

Nonruminant Nutrition: Feed Ingredients

T195 The granulated barley provided during growing or finishing period improves the major fatty acid composition in the intramuscular fat of longissimus dorsi muscle and of dry-cured ham from heavy pigs. A. Daza¹, M. A. Latorre², and C. J. López-Bote³, ¹Universidad Politécnica de Madrid, Spain, ²Universidad de Zaragoza, Spain, ³Universidad Complutense de Madrid, Spain.

A total of 48 Duroc × (Large White × Landrace) gilts of 46.8 ± 1.39 kg BW were used to study the effect of diet on fatty acid profile of intramuscular fat (IMF) of longissimus dorsi muscle (LD) and of dry-cured ham after 18 mo of ripening. Experimental diets were provided ad libitum according to the following treatments: i) control diet with 3,210 kcal ME/kg, 13.7% CP and 0.62% digestible Lys from 45.6 to 127.8 kg BW (group C), ii) control diet from 47.0 to 91.8 kg BW and granulated barley with 3,020 kcal ME/kg, 10.2% CP and 0.26% Lys from 91.8 to 129.7 kg BW (group C+GB) and iii) granulated barley from 47.9 to 93.1 kg BW and control diet from 93.1 to 135.1 kg BW (group GB+C). Each treatment was replicated 8 times with 2 gilts per replicate. Data were analyzed by ANOVA using SAS. The model included dietary treatment as main effect. The LD from C+GB gilts had 18% higher ($P < 0.05$) C18:1n-9 and MUFA than that from C gilts, whereas the C18:2n-6 and PUFA were lower in the LD from C+GB gilts than in that from C or GB+C gilts (8.2 vs 12.7 and 10.2; 9.7 vs 15.0 and 9.7; $P < 0.05$). The C16:0 was lower in LD from GB+C gilts than in that from C+GB (4%) or C (5%) gilts, and SFA was 4.7% lower ($P < 0.05$) in BG+C than in C gilts. A relation adjusted to a quadratic function between IMF percentage and C18:1n-9 proportion in LD was observed: $C18:1n-9 = 25.75 + 6.64 IMF - 0.56 \times IMF^2$ ($R^2 = 0.78$, $RSD = 1.24$, $P < 0.001$). The diet had no effect ($P > 0.05$) on C16:0, C18:0 and SFA of IMF from hams. However, hams from C+GB and GB+C gilts had ($P < 0.05$) higher C18:1n-9 (37.9, 40.9 and 40.0%) and lower C18:2n-6 (13.2, 10.8 and 10.8%) and PUFA (17.1, 14.4 and 14.1) than those from C gilts. The MUFA was 8.4% higher in hams from C+GB gilts than in those from C gilts, but no differences were detected ($P > 0.05$) when hams from C and GB+C and from C+GB and GB+C gilts were compared. It is concluded that granulated barley given during growing or finishing periods to heavy gilts improved the major fatty acids profile in the IMF of LD and of dry-cured ham of heavy pigs.

Key words: barley, fatty acid composition, heavy pigs

T196 Sulfur addition in corn-soybean meal diets reduced nursery pig performance. V. G. Perez*, H. Yang, T. R. Radke, and D. P. Holzgraefe, *ADM Alliance Nutrition Inc., Quincy, IL.*

Dietary sulfur (S) from distillers dried grains has been suggested to be detrimental for pig growth. The objective of this study was to determine the effect of increasing concentrations of dietary S on pig performance. Corn-soybean meal-based diets were used to differentiate any S effect from distillers dried grains. The experiment was a randomized complete block design; blocks were 4 categories of initial BW. Treatments were the inclusion of dietary S at 0.0, 0.2, 0.4, or 0.6% of the diet. Each treatment was replicated with 8 pens of 4 pigs per pen. Polynomial contrasts were used to determine linear and quadratic effects of dietary S addition. Sources of added S were sodium bisulfate (NaHSO₄) and calcium sulfate (CaSO₄•2H₂O); both were provided in equal amounts. The Na and Ca from these compounds replaced dietary salt and limestone, respectively. All diets were formulated to provide similar amounts of ME, CP, Ca, available P, and digestible Lys within feeding phase. Two feeding phases were used for 14 and 21 d,

respectively. Pigs were weaned at about 21 d of age and the experiment started 2 wk after weaning. The treatment with 0.0% added S had the lowest concentration of analyzed dietary S, with 0.25 and 0.24% S in feeding phases 1 and 2, respectively. Pig growth and feed efficiency were reduced ($P < 0.05$) proportionally to the inclusion of dietary S (Table 1). Feed intake followed a similar pattern of response to dietary S on the overall period. The larger reduction in ADG was observed between treatments with 0.0 vs. 0.2% added S, which can explain the quadratic effect observed in G:F. Increasing concentrations of added S up to 0.6% of the diet, proportionally decreased pig performance.

Table 1. Dietary sulfur addition and pig performance

Item	0.0% S	0.2% S	0.4% S	0.6% S	SEM
Initial BW, kg	9.63	9.65	9.65	9.66	0.03
Days 1-14					
ADG, g/d ^a	593	564	538	536	15
ADFI, g/d	771	762	751	745	20
G:F, g/kg ^{a,b}	770	741	716	722	8
Days 1-35					
ADG, g/d ^a	759	733	716	697	11
ADFI, g/d ^c	1,170	1,163	1,147	1,118	17
G:F, g/kg ^a	649	631	626	624	6

^aSulfur linear, $P < 0.01$; ^bSulfur quadratic, $P < 0.05$; ^cSulfur linear, $P < 0.05$.

Key words: sulfur, nursery, pigs

T197 The effect of Kapok seed meal supplementation on growth performance, nutrient digestibility, blood characteristics, meat quality, and fatty acids profile in finishing pigs. H. J. Kim*, T. X. Zhou, and I. H. Kim, *Dankook University, Cheonan, Choongnam, South Korea.*

This study was conducted to evaluate the effect of Kapok seed meal supplementation on growth performance, nutrient digestibility, blood characteristics, meat quality, and fatty acids profile in finishing pigs. A total of 96 finishing pigs [(Landrace × Yorkshire) × Duroc] with an average initial BW of 67.0 ± 1.5 kg were used in a 10 wk trial. Pigs were allotted to 1 of 3 dietary treatments with 8 replicate pens per treatment and 4 pigs per pen. The treatments included: 1) CON (basal diet), 2) K1.5 (basal diet + 1.5% Kapok) and 3) K3.0 (basal diet + 3.0% Kapok). Data were subjected to the GLM procedure of SAS. Differences among treatments were evaluated by Duncan multiple test. Growth performance was unaffected. Apparent total tract digestibility (ATTD) of DM and N was lower (74.15 vs. 77.68, 73.76 vs. 78.71%; $P < 0.05$) in K3.0 treatment than in CON treatment. At the end of the experiment, K1.5 and K3.0 diets had higher low density lipoprotein (LDL) cholesterol concentrations than CON diet (53.25 vs. 42.50; $P < 0.05$). Redness (a*) of pigs fed K3.0 diet was greater than that of CON diet (18.85 vs. 17.82; $P < 0.05$). Marbling score was higher in K3.0 treatment than that in CON treatment (2.2 vs. 1.9; $P < 0.05$). Total SFA of pigs fed K3.0 diets were greater than those of pigs fed CON diet (57.37 vs. 38.01%; $P < 0.05$) in adipose tissue. Palmitoleic acid, and oleic acid in K1.5 and K3.0 treatments were lower than CON treatment (1.49 vs. 2.35%; $P < 0.05$) in adipose tissue and lean. Stearic acid in K1.5 and K3.0 diets was increased compared with CON diet (24.67 vs. 13.24%; $P < 0.05$). In lean, pigs fed K3.0 diets had a greater stearic acid than that of pigs fed CON and K1.5 diets (22.34 vs. 14.25, 16.63%; $P < 0.05$). However, no significant differences were

observed on myristic acid, palmitic acid, linoleic acid, linolenic acid, SFA, PUFA, and SFA/PUFA in this study. In conclusion, kapok seed meal can improve meat quality but decrease nutrient digestibility and unsaturated fatty acid (UFA) in adipose tissue of finishing pigs.

Key words: fatty acids, finishing pigs, Kapok

T198 Performance of 1-d-old to 42-d-old broiler chicks fed with increasing levels of acerola meal replacing corn in diet. V. C. da Cruz*¹, L. H. Zanetti¹, G. do Valle Polycarpo², R. F. de Oliveira¹, A. L. C. Brichi¹, D. D. Millen¹, L. C. Carvalho¹, D. O. dos Santos Gomes¹, O. J. Sabbag¹, and M. L. Poiatti¹, ¹São Paulo State University, Dracena Campus, Dracena, São Paulo, Brazil, ²São Paulo State University, Botucatu Campus, Botucatu, São Paulo, Brazil.

This study, carried out at the São Paulo State University, Campus of Dracena, Brazil, aimed to evaluate the performance of 1 to 42-d-old broilers fed with different additions of acerola meal (AM) replacing corn (C) in the diet. Nine hundred eighty 1-d-old male Cobb chicks were housed with an initial density of 14 chickens/m². The experiment had a completely randomized design, 4 treatments: T0- basal diet - without addition of AM, T5- addition of 5% AM replacing C, T10- addition of 10% AM replacing C, T15- addition of 15% AM replacing C, and 7 replications with 35 birds each. At 42 d, a significant difference ($P < 0.05$) was observed in the final BW, ADG and G:F of chickens by regression analysis. Final BW and ADG decreased linearly with the addition of AM in diet ($BW = - 8.7780x + 2210.78$; $ADG = -0.2090x + 51.5772$). The G:F of birds, obtained from the gain-to-feed ratio, increased linearly with the addition of AM percentage in diets ($G:F = 0.0038x + 1.6784$). Therefore, the AM effects on the body weight of the birds influenced the G:F. This situation was more evident in treatments with greater amounts of AM, which resulted in worse G:F. The ADFI was not influenced by the treatments ($P > 0.05$), corroborating previous research that evaluated byproducts in broilers' diets. Since the diets were isocaloric, it can be inferred that ADFI was not affected by the AM addition, because birds primarily satisfy their energy needs, except when there is a limitation in the capacity of digestive tract. This seems to have been primordial in the initial phase, but it could not be applied to the entire breeding period due to the development of the birds' digestive tract. In this period, no difference ($P > 0.05$) among the treatments was observed for the production efficiency index (PEI). The AM addition becomes interesting at 5% without affecting the broilers' performance. When analyzing the PEI, addition of 15% is still advantageous because it allows a smaller addition of corn.

Key words: poultry, residue byproducts

T199 Inclusion of acerola meal replacing corn in the diet of broilers of 1-d-old to 21-d-old. L. H. Zanetti*¹, V. C. da Cruz¹, G. do Valle Polycarpo², R. F. de Oliveira¹, A. L. C. Brichi¹, D. D. Millen¹, V. B. Fascina², M. L. Poiatti¹, and O. J. Sabbag¹, ¹São Paulo State University, Dracena Campus, Dracena, São Paulo, Brazil, ²São Paulo State University, Botucatu Campus, Botucatu, São Paulo, Brazil.

This work, carried out at the São Paulo State University, Dracena Campus, Brazil, aimed to evaluate different levels of inclusion of acerola meal (AM) replacing corn (C) on the performance of broiler chickens during the initial phase (1 to 21-d-old). 980 1-d-old male Cobb chicks were housed with an initial density of 14 chickens/m². The experiment had completely randomized design, 4 treatments: T0- basal diet - without addition of AM, T5- addition of 5% AM replacing C, T10- addition of 10% AM replacing C, T15- addition of 15% AM replacing C, and 7 replications with 35 birds each. Throughout the

experimental period, water and feed were provided ad libitum. The statistical analysis of data was done by ANOVA, and when the treatment effect was positive, it was unfolded by polynomial regression analysis. At 21 d old, the chickens were weighed to evaluate performance. It was observed that the addition of AM replacing C in the diets influenced ($P < 0.05$) G:F and ADFI, the latter having a linear reduction ($ADFI = 3.1811x + 1091.19$, $P < 0.01$) with the inclusion of AM in diet, which may be justified by the crude fiber level (43.34%) in this byproduct, which can decrease the density of the diet. The inclusion of AM exerted a quadratic effect on G:F ($G:F = 0.0004x^2 - 0.0082x + 1.4061$, $P < 0.05$), demonstrating that this variable was more efficient in the treatment with 5% of MA replacing C in diet, and from this point, G:F of chickens tends to worsen, showing undesirable results with higher inclusions. Otherwise, final BW, ADG and viability were not affected by the addition of AM ($P > 0.05$). For the phase (1–21-d), the different levels of AM inclusion replacing C does not interfere on broiler performance, which shows that the AM inclusion can be made up to 15% without causing damage to group.

Key words: animal feeding, industrial by-product, poultry

T200 Fatty acid content and sensory evaluation of trimmed loins as influenced by timing of feeding flaxseed or fish oil to pigs. H. R. Martínez-Ramírez*¹, L. M. Pivotto¹, I. B. Mandell¹, J. K. G. Kramer², and C. F. M. de Lange¹, ¹Centre for Nutritional Modelling, Department of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada, ²Agriculture and Agri-Food Canada, Guelph, ON, Canada.

Pork containing n-3 fatty acids (FA) can provide health benefits to consumers. The effect of timing of feeding n-3 FA from ground flaxseed (FS) or fish oil (FO) to pigs on the FA content and sensory evaluation of trimmed loins (Loin) was investigated. Either FS or FO was included in corn based diets and fed continuously (treatments FSC and FOC, 25 to 120 kg BW), only during the growing phase (FSG and FOG, 25 to 65 kg BW), or only during the finishing phase (FSF and FOF, 85 to 120 kg BW). The 7th treatment, a diet free of FS and FO served as control (CON). At 25 kg BW, 4 barrows and 4 gilts (Landrace × Yorkshire × Duroc) were assigned to treatments. Pigs were fed ad libitum and feed intake was recorded per pig. Cumulative intake of FS was similar for FSG, FSF, and FSC ($P > 0.10$; 6.8, 7.2, 7.2 kg/pig, respectively), whereas intake of FO was similar for FOG, FOF, and FOC ($P > 0.10$; 2.0, 2.0, 2.2 kg/pig, respectively). Growth performance and measures of Loin meat quality (color, drip loss, 24 h pH) were not influenced by dietary treatments ($P > 0.10$). In terms of FA content (mg/100 g fresh Loin), α -linolenic acid (ALA) was independent of FS feeding regimen ($P > 0.10$; 274, 237, 187 for FSG, FSF, and FSC, respectively), and higher ($P < 0.01$) than the other treatments (40.1, 38.6, 63.0, and 30.5 for FOG, FOF, FOC and CON, respectively). Content of highly unsaturated n-3 FA (sum of n-3 FA minus ALA) was independent of FO feeding regimen ($P > 0.10$; 122, 138, and 129 for FOG, FOF, and FOC, respectively), higher ($P < 0.01$) than FS (102, 66.8 and 77.4, for FSG, FSF and FSC, respectively); and lowest for CON (32.2; $P < 0.05$). Based on a trained taste panel analysis, off-flavor ratings were higher for FOF than FSC ($P < 0.05$; 1.47 vs. 0.54); whereas ratings were similar for FSG, FSF, FOG, FOC, and CON ($P > 0.10$; 1.10, 0.95, 1.27, 1.30, and 0.91). These results indicate that enrichment of n-3 FA in Loin appears independent of timing of when n-3 FA containing diets are fed during pig development, and that feeding FO in the pre-slaughter diet may reduce consumer acceptance of pork.

Key words: pig growth, n-3 fatty acid, pigs