FEEDING FIELD PEAS TO MARKET PIGS HAD ONLY MINIMAL EFFECTS ON CARCASS COMPOSITION, MEAT QUALITY, OR COOKED PORK PALATABILITY

A. K. R. Everts*, H. H. Stein, D. N. Peters, C. Pedersen, K. K. Sweeter, D. M. Wulf, and R. J. Maddock

Department of Animal and Range Science, Box 2170 South Dakota State University, Brookings, 57220, USA

Key Words: Carcass quality, Field peas, Palatability, Pigs

Introduction

Field peas (Pisum sativum L.) production in the Midwestern United States is rapidly increasing and field peas have great potential for use as an alternative feedstuff in swine diets (Stein et al., 2004). Even though field peas are not commonly used in swine diets in the United States, field peas are utilized in other countries (Stefanyshyn-Cote, et al, 1998). Utilization of field peas could be economically beneficial to swine producers due to the high nutritional quality of pea protein (Stein et al., 2004). Field peas may be a potential substitute for corn and soybean meal in diets for pigs. However, the effects of field pea inclusion in swine diets on carcass composition, meat quality, and cooked pork palatability are yet to be researched and reported.

Objectives

To determine if field peas fed at various levels to growing-finishing pigs affect pig performance, carcass composition, meat quality, or cooked pork palatability.

Methodology

Pigs and Diet

Forty-eight pigs (initial BW: 22.7 ± 1.41 kg) were fed using a three phase program during the grower and finisher periods (34, 36, and 46 d, respectively for each phase). Pigs were randomly assigned to one of three dietary treatments (n = 16 pigs per treatment): 1. Control diet consisting of corn, soybean meal and no field peas; 2. Field Pea 1 diet consisting of corn, soybean meal, and 36% field peas in all three phases; 3. Field Pea 2 diet consisting of corn and 66% field peas in phase 1, 48% field peas in phase 2, and 36% field peas in phase 3. Pigs were individually weighed at the end of each phase and at the end of the entire trial. Feed intakes were recorded and gain:feed was determined for each pen. Following the third phase, all pigs were harvested at the SDSU

meat laboratory using common slaughter procedures. Pigs had an average final live weight of 123.6 ± 1.06 kg.

Carcass traits

pH was measured in the longissimus 24 h after exsanguination using a pH star (Model 5000 SFK tech., Herlev, Denmark) equipped with a puncture-type combination pH electrode (LoT406-M6-DXK-S7/25, Mettler-Toledo, GmbH, Urdorf, Switzerland). The left side of each carcass was ribbed between the 10th and 11th ribs at 24 h postmortem. Loin eye area, loin eye depth and fat thickness were measured at the 10th rib. In addition, subjective color and marbling scores were obtained according to the National Pork Producers Council Quality Standards (NPPC, 1999). L* color values for the longissimus were also measured using a Minolta Chroma Meter CR-310 (Minolta Corp., Ramsey, NJ) set at D65 illuminant. Finally, an area, large enough for the Minolta Chroma Meter aperture to fit in, just cranial of the 10th rib, was skinned in order to obtain L*, a*, and b* color values for the 2nd layer of fat, counting from the skin inward, using a Minolta Chroma Meter CR-310 (Minolta Corp., Ramsey, NJ) set at D65 illuminant.

Sample fabrication

At 48 h postmortem, the loins were removed from the left side of each carcass. The loins were made boneless and the 3rd through 10th rib section was vacuum packaged, aged for 10 d and used for shear force analysis. Starting at the 11th rib location and continuing towards the caudal end, one chop was removed for drip loss and the remainder of the loin was vacuum packaged for purge loss. Loin trimmings were pooled by treatment, ground, and formed into 115 g patties using a hand patty form.

Drip loss

As previously described, a 2.5-cm thick chop was removed from the 11th rib location of the loin. The chop was then weighed to the nearest 0.01 g, placed on a white Styrofoam tray and retail wrapped. Next, the chop placed at an approximate 30-degree angle and placed in a 1.4^{o}C cooler for 48 h. After 48 h, the chop was removed from the package and weighed again to the nearest 0.01 g. Drip loss was determined as a percentage of initial weight.

Purge loss

Once the drip loss chop was removed, the remainder of the loin, from the 11th rib location to the caudal end, was weighed to the nearest 0.01 lb, vacuum packaged, and stored at 1.4^{o}C for 7 days. After 7 days, the loin was removed from the vacuum package bag and allowed to drip for 15 min. After the 15 min drip time, the loin was weighed to the nearest 0.01 lb. Purge loss was determined as a percentage of initial weight.

Warner-Bratzler shear force

As previously described, the 3rd through 10th rib section of the loin was vacuum packaged, aged for 10 d after exsaguaintion and frozen. Two, 2.5-cm thick, chops were removed from the caudal end and allowed to thaw for 24 h at 1.4^{o}C before cooking. Chops were cooked in an impingement oven (Lincoln Foodservice Products, Inc., Ft. Wayne, IN) set at 190°C for 13.5 min. The chops were weighed raw (prior to cooking) and again after cooking to the nearest 0.01 g. Cooking loss was determined and expressed as a percentage of initial raw weight. After the chops cooled to room temperature, three 1.27-cm diameter cores were taken from each chop (six cores per loin) parallel to the muscle fiber orientation. Peak shear force was measured, once on each core, using a Warner-Bratzler shear force machine.

Cooked Pork Palatability

A trained sensory panel evaluated cooked longissimus chops for tenderness, juiciness, flavor intensity, and off-flavors, and cooked ground pork patties for texture, juiciness, flavor intensity, and off-flavors. Briefly, a panel was recruited and trained to evaluate pork loin chops and ground pork patties according to guidelines set by AMSA (1995). Pork loin chops were cooked on a clamshell-style grill to a target internal temperature of 71°C, cut into 1.3 x 2.5 cm cubes using a template, and placed into a Styrofoam bowl with holes in the bottom to allow meat juice to drain away from the sample. Samples were held in a 50°C warming oven until served. Panelists received samples identified by code in segregated sensory booths under red lights. To evaluate ground pork palatability, patties were cooked to a target internal temperature of 71°C. Cooked patties were sliced into six pie-shaped portions and placed into Styrofoam bowls with holes in the bottom to allow meat juice to drain away from the sample. Samples were held in a 50°C warming oven until served. Panelists received samples identified by code in segregated sensory booths under red lights.

Results & Discussion

Growth Performance. There were no differences in pig performance during any of the three phases (Table 1.). Likewise, for the entire experimental period, ADG and average G:F did not differ among treatment groups. When considering live performance, Field peas appear to be an acceptable substitute for corn and soybeans in swine grower/finisher diets.

Carcass Composition and Meat Quality. Carcass composition and lean quality are reported in Table 2. Lean color score was higher/darker ($P < 0.05$) for Field Pea 2 diet than for the control and Field Pea 1 diet. Drip loss was lower ($P < 0.05$) for Field Pea 2 than for control and Field Pea 1. No other carcass composition or meat quality traits were affected by treatment.

Meat Palatability Traits. Trained panelists indicated patties from Field Pea 2 carcasses had a higher ($P < 0.05$) incidence of “stale” off-flavors than patties from Control and Field Pea 1 carcasses ($P < 0.05$). All other sensory traits were similar for all treatments ($P > 0.05$).

Conclusions

Feeding field peas to market pigs had no effect live performance, carcass composition and only minimal effects on meat quality and palatability. Therefore, field peas may replace all the soybean meal and a portion of the corn in diets for growing and finishing pigs.

References

AMSA. 1995. Research guidelines for cookery, sensory evaluation and instrumental tenderness measurements of fresh meat.

Stefanyshyn-Cote, B., M. Fleury, and L. Ellwood. 1998. Research Summaries: Canola and Pea in Livestock Diets. University of Saskatchewan, Saskatoon, Saskatchewan, Canada.

Stein H. H., G. Benzoni, R. A. Bohlke, and D. N. Peters. 2004. Assessment of the feeding value of South Dakota-grown field peas (Pisum sativum L.) for growing pigs. J. Anim Sci. 82: 2568–2578.

Tables and Figures

Table 1. Performance data for growing/finishing pigs fed diet various levels of field peas (Con = 0% field peas, FP1 = 36% field peas in all three phases, FP2 = 66% field peas in phase 1, 48% field peas in phase 2, and 36% field peas in phase 3).

	Treatment			SEM	P
	CON	FP1	FP2		
Initial weight, kg	22.9	22.7	22.7	0.45	0.50
Slaughter weight, kg	123.6	122.0	125.3	4.24	0.59
Phase 1 - grower					
ADFI, kg	1.86	1.85	1.83	0.078	0.93
ADG, kg	0.800	0.811	0.814	0.028	0.89
G/F	0.430	0.440	0.446	0.0077	0.38
Phase 2 – finishing 1					
ADFI, kg	2.87	2.81	2.99	0.230	0.28
ADG, kg	0.926	0.956	0.995	0.056	0.26
G/F	0.325	0.341	0.333	0.0098	0.31
Phase 3 – finishing 2					
ADFI, kg	3.33	3.03	3.45	0.164	0.11
ADG, kg	0.886	0.822	0.863	0.042	0.57
G/F	0.269	0.272	0.254	0.0118	0.53
Overall					
ADFI, kg	2.74	2.60	2.82	0.147	0.13
ADG, kg	0.871	0.860	0.889	0.035	0.60
G/F	0.319	0.331	0.317	0.0087	0.38

Table 2. Influence of feeding field peas to growing/finishing pigs on carcass composition and meat quality (Con = 0% field peas, FP1 = 36% field peas in all three phases, FP2 = 66% field peas in phase 1, 48% field peas in phase 2, and 36% field peas in phase 3).

	Treatment			SEM	P <
	CON	FP1	FP2		
HCW, kg	92.5	90.3	93.5	3.09	0.42
Loineye Depth, cm	6.17	5.92	6.07	0.192	0.26
Loineye Area, sq. cm	46.1	44.5	46.3	2.40	0.37
10th rib fat, mm	23.2	24.0	24.1	4.01	0.81
Percent Muscle	51.7	51.0	51.2	2.40	0.68
L*	58.6	58.1	56.0	0.83	0.07
Subjective Marbling	1.06	1.06	1.03	0.123	0.97
Subjective Color (scale 1-5)	2.41x	2.72x	3.22y	0.156	0.003
pH	5.42	5.41	5.44	0.038	0.37
Fat color, L*	80.0	80.6	80.3	0.49	0.52
Fat color, a*	5.87	5.60	5.79	0.307	0.71
Fat color, b*	5.93	5.90	5.82	0.336	0.95
Drip loss, %	3.39x	2.51xy	1.95y	0.351	0.03
Purge loss, %	2.18	1.84	1.82	0.355	0.55

Table 3. Meat quality characteristics of pork loin chops and ground pork from pigs fed field peas (Con = 0% field peas, FP1 = 36% field peas in all three phases, FP2 = 66% field peas in phase 1, 48% field peas in phase 2, and 36% field peas in phase 3).

	Treatment			SEM	P
	CON	FP1	FP2		
Cooking Loss, %	19.85	19.80	20.27	0.92	0.90
Warner-Bratzler Shear Force, kg	3.54	3.90	3.86	0.206	0.42
Chop panel (8-point scale)					
Tenderness	5.50	5.57	5.47	0.253	0.92
Juiciness	5.30	5.46	5.27	0.159	0.65
Flavor	5.38	5.26	5.26	0.151	0.72
Patty panel (8 point scale)					
Texture	5.96	5.82	5.79	0.161	0.72
Tenderness					
Juiciness	5.59	5.55	5.48	0.195	0.93
Flavor	5.11	5.30	5.25	0.140	0.60
Off Flavors, %					
Piggy	0.089	0.070	0.088	0.0305	0.89
Rancid	0.070	0.088	0.018	0.0235	0.11
Stale	0.035x	0.000x	0.106y	0.0246	0.02
Other	0.070	0.108	0.052	0.0337	0.52
Total Off Flavors	0.27	0.27	0.27	0.059	0.99