

Nonruminant Nutrition: Management

W173 Appetite stimulants on diets of lactating sows. A. Rodríguez,* A. Pineda, E. Toledo, and A. Borbolla, *Department of Animal Production: Pigs, Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de México, D.F. México City, México.*

This study evaluated the effect of appetite stimulating ingredients and feed additives on feed consumption and body condition of lactating sows and their litters. Forty-four sows (11 sows/treatment) were randomly assigned to 4 experimental treatments, using a randomized complete block design, with parity as the blocking factor. Four treatments were used in this study: C (control, basal diet for lactating sows), B (basal diet + 1 kg/ton of a phytogetic additive, containing essential oils of oregano, anis and citrus peels mixed with chicory), F (basal diet + 1 kg/ton of homeopathic additive containing natural active substances from plants of the poppy family, such as tetterwort, bloodroot, plume poppy, etc.), and P (basal diet + 5 kg/ton of animal plasma). Diets were fed ad libitum during lactation (22.9 ± 0.2 d). Feed consumption (FC), weight loss (WL) and backfat loss (BL) were measured in each sow. BL was measured at the last rib in the P2 point, upon entering the farrowing room and at weaning, using a Renco® ultrasound (Lean-Meater series 12, Minneapolis, MN, USA). WL was estimated by weighing each sow at entering the farrowing room and at weaning. Weight gain in litters was also evaluated. The resulting data were analyzed using the statistical program SPSS 17.0. There were no differences ($P > 0.05$) for any of the variables evaluated. The FC was similar for all treatments ($C = 108.2 \text{ kg} \pm 6.76$, $B = 114.2 \text{ kg} \pm 5.93$, $F = 112.7 \text{ kg} \pm 5.93 \text{ kg}$ and $112.4 \pm P = 6.79$). BL showed no differences ($P > 0.05$), among treatments; however, sows receiving both additives and animal plasma had a lower BL, compared with the control group ($B = 1.3 \text{ mm} \pm 0.3$, $F = 1.6 \text{ mm} \pm 0.34$, $P = 1.7 \text{ mm} \pm 0.27$ and $C = 2.5 \text{ mm} \pm 0.29$, respectively). Similarly, the WL did not differ ($P > 0.05$) for any treatment; however, sows receiving the phytogetic and homeopathic additives, lost the least weight ($C = 22.6 \pm 3.53 \text{ kg}$, $B = 9.9 \text{ kg} \pm 3.09$, $F = 14.9 \text{ kg} \pm 3.53$, $P = 19.1 \text{ Kg} \pm 3.55$). The initial weight of all litters was similar ($P > 0.05$) for all experimental groups ($C = 18.6 \pm 1.27 \text{ kg}$, $B = 18.1 \pm 1.11 \text{ kg}$, $F = 16.4 \text{ kg} \pm 1.06$, $P = 18.1 \text{ kg} \pm 1.27$); and no effect ($P > 0.05$), was observed in this parameter after weaning ($C = 60.8 \pm 5.16 \text{ kg}$, $B = 55.5 \pm 4.52 \text{ kg}$, $F = 54.7 \text{ kg} \pm 4.52$, $P = 64.9 \text{ kg} \pm 5.18$). These results indicate that under the rearing conditions used in this study, it is not necessary to use these appetite stimulants, although additional studies are needed.

Key Words: feed consumption additives, sows, litters

W174 Reproductive response of sows in lactation anoestrus to additional organic chromium intake and postweaned GnRH-A application. S. A. Félix¹, J. A. Romo¹, J. M. Romo^{1,2}, H. R. Güemez^{1,2}, and R. Barajas*¹, ¹FMVZ-Universidad Autónoma de Sinaloa, Culiacán, Sinaloa, México, ²Granja Porcina La Huerta, Culiacán, Sinaloa, México.

Three hundred sixty-eight hybrid multi-parturient sows were utilized to determine the reproductive response of sows in lactation anoestrus to additional organic chromium intake and post weaned GnRH-A application. The study was performed from November 2010 to October 2011 in Culiacan, Sinaloa localized in the Northwest of Mexico. In agreement with a completely randomized experimental design with a 2×2 factorial arrangement, Sows were randomly assigned to one of 4 the treatments: 1) Feeding with a lactating corn-soybean meal based-diet, during period of lactation and first 7 d post weaning, and 1 mL-Injection of sterile

saline solution 24 and 48 h post weaning (CTRL; n = 96); 2) Diet similar to control and application of 25 µg of GnRH-A at 24 and 48 h post weaning (GnRH-A; n = 84); 3) Diet similar to control plus 400 ppb of additional organic chromium supplementation during lactation time and 1 mL-Injection of sterile saline solution 24 and 48 h post weaning (Cr; n = 85); and 4) Diet similar to control plus 400 ppb of additional organic chromium supplementation during lactation time and application of 25 µg of GnRH-A at the 24 and 48 h post weaning (CrGnRH; n = 103). A GnRH-A x Cr interaction ($P < 0.01$) on interval weaning to estrus was observed, where Cr alone had not effect respect to CTRL, and GnRH-A application lengthened the interval weaning to estrus (5.1 vs. 4.5 d for GnRH and CTRL, respectively), however, when GnRH was applied joint with Cr supplementation (CrGnRH treatment), the length of the interval weaning to estrus was similar to observed in CTRL sows (4.5 vs. 4.4 d for CTRL and CrGnRH treatment, respectively). Treatments had not effect ($P > 0.10$) on the farrowing rate, litter size and the litter weight at the born time. We conclude that postweaned GnRH-A application lengthens the interval weaning to estrus, and the additional intake of organic chromium during lactation time appears to reduce the effect of GnRH-A application on the length of interval weaning to estrus in multi-parturient sows.

Key Words: sows, GnRH-A, reproductive response

W175 Feeding high fiber diet improves productive and reproductive performances of sows. A. Woldeghebriel,* M. Mama-Nodeli, T. Barios, and B. Pope, *North Carolina A&T State University, Greensboro.*

Sows (n = 36) in early gestation were used to determine the effects of feeding different sources of fiber and how these effects may relate to piglet performance. The experimental design employed 4 diets and 9 individually housed sows per diet. The sows were randomly assigned to 1 of 4 diets. Diets included a corn-soybean meal basal diet as the control (CON), and 3 antibiotic-free, high-fiber diets (D1, D2 and D3) each containing 5% sugar beet pulp plus one of the following: 1:2, 1:1, and 2:1 oat to barley ratios. Diets were formulated to contain similar amounts of protein (14% CP) and energy (3.145 Mcal DE/kg), but the fiber content of the CON diet was lower than the average of the high-fiber diets (8.38% vs. 22.40% NDF). All sows were fed the low-fiber diet for the first 84 d of gestation and randomly assigned to 1 of 4 diets for the next 30 d. This means that sows continued receiving either the low fiber (229 g of NDF/d) or high fiber (612 g of NDF/d) diets until farrowing. Each sow received 2.73 kg of feed per day during gestation and 2.73 kg 3 times per day during lactation. Sows were weighed initially, weekly during gestation, after farrowing and when piglets were weaned. Litter sizes and weights were also recorded at birth and weekly for up to 2 weeks post-weaning. Data collected were analyzed using SAS procedure where animals were considered random effects, and diet means were used to compare treatment effects. Results of the study indicated that average litter size at birth in high fiber-fed sows increased by 0.28 pig/sow/y. Litter growth rates were not affected by diet. However, average litter weights at birth and at weaning from high fiber-fed sows were 0.60 and 2.24 kg, respectively, being higher than in CON-fed sows. Average litter weight from high fiber-fed sows was also higher ($P < 0.05$) during the first week of lactation than during the second, but not the third week of lactation. In conclusion, results of the current study indicate that feeding sows with high fiber diet during the last 30 d of gestation had beneficial effects to both the litter and the sow itself.

Key Words: sow, lactation, dietary fiber

W176 Effects of dietary fat and protein quantity from different feedstuffs on litter gain. K. Koch*¹, L. Chu², K. Kalscheur¹, R. C. Bott¹, and R. C. Thaler¹, ¹South Dakota State University, Brookings, ²China Agricultural University, Beijing, China.

A sow lactation study was performed to evaluate the effects of different quantities of fat and protein inclusion in lactation diets on litter gain and milk composition. Ninety-six sows and 3 dietary treatments were used in a complete randomized design. Sows used were of mixed parity (0–8), and litters were standardized within dietary treatment. Lactation length was standardized to 18 d. Treatments were low fat, high protein (LH, n = 32), comprised of corn and soybean meal; medium fat, low protein (ML, n = 31), comprised of corn and a co-extruded corn and soybean product; and high fat, high protein (HH, n = 33), comprised of corn, soybean meal and added soy oil. Fat quantities were provided at 2.51%, 5.30% and 8.96% of the diet (DM basis) in the low, medium, and high levels, respectively. Protein quantities were 19.36% and 20.50% of the diet (DM) for the LH and HH treatments and 12.14% of the diet (DM) for the ML treatment. Data were analyzed using PROC MIXED of SAS (SAS Inst. Inc., Cary, NC) with diet being a fixed effect. Litter gain was estimated by determining the difference of average litter weight at birth and at weaning, adjusted for the number of piglets. There was an effect on litter gain due to treatment ($P < 0.05$). Litter gain was approximately 4.61, 4.22 and 5.02 kg per piglet, for LH, ML, and HH, respectively. Upon weaning at d 18, 8 sows per treatment were randomly selected to determine if diet affected milk fat concentration. Sows selected had similar body condition scores (2.6 ± 0.1) at the start of the experiment. Milk fat concentration was $6.22 \pm 0.51\%$, $6.70 \pm 0.50\%$ and $7.63 \pm 0.12\%$ for the LH, ML and HH treatments, respectively. Treatment had no effect on milk fat concentration ($P > 0.198$). Parity was included as a covariate and no effect was demonstrated on litter gain ($P > 0.195$) or milk fat ($P > 0.839$) concentration. Therefore, litter gain may be improved by elevated fat levels in lactation diets, when protein is provided at high level, but there is no effect on milk fat concentration.

Key Words: sow, lactation, fat

W177 The effects of blends of sensory functional ingredients on feed intake and growth in juvenile pigs during a food transition. C. Clouard¹, V. Noiro*², M. Champagnac², P. Etienne², D. Éclache², MC Meunier-Salaün¹, and D. Val-Laillet¹, ¹INRA, UMR1079 SENAH, Saint Gilles, France, ²Laboratoires Phodé, Terssac, France.

When exposed to a novel diet during food transition, pigs often decrease spontaneously their feed intake, which can lead to impaired growth. The related experiment was conducted by the INRA team of UMR1079 SENAH (Saint Gilles, France). The objective was to identify blends of sensory functional ingredients based on aromatic active principles and plant extracts, formulated by Laboratoires Phodé (Terssac, France), that were likely to improve feed intake during food transitions. The spontaneous feed intake of 24 juvenile female pigs, housed in individual pens, was assessed during a food transition. After 9 d during which they were fed with a familiar starter diet, the pigs were divided into 3 experimental groups and fed with an unfamiliar grower diet added with either the N1 blend, the N3 blend, or without supplementation (control: C). The mean amount of food consumed and the mean body weight of the animals were compared between treatments using non-parametric Kruskal-Wallis tests. After the transition day, no difference in the mean feed intake and in the mean body weight per week was observed between the groups ($P > 0.05$). On d 10 (i.e., the transition day), compared with the consumption of the starter diet on d 9, the consumption of the C

diet was 10.31% lower, while the consumption of the N3 diet was only 5.46% lower and the consumption of the N1 diet was 3.77% higher. However, the difference of consumption between d 9 and 10 was not significant ($P > 0.05$), due to high inter-individual variability. Albeit the adjunction of the functional ingredients in the novel diet did not increase feed intake or weight gain in these experimental conditions, N1 was likely to maintain a normal consumption the day of the food transition. Further investigations using an increased number of pigs would have counterbalanced the effects of individual variability and would have been likely to result in more significant results in terms of food intake and preferences.

Key Words: functional feed ingredients, pigs, food transition

W178 Effects of genotype and dietary oil supplementation in pigs. 1. Growth performance and carcass traits. T. M. Bertol*¹, J. V. Ludke¹, R. M. L. de Campos², N. N. Terra³, E. A. P. de Figueiredo¹, A. Coldebella¹, and J. I. dos Santos Filho¹, ¹Embrapa Suínos e Aves, Concórdia, SC, Brazil, ²Fundação Universidade Federal do Vale do São Francisco, Petrolina, PE, Brazil, ³Universidade Federal de Santa Maria, Santa Maria, RS, Brazil.

A 42-d study was carried out to evaluate the effect of genotype (GEN): terminal sire line Duroc × F1 (DC×F1); terminal sire line Embrapa MS115 × F1 (MS115×F1); and MS115 × Moura (MS115×MO) and 3 dietary oils (DIET): 3% soybean oil (SBO); 3% canola oil (CAN); and 1.5% canola oil + 1.5% flax oil (CAN+FLX), on pig growth performance and carcass traits. Ninety animals (45 barrows and 45 gilts) averaging 130.7 ± 3 d of age were utilized, 15 barrows and 15 gilts of each GEN per diet. The ANOVA model included block (initial weight), sex, GEN, DIET and interactions of second and third order. Means were compared by protected *t*-test ($P < 0.05$). There was no DIET effect ($P > 0.05$) on growth performance and carcass traits. Final weight (FW), average daily gain (ADG) and daily feed intake (DFI) were higher ($P < 0.001$) in DC×F1, with the lowest values observed in the MS115×MO pigs (FW = 122.4 ± 0.85^a , 112.8 ± 1.38^b , 96.8 ± 1.30^c kg; ADG = 1.090 ± 0.018^a , 0.987 ± 0.019^b , 0.828 ± 0.015^c kg; DFI = 3.415 ± 0.053^a , 3.033 ± 0.056^b , 2.725 ± 0.059^c kg, for DC×F1, MS115×F1 and MS115×MO, respectively). Feed conversion ratio was higher ($P < 0.01$) in the MS115×MO pigs than in the other GEN. The highest ($P < 0.001$) hot carcass weight was found in the DC×F1 and the lowest in the MS115×MO pigs. The MS115×F1 pigs had the lowest ($P < 0.001$) backfat thickness (BF) and the MS115×MO showed the lowest ($P < 0.001$) loin depth (LD) (BF = 22.75 ± 0.71^a , 17.09 ± 0.63^c , 20.46 ± 0.86^b mm; LD = 62.04 ± 0.74^a , 63.35 ± 1.21^a , 54.52 ± 1.11^b mm). The GEN by DIET interaction was significant ($P < 0.05$) for carcass lean percentage (LP), with the highest ($P < 0.05$) LP provided by CAN diet in the DC×F1 pigs and by SBO DIET in the MS115×MO pigs, while no differences were observed ($P > 0.05$) among DIET in the MS115×F1 pigs. For the GEN effect within DIET, the MS115×F1 pigs showed higher ($P < 0.05$) LP than the other GEN, regardless the DIET. In conclusion, the type of oil did not influence growth but did affect carcass traits, depending upon genotype. DC×F1 pigs showed the best growth performance and MS115×MO the worst. The MS115×F1 GEN had the best carcass quality.

Key Words: canola oil, flax oil, soybean oil

W179 Improving feed efficiency in fattening pigs through sensorial stimulation. G. Tedó¹, D. Torrallardona², and I. R. Ipharraguerre^{*1}, ¹Feed Additives Division, Lucta S.A., Montornés del Vallée, Barcelona, Spain, ²IRTA-Mas de Bover, Reus, Tarragona, Spain.

Interest in strategies to improve feed efficiency and prevent excessive fat deposition in fattening pigs is growing. We hypothesized that triggering sensory and gastrointestinal satiety through flavoring compounds may contribute to achieve such a goal by reducing over-consumption of feed without compromising animal growth. To test this hypothesis, an experiment was conducted in which a flavoring composition developed to induce satiety (SAT) was added into the diet of fattening pigs. One hundred and 44, mixed sex (50:50) pigs [Duroc × Landrace (sow line) × Pietrain (boar line); 49 ± 4.55 kg BW] were distributed into 48 pens (3 animals/pen) and 4 blocks of BW, and fed ad libitum either a control diet or the same diet treated with SAT (750 ppm) during the last 49 d before slaughter. Animals were individually weighed on d 0, 21, 35 and 49 and feed intake was recorded every week from d 0 to d 49. Data (BW, ADG, ADFI, GFR) were analyzed as a mixed-effect model with repeated measures in time in which pen was treated as a random effect and diet, block, sex and their interactions were considered fixed effects. Analyses were carried out using the MIXED procedure of SAS. No interactions ($P > 0.5$) were observed for any of the measured parameters. In addition, no differences were observed for BW ($P > 0.7$) and ADG (745 vs. 746 g/d; $P > 0.8$) between treatments. The addition of SAT into the diet, however, reduced ($P < 0.02$) ADFI by 6% (2437 vs. 2287 g/d) resulting thereby in a 7% improvement ($P < 0.05$) in GFR (0.30 vs. 0.32). In conclusion, the inclusion of a satiety-inducing flavor in pig finishing diets improved feed efficiency through the reduction of feed intake without affecting body weight gain.

Key Words: efficiency, flavor, satiety

W180 Gene expression of myosin heavy chain isoforms and β -adrenergic receptors induced by ractopamine feeding duration in finishing pigs. V. V. Almeida^{*1}, A. J. C. Nuñez², A. P. Schinckel³, M. Ward³, K. Ajuwon³, G. Gasparin¹, C. Andrade¹, M. Sbardella¹, L. L. Coutinho¹, and V. S. Miyada¹, ¹University of Sao Paulo/ESALQ, Piracicaba, SP, Brazil, ²University of Sao Paulo/FZEA, Pirassununga, SP, Brazil, ³Purdue University, West Lafayette, IN.

Ractopamine (RAC) is fed to finishing pigs to increase muscle mass and decrease fat deposition, to improve feed efficiency and carcass value. To understand how RAC feeding induces skeletal muscle growth, 80 finishing barrows were used to evaluate the time-dependent effect of RAC feeding on myosin heavy chain (MyHC) isoforms (I, IIa, IIx and IIb), β 1-adrenergic receptor (AR) and β 2-AR mRNA abundance. Pigs were blocked by initial BW (69.42 ± 1.24 kg) and assigned randomly to 5 treatments, with 8 replicates per treatment and 2 pigs per pen. Dietary treatments consisted of corn and soybean meal diets containing no RAC (control) for 28 d and 10 mg/kg RAC for 7, 14, 21, or 28 d before slaughter. Longissimus muscle samples were collected immediately post-exsanguination, snap frozen in liquid nitrogen and stored at -80°C until processed for gene expression analysis. Total RNA was extracted and the mRNA expression was determined by quantitative real-time

RT-PCR. Relative gene expression ratio was calculated with the Pfaffl's method, using 18S rRNA as reference gene. Statistical analyses were performed by ANOVA using the GLM procedure of SAS. Linear and quadratic responses were determined utilizing polynomial orthogonal contrasts. Although β 1-AR mRNA abundance was not affected ($P > 0.05$) by RAC treatment, increasing RAC feeding duration tended to decrease β 2-AR expression (1.39, 1.03, 0.83, 0.83, 0.62 ± 0.15; $P = 0.08$). Expression of MyHC I decreased linearly (1.81, 1.72, 1.53, 0.98, 0.94 ± 0.20; $P = 0.02$), whereas MyHC IIb mRNA expression increased linearly (0.32, 1.05, 1.20, 1.41, 1.79 ± 0.16; $P = 0.001$) as RAC feeding period increased. Conversely, transcript abundance of MHC IIa and IIx did not differ ($P > 0.05$) between treatments. These results suggest that RAC feeding alters the MyHC isoform gene expression profile, and that the responses might be mediated by β 2-AR.

Key Words: β -adrenergic agonist, skeletal muscle growth, swine

W181 Influence of pellet size on pellet quality and performance and nutrient utilization of broilers. M. R. Abdollahi, T. J. Wester,* G. Ravindran, D. V. Thomas, and V. Ravindran, *Institute of Food, Nutrition and Human Health, Massey University, Palmerston North, New Zealand.*

The importance of physical quality of pellets in improving growth is well recognized in the broiler industry. High conditioning temperatures during pelleting increase pellet quality, but decrease nutrient availability. This study tested whether manipulation of pellet diameter and length, at low conditioning temperature, would influence quality of pellets, and performance and nutrient utilization of broilers. total of 192, 10-d old birds were used in a 2 × 2 factorial arrangement to evaluate pellet diameter (3 or 4.76 mm) and pellet length (3 or 6 mm). Wheat-based grower (d 10 to 21) and finisher (d 22 to 42) broiler diets were formulated to meet Ross 308 strain recommendations. Diets were steam-conditioned at 60°C before pelleting. In grower and finisher diets, improvements in pellet durability index and pellet hardness with increasing pellet length were greater ($P < 0.05$) in pellets with 3-mm diameter than those with 4.76-mm. Increasing pellet length from 3 to 6 mm increased ($P < 0.05$) apparent ME value (3322 vs. 3288 kcal/kg DM). Neither main effects of pellet diameter and length nor the interaction were significant for ileal digestibility of nitrogen and starch. During the grower period, birds fed pellets of 6-mm length had greater weight gain ($P < 0.05$; 745 vs. 725 g/bird) and better feed conversion ($P < 0.05$, 1.427 vs. 1.446 feed/gain) than those fed 3-mm long pellets. Feed intake was unaffected. During the finisher phase and over the whole trial (d 10 to 42), neither the main effects nor the interaction were significant for weight gain and feed intake. Pellet length had no effect on feed conversion for 3-mm diameter pellets; however, increasing pellet length from 3 to 6 mm improved ($P < 0.05$) feed conversion at 4.76-mm pellet diameter (1.755 vs. 1.792 feed/gain, finisher phase; 1.675 vs. 1.706 feed/gain, whole trial). Overall, best pellet quality was achieved in 6 mm long and 3 mm diameter pellets, while best performance was in broilers fed 6-mm pellets that were 4.76 mm wide. When low conditioning temperatures are used to optimize nutrient availability, it seems a longer pellet is better, but choice of die size creates a trade-off between pellet quality and bird performance.

Key Words: broiler, pelleting, growth