley to replace wheat grain increased feed cost by $1.95 and $4.84 per tonne of low or typical nutrient density diets, respectively, but slightly decreased feed cost per kg of body weight gain. Formulating diets with low nutrient density reduced feed cost $42.74 and $45.63 per tonne of wheat or barley-based diet, respectively, and slightly reduced feed cost per kg of body weight gain.

Recommendation

Feeding barley instead of wheat grain in diets to weaned pigs increased weight gain and feed efficiency. Nutrient density had no effect on growth performance, but lower than typical nutrient density reduced feed cost and cost per kg gain. Producers could therefore consider lower nutrient density and progressively including more barley in nursery diets to allow the pigs to adapt by increasing gut capacity. Barley fibre likely has a prebiotic effect in the intestine favouring microbes that promote gut development and health.

Acknowledgements

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