Feeding chickpea to weaned pigs

Lifang Wang[1], Eduardo Beltranena[1,2], and Ruurd T. Zijlstra[1*]

[1]Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, AB; [2]Alberta Agriculture and Forestry, Edmonton, AB
*E-mail address: ruurd.zijlstra@ualberta.ca

Take Home Message

Feeding 15 per cent chickpea by replacing 10 per cent soybean meal and 5 per cent wheat grain increased feed intake and weight gain of weaned pigs while maintaining feed conversion. Further inclusions to 30 per cent chickpea reduced growth and feed conversion due to reduced protein digestibility. Sourced at a right price, chickpea can be an attractive alternative feedstuff for pigs. Chickpea should be introduced progressively by phase feeding to get pigs used to digesting it.

Feeding chickpea

Increased prices of feedstuffs reduce profit margins in pork production. Off-grade chickpea can be a sporadic alternative feedstuff for pigs from time to time. Chickpea production is 13.7 million metric tonnes worldwide, and 110,000 tonnes are forecasted this year for the Prairies of which Saskatchewan grows ~95 per cent and Alberta ~5 per cent. Chickpea contains starch, protein and fibre, and is mostly destined for human food export; Pakistan and USA are our two main markets. Feed inclusion of locally grown off-grade chickpea can replace imported soybean meal as protein source to reduce feed cost. Little information is available feeding chickpea to pigs, so we decide to evaluate its effects on growth performance and diet digestibility feeding weaned pigs up to 30 per cent chickpea in late nursery diets.

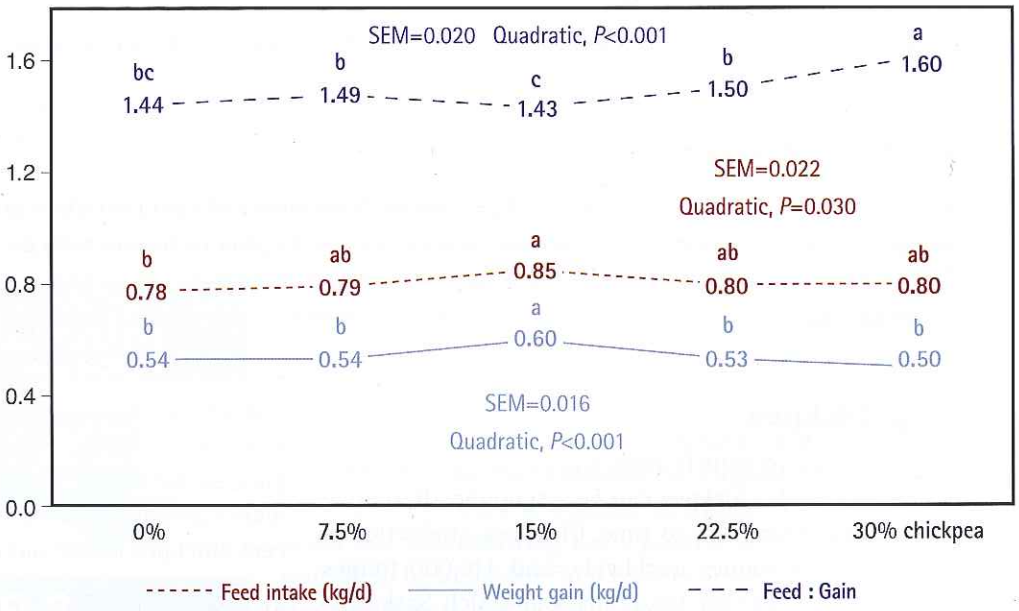
Nutrient profile of chickpea and the diets fed

The chickpea sample fed contained 33 per cent starch, 21 per cent protein, 12.5 per cent total dietary fibre and nearly nine per cent fat (much greater than ~1.5 per cent in field pea or

CONTINUED ON PAGE 54

fababean). Chickpea also contained some anti-nutritional factors (5.2g trypsin inhibitor activity and 4g tannin per kg) that may reduce protein digestion and absorption. A wheat-based control diet and four diets containing 7.5, 15, 22.5 or 30 per cent chickpea (Kabuli type, Moose Jaw, SK) were formulated by replacing up to 20 per cent soybean meal and 10 per cent wheat grain. Diets provide 2.35 Mcal net energy/kg and 5 g standardised ileal digestible lysine/Mcal net energy. Fish meal and soy protein concentrate were included at five and 2.5 per cent, respectively. Because of the starch and fat content in chickpea, inclusion of canola oil decreased from 0.9 per cent in the control diet to 0.15 per cent in the diet containing 30 per cent chickpea to balance net energy. Because of relatively lower protein in chickpea, increasing feed inclusion decreased diet protein content; amino acids were balanced by inclusion of crystalline sources. Diets without antimicrobials or growth promoters were mixed and then steam-pelleted at 70°C.

Figure 1. Growth performance of weaned pigs fed late nursery diets containing increasing inclusions of chickpea in substitution for up to 20 per cent soybean meal



a, b, c Within growth performance variable, means without a common letter differ (P < 0.05)

Weaned pig trial set up

The nursery trial was conducted at the Swine Research and Technology Centre, University of Alberta (Edmonton, AB). In total, 300 crossbred pigs (Duroc × Large White/Landrace F1; Hypor, Regina, SK) weaned at 20 ± 1 days of age were used in this three-week trial that started from two weeks after weaning. Pigs that averaged 9.6 kg were randomized to 75 pens in four nursery rooms housing two barrows and two gilts per pen. Pigs within different areas of the room were fed one of the five test diets to achieve 15 pen-replicates per diet. Pigs had free access to feed and water throughout the trial. Individual pigs, feed added during each week and feed remaining at the end of each week were weighed. Faeces were collected during the last two days on test to calculate the digestibility of protein and energy.

What we found

Pigs remained healthy during the entire trial. For the overall three weeks, there was a curvilinear response to increasing feed inclusion of chickpea (Figure 1). Increasing chickpea inclusion to 15 per cent was optimal, but growth performance decreased thereafter by increasing inclusion to 30 per cent. Therefore, final body weight for pigs fed diets including 0, 7.5, 15, 22.5 or 30 per cent chickpea was 20.6, 20.8, 21.9, 20.7 and 20.0 kg, respectively. We also noted poorer feed conversion with greater feed inclusion of chickpea in the first two than in the third week of the trial, indicating that young pigs required time to adapt to diets containing increasing chickpea inclusions.

Increasing feed inclusion of chickpea increased diet digestibility of dry matter and energy, digestible energy and predicted net energy values, but decreased protein digestibility at 30 per cent chickpea inclusion. About 30 per cent

of chickpea starch is amylose that is a resistant type of starch. Hence, small intestine digestibility of starch might be lower for chickpea than for cereal grains. It also suggests that more of the starch in chickpea compared with wheat grain starch bypasses the small intestine and is fermented in the hindgut. The energy utilisation of hindgut fermentation end products that are mostly short chain fatty acids is 17 per cent lower than that of starch digested in the small intestine as glucose. Increasing feed inclusions of chickpea implied greater content of anti-nutritional factors that might explain the reduced diet protein digestibility. Tannins tie up plant protein making it less available to the pig. Trypsin inhibitors can cause excess pancreatic secretion or block the conversion of its precursor to the active enzyme that plays a major role in the pig's ability to breakdown whole feed protein chains into smaller digestible links (single amino acids or smaller chains of two or three amino acids).

Cost vs. benefit

The following prices were assumed ($ per MT): wheat grain, 226; soybean meal, 490; chickpea (off-grade), 255; canola oil, 1,000; limestone, 107; mono/dicalcium phosphate, 825; L-lysine-HCl, 2,100; L-threonine, 3,700; DL-methionine, 4,500; and L-Tryptophan, 13,100. Each 7.5 per cent inclusion of chickpea replacing 5 per cent soybean meal reduced feed cost by $4.8 per MT. Dietary inclusion of 15 per cent chickpea to replace 10 per cent soybean meal reduced feed cost per kg of body weight gain by 2 cents, but dietary inclusion of 7.5, 22.5 and 30 per cent chickpea increased feed cost per kg of body weight gain by 1.2, 0.3, and 3.4 cents respectively. If food grade chickpea (assuming $663 per MT) were included instead, each 7.5 per cent inclusion of chickpea to replace 5 per cent soybean meal would increase feed cost by $26 per MT. Dietary inclusion of 7.5, 15, 22.5 and 30 per cent chickpea to replace up to 20 per cent soybean meal would increase feed cost per kg of body weight gain by 5.7, 6.8, 14, and 23 cents, respectively.

Conclusions

Despite increased energy digestibility with increasing inclusions, levels above 15 per cent chickpea in feed for weaned pigs are not suggested. Considering increasing content of anti-nutritional factors and decreased diet protein digestibility with increasing inclusion of chickpea, formulating a safety margin of amino acids is recommended.

Acknowledgements

We appreciate funding for this research from Swine Innovation Porc, Alberta Crop Industry Development Fund, Alberta Pork, Danisco Animal Nutrition, and the Canola Council of Canada. We would like to thank Midwest Investment, Moose Jaw, SK for donating the chickpea. ■