of 0, 1.25, 2.50, or 3.75 ppm beta acids and either barley or alfalfa substrate. Experiment 2 had treatments of control, 2 ppm alpha acids, 2 ppm beta acids, 2 ppm hexahydro-iso-alpha acid, 2 ppm iso-alpha acid, 2 ppm rho-iso-alpha acid, 2 ppm tetrahydro-iso-alpha acid, 6 ppm monensin and either alfalfa, barley, or corn substrate. Addition of beta acids in Exp.1 decreased ($P < 0.01$) gas production, pH, DM disappearance, microbial purines and increased ($P < 0.01$) lactate production when barley was the substrate. When alfalfa was the substrate, addition of beta acids decreased ($P < 0.01$) DM disappearance, pH, NDF disappearance, total gas production and rate of gas production. Beta acids decreased ($P < 0.01$) total VFA production with both barley and alfalfa substrates. However, with beta acids addition to barley, the molar proportions of acetate and propionate increased ($P < 0.01$), whereas, butyrate decreased ($P < 0.01$). In contrast, beta acids addition to alfalfa decreased ($P < 0.01$) the molar proportions of acetate and butyrate and increased ($P < 0.01$) propionate. Protozoal numbers and microbial purines decreased ($P < 0.01$) for barley, but only microbial purines decreased for alfalfa. In Exp. 2, beta acids showed the most favorable response of the hop acids with decreased ($P < 0.01$) gas production, increased propionate but not acetate. Significant decreases ($P < 0.01$) in DM and starch disappearance were observed, suggesting the rate of fermentation decreased. Monensin increased ($P < 0.01$) propionate and decreased ($P < 0.01$) protozoal numbers and bacterial purines compared to the control. Beta acids at approximately 2 ppm appeared to have beneficial effects on *in vitro* ruminal fermentation.

Key Words: Hop acids, *In vitro*, Fermentation

T252 Effects of hop acids. II. Beta acids on ruminal methane emission, protozoal population, fermentation, and CoM concentration in cannulated finishing steers. M. A. Schmidt, M. L. Nelson*, J. J. Michal, and H. H. Westberg, *Washington State University*, *Pullman*.

The objective of this study was to determine if beta acids (lupulones) from hops (*Humulus lupulus* L.) had an impact on *in vivo* ruminal fermentation. Four ruminally cannulated steers were randomly assigned to a 4 × 4 Latin Square design. The steers were fed a 90% corn, 10% alfalfa haylage diet with treatments added to the supplement. The treatments included 0, 0, 16.5, or 33 g beta acid/1000 kg diet. Two control treatments (0 g beta acid/1000 kg diet) were included to allow testing for carryover. Intake of DM and GE and methane emission decreased ($P < 0.10$) quadratically. Ruminal pH and lactic acid concentration increased ($P < 0.01$) linearly with beta acids addition. The molar proportions of acetate and propionate were quadratically affected ($P < 0.05$) to a maximum with addition of beta acids. However, the ratio of molar proportions of acetate and propionate was not affected by beta acids addition. There was a linear decrease ($P < 0.10$) in the rate of *in situ* DM disappearance but the extent of disappearance was quadratically affected ($P < 0.05$) with beta acids addition. There was no effect on ruminal volume; however, ruminal mass increased ($P < 0.05$) quadratically when beta acids were fed. Beta acids had no effect on DM, NDF, ADF, starch, or nitrogen digestibility. Coenzyme M concentration in the fluid and particulate fractions increased ($P < 0.10$ and $P < 0.05$, respectively) with beta acids addition. Total protozoa and *Entodinium* spp. quadratically increased ($P < 0.0001$) with addition of beta acids. There was no change in microbial purines when beta acids were added. Therefore, addition of beta acids to the diet resulted in more efficient ruminal fermentation and starch digestion.

Key Words: Corn hop, Beta acids, Methane

T253 Use of sodium bicarbonate and an exovenous fibrolytic enzymatic compound on diets for Holstein steers. O. D. Montañez Valdez*[1], J. R. Bárcena Gama[2], S. S. González Muñoz[2], M. E. Ortega Cerrilla[2], M. A. Cobos Peralta[2], L. Landois Palencia[2], E. O. García Flores[3], J. H. Avellaneda Ceballos[4], and I. E. Morales Zambrano[1], [1]*Centro Universitario del Sur. Universidad de Guadalajara*, *Ciudad Guzmán, Jalisco, México*, [2]*Colegio de Postgraduados*, *Montecillos, Texcoco, Estado de México, M\eacute;xico*, [3]*Centro Universitario de la Costa Sur. Universidad de Guadalajara*, *Autlán, Jalisco, México*, [4]*Universidad Técnica Estatal de Quevedo*, *Quevedo, Los Ríos, Ecuador.*

The objective of this study was to evaluate the effect of sodium bicarbonate (SB) and the buffering capacity (BC) of the diets on the in situ digestibility of DM, ADF and NDF and ruminal fermentation. Five Holstein steers fitted with rumen cannula (BW 450±15 kg) were randomly assigned to a 5 x 5 latin square and they were housed in individual pens. Each period was 15 d, 10 for adaptation to diets and 5 to collect samples. Diet was 70% concentrate (47% ground sorghum, 8 % soybean meal, 7% molasses cane, 6. 8% corn gluten meal and 1.2 % mineral premix) and 30% forage (15% alfalfa hay and 15% corn silage) with different concentrations of SB and one exogenous fibrolytic enzymatic (Fibrozyme®; EFE) used to evaluate changes in fiber digestion. The treatments were: T1) control; T2) 0% SB + 3 g EFE; T3) 1.5% SB + 3 g EFE; T4) 3% SB + 3 g EFE; T5) 4.5% SB + 3 g EFE. There were no differences ($P \geq 0.05$) among treatments on the in situ digestibility of DM, NDF, ADF, VFA, and protozoa concentration. The N-NH3 was different between treatments ($P \leq 0.05$) on 2, 4 and 6 h postfeeding, with a higher concentration in T3 (21.23 mg/dL) and lower in T2 (17.20 mg/dL) compared with T1 (19.17 mg/dL). The cellulolityc bacteria were higher in T3 and lower in T2. There was no effect of BC, SB and EFE on high concentrate diets on the in situ digestibility of fiber, VFA or ruminal pH, but improved the N-NH3 and cellulolityc bacteria concentration.

Key Words: Buffering capacity, Enzyme, Digestibility

Swine Species

T254 Protein source affects feed palatability in piglets. D. Solà-Oriol[1], E. Roura*[2], and D. Torrallardona[1], [1]*IRTA-Centre de Mas Bové*, *Reus, Spain*, [2]*Lucta SA*, *Barcelona, Spain*.

The choice of a protein source for piglet diets is mainly driven by their nutritive value. However, the palatability of these proteins may also play an important role in feed intake and weight gain. The palatability of different protein sources in piglet diets was studied using a double choice preference test (two trials of 36 pens; 4 animals/pen) in which a reference basal diet (REF) with 20% of a soy protein product low in anti-nutritional factors (56% CP) was used. Each pen was offered free access to two different diets in two feeders: either the REF diet or

the diet containing the protein source to be tested. The protein sources were included in the diets at 5, 10 and 20% of inclusion by replacing the soy protein product from the REF diet and these were presented in mash form. In each trial a double control test (REF vs. REF) was included. The inclusion levels of 5, 10 and 20% were tested in three consecutive 4 d periods, respectively. Each protein source preference (relative to the reference diet) was calculated as the percentage contribution of the test diet to total feed intake. The preference values were analyzed taking into account the effects of protein source, level of inclusion and their interaction. At 5% of inclusion, the preferences (% of total feed intake) observed were: digestible porcine peptides (DPP), 76a; fishmeal (FM), 72^{a}; REF, 45^{b}; wheat gluten (WG), 40^{b}; soybean meal concentrate (SBM), 18^{c} and potato protein (PP), 9^{c}. At 10% of inclusion the preferences were: FM, 72^{a}; DPP, 61^{ab}; REF, 47^{b}; WG, 39^{b}; SBM, 15^{c} and PP, 9^{c}. Finally, at 20% of inclusion the preferences were: FM: 66^{a}, REF: 50^{b}, SBM: 33^{c}, DPP: 32^{c}, WG: 32^{c} and PP: 3^{d}. Values with different superscripts were significantly different ($P<0.05$); pooled SEM=6.3. In conclusion, protein source and inclusion level affect the palatability of diets for piglets. Amongst the products tested, fishmeal consistently had the highest palatability values across the three inclusion levels and potato protein had the lowest.

Key Words: Piglet palatability, Diet preference, Protein sources

T255 Estimation of the ideal ratio of threonine:lysine in diets for growing pigs weighing 30-60 kg. I. Moreira*[1], D. Paiano[1], P. L. O. Carvalho[1], A. R. Poveda Parra[1], A. R. B. Quadros[2], and L. S. Perdigão[1], [1]*Universidade Estadual de Maringà*, *Maringà, Paranà, Brazil*, [2]*Universidade Federal de Santa Maria*, *Santa Maria, Rio Grande do Sul, Brazil*.

This study was carried out to evaluate the effects of threonine:lysine ratio (Thr:Lys) for growing pigs. Forty crossbred pigs (20 barrows and 20 gilts) with initial an weight of 30.1±1.8 kg were used. Pigs were housed in individual pens ($4m^2$) and had ad libitum access to one nipple waterer and a one-hole feeder. Pigs were allotted to one of five dietary treatments in a randomized complete block design with eight replicate pens per treatment. A corn-soybean meal diet was formulated according to the ideal protein concept, to meet NRC – 1998 requirements (3.4 Mcal DE/kg; 14.7% CP; 0.81% true digestible lysine; 0.55% Ca and 0.39% P). Additional synthetic amino acids were supplied as necessary to meet intended Thr:Lys ratios (0.574; 0.624; 0.672; 0.722; 0.772). Data were analyzed by polynomial regression using Thr:Lys as an independent variable. Thr:Lys had no effect on feed intake, daily weight gain, feed:gain ratio and PUN. However, backfat thickness decreased linearly with increasing Thr:Lys. These data indicate that the ideal ratio of Thr:Lys for growing pigs (30–60 kg BW) is as high as 0.772.

Key Words: Amino acid, Backfat thickness, Ideal protein

T256 Estimation of the ideal ratio of threonine:lysine in diets for finishing pigs weighing 60-90 kg. I. Moreira*, D. Paiano, A. C. Furlan, P. L. O. Carvalho, C. Scherer, and N. Silvestrini, *Universidade Estadual de Maringà*, *Maringà, Paranà, Brazil*.

An experiment was conducted to evaluate the effects of threonine:lysine ratio (Thr:Lys) for finishing pigs. Forty crossbred pigs (20 barrows and 20 gilts) with an initial weight of 60.7±4.7 kg were used. Pigs were housed in individual pens ($4m^2$) and had ad libitum access to one nipple waterer and a one-hole feeder. Pigs were allotted to one of five dietary treatments in a randomized complete block design with eight replicate pens per treatment. A corn-soybean meal diet was formulated according to the ideal protein concept, to meet NRC–1998 requirements (3.4 Mcal DE/kg; 12.5% CP; 0.68% true digestible lysine; 0.49% Ca and 0.33% P). Additional synthetic amino acids were supplied as necessary to meet intended Thr:Lys ratios (0.574; 0.624; 0.672; 0.722; 0.772). Data were analyzed by polynomial regression having Thr:Lys as the independent variable. There were no effects of Thr:Lys rations on feed intake, daily weight gain, feed:gain ratio, PUN and carcass traits. Liver weight increased linearly with increasing Thr:Lys. The results suggest that for better lean meat accretion, finishing (60–90 kg BW) pigs should be fed on diets with 0.722 Thr:Lys ratio.

Key Words: Amino acid, Carcass traits, Ideal protein

T257 Nucleotide supplementation enhances piglet performance. S. Tibble*[1], P. Köppel[2], and T. van Kempen[3], [1]*SCA Iberica*, *Spain*, [2]*Chemoforma Ltd.*, *Switzerland*, [3]*Provimi RTC*, *Belgium*.

Nucleotides play several key roles in metabolism. They are the building blocks of RNA and DNA, intermediates in and regulators of energy metabolism, and co-factors for enzymes. The objective of this research was to determine if supplemental nucleotides enhanced performance of nursery piglets. Piglets (n=1280) weaned at 21 d of age were blocked into weight categories of 5, 6, and 7 kg and housed 12 per pen. Pens were assigned using a RCB design to diets containing 0 (control), 0.05%, 0.1%, 0.2%, and 0.4% nucleotides (Ascogen from Chemoforma). Piglets were fed high quality high zinc diets manufactured by SCA Iberica. Data were analyzed using analysis of variance, and treatment means were used to model the dose response using quadratic regression. ADG and G/F was significantly improved in all periods at 0.20% nucleotides. ADFI was only significantly improved in period 1 (Table). The results of the dose-response analysis showed that nucleotide supplementation improved ADG by 18.7, 6.3, and 6.3% at an optimum dose of 0.23, 0.21, and 0.21%, in period 1, 2, and 3, respectively. In line with the results of the ANOVA, the feed intake response was less consistent, with an increase in feed intake in period 1 by 7.7% at a dose of 0.23%. G/F was improved by 10.4, 10.6, and 10.4 at doses of 0.25, 0.25, and 0.21% nucleotides in periods 1, 2, and 3, respectively. Overall, these data demonstrate that the optimum dose for nucleotides in order to optimize daily gain and gain/feed is 0.20 to 0.25%. The response for feed intake was variable and less strong.

Table 1.

	ADG, g/d			FI, g/d			G/F		
Dose, %	d0-11	d11-26	d26-68	d0-11	d11-26	d26-68	d0-11	d11-26	d26-28
0	127	363	543	137	438	961	0.92	0.83	0.56
0.05	138	371	559	142	437	954	0.98	0.85	0.59
0.10	143	378	567	146	427	940	0.98	0.89	0.60
0.20	151	386	577	147	424	934	1.02	0.91	0.62
0.40	140	367	550	142	418	961	0.99	0.88	0.57
P	0.00	0.00	0.00	0.00	0.20	0.15	0.24	0.00	0.00

Key Words: Piglet, Nucleotides

T258 Palatability of diets with different oil and fat sources in piglets. D. Solà-Oriol[1], E. Roura*[2], and D. Torrallardona[1], [1]*IRTA-Centre de Mas Bové*, *Reus, Spain*, [2]*Lucta SA*, *Barcelona, Spain*.

Oils and fats are used in piglet diets mainly as a source of energy. However, they may also affect palatability and play an important role in feed intake and weight gain. The palatability of different sources of fat and oil in piglet diets was studied in two trials of 36 pens (4 animals/pen) using a double choice preference test in which a reference basal diet (REF) with sunflower oil was used. Each pen was offered free access to two different diets in two feeders: either the REF diet or the diet containing the fat or oil source to be tested (TEST). The oil and fat sources tested were included in the TEST diets at 1.5, 3 and 10% of inclusion by replacing the same amount of sunflower oil from the REF diet and these were presented in mash form. In each trial a double control test (REF vs. REF) was included. The TEST diets were studied in three consecutive 4d periods, from the lowest to the highest level of inclusion. Each fat or oil preference (relative to the reference diet) was calculated as the percentage contribution of the TEST diet to total feed intake. The preference values were analyzed taking into account the effects of fat or oil source, level of inclusion and their interaction. REF diet included 3, 3 and 10 % sunflower oil in the first, second and third periods, respectively. At 1.5% of inclusion, the preferences (% of total feed intake) were: fish oil: 54, REF: 54, palm oil: 53, soybean oil: 52, coconut oil: 45, linseed oil: 40 and lard: 40. At 3% of inclusion, the preferences were: palm oil: 69^{a}, fish oil: 56^{ab}, REF: 56^{ab}, coconut oil: 53^{b}, soybean oil: 49^{b}, lard: 46^{b} and linseed oil: 26^{c}. Finally, at 10% of inclusion the preferences were: coconut oil: 57^{a}, REF: 53^{a}, fish oil: 51^{a}, lard: 50^{ab}, palm oil: 43^{ab}, soybean oil: 38^{b} and linseed oil: 34^{b}. Values with different superscripts are significantly different ($P<0.05$); pooled SEM=5.5. In conclusion oil or fat source affects the palatability of diets for piglets and linseed oil had the lowest palatability, particularly at 3 and 10% inclusion.

Key Words: Piglet palatability, Diet preference, Oil and fat sources

T259 Effect of inclusion of sweet potato (*Ipomoea batatas* L) meal on weight gain and dressing percentage of finishing pigs. S. Pietrosemoli*, O. Moron, A. Paez, C. Chirinos, and A. Marrugo, *La Universidad del Zulia*, *Maracaibo, Zulia, Venezuela*.

The objective of this study was to assess the effect of including sweet potato meal (foliage [**F**] and root [**R**]) on the weight gain and dressing percentage of growing pigs. Eighteen female and castrated males (1:1) Duroc × Landrace pigs (62 ± 3.9 kg), were balanced across 3 treatments in a completely randomized design: **T1**, 100 % commercial concentrate (**CC**); **T2**, 60 % **CC**, 30 % **F** and 10 % **R**; **T3**, 50 % **CC**, 40 % **F** and 10 % **R**. Pigs had *ad libitum* access to feed and body weight was monitored weekly until they reached a final weight of 90 ± 5 kg. Pigs of **T1** reached final weight 2 weeks earlier than those of **T2** and **T3**. Daily weight gain, hot carcass weight, and dressing percentage differed ($P \leq 0.01$), whereas no difference was observed for the other variables. Including sweet potato meal into diets of finishing pigs negatively affected daily weight gain, hot carcass weight and dressing percentage.

Table I. Performance of finishing pigs feed with sweet potatoes meal.

	TREATMENTS		
	T1	T2	T3
Inicial weight, kg	64.27 ± 1.96	61.63 ± 1.70	60.10 ± 1.52
Final weight, kg	93.60 ± 1.82	86.0 ± 4.01	85.20 ± 2.14
Daily gain, kg	0.84 ± 0.04a	0.55 ± 0.04b	0.51 ± 0.04b
Hot Carcass weight, kg	67.0 ± 2.4a	59.8 ± 1.9b	58.4 ± 1.9b
Dressing percentage, %	53.9 ± 5.1a	67.5 ± 4.2b	66.8 ± 4.2b

a,b: Within a row differ (p < 0, 05)

Key Words: *Ipomoea batatas*, Pig, Growth

T260 Effects of in-feed anti-salmonella egg yolk antibodies on growth performance and health status in weaned pigs challenged with *Salmonella* Typhimurium. S. Rattanatabtimtong*, A. Mathew, A. Saxton, S. Chattin, E. Jarboe, and R. Clift, *University of Tennessee*, *Knoxville*.

An experiment was conducted to determine effects of anti-salmonella egg yolk antibodies (ASEYA) on the growth performance, rectal temperatures and immunological indicators prior to and following *Salmonella enterica* Typhimurium challenge. In two replicate trials, weaned pigs (n=132) were randomly assigned to six dietary treatments, including a control diet without additives or similar diets containing apramycin followed by carbadox, or oxytetracycline, or egg yolk powder containing ASEYA, or egg yolk powder lacking ASEYA, or spray dried plasma protein. Pigs were challenged with S. Typhimurium seven days following initiation of dietary treatments. Blood samples were collected, weights were recorded, and rectal temperatures were measured prior to initiation of dietary treatments (day 0), just before challenge (day 7), and on days 8, 12, 14, 21, and 28 of the experiment. Blood was analyzed for white blood cell (WBC) counts and serum was analyzed for anti-salmonella antibody and interleukin-1β (IL-1β) concentrations. Weight gains did not differ between treatment groups over the course of the study. Rectal temperatures also did not differ between treatment groups; however, pigs in all groups had higher rectal temperatures 24 h after challenge ($P<0.001$) and had decreasing rectal temperatures beginning on day 12. Concentrations of anti-salmonella antibodies and IL-1β in serum did not differ between treatment groups. Anti-salmonella antibody concentrations increased in all groups beginning on day 14 and continued to increase through day 28 ($P<0.001$). Pigs fed diets containing antibiotics had lower WBC counts compared to other treatment groups ($P<0.05$). This study indicates that in-feed addition of anti-salmonella egg yolk antibodies may not be effective in improving the performance or health status of pigs challenged with salmonella.

Key Words: Egg yolk antibodies, Salmonella, Swine

T261 Differential effects of three herbal feed additives on growth and gut microbiota of weanling piglets. T. Doriana*, G. Sara, and S. Simone, *University of Milan*, *Milan, Italy*.

As the use of antibiotic growth promoters has been banned in Europe, research has focused on an effective replacement. One of the possible strategies towards this objective is the use of bioactive compounds from plants. The aim of the present study was to evaluate the differential effects of three plant extracts on growth and intestinal microbiota of

weanling piglets. Animals were divided into five groups of 28 piglets each and treated from 21 to 41 days of age as follows: CN (negative control, no additives); AB (positive control, 2 g/kg feed of apramycin and 1 g/kg feed of colystin); CO (2 g/kg of LM51228); GY (2 g/kg of LM53411); LO (2 g/kg of LM 54236). Individual weight was determined on d21, d29, d41, and d71 and feed intake was estimated at the end of the treatment period (d41). Fecal samples were collected on d29 and d41 and total bacterial count, *Escherichia coli*, *Enterococcus* spp., total coliforms, anaerobic bacteria, and *Lactobacillus* spp. were cultured in selective media. The average weight gain in the treatment period (21 to 41d) was greater in treated groups compared to the CN group: LO 2.76 kg ($P<0.1$), CO 3.39 kg ($P<0.05$), GY 3.52 kg ($P<0.01$), CN 2.58 kg (SE=0.23 kg). Average feed intake was also higher in these groups compared to CN, indicating that the tested substances did not negatively affect palatability of feed. Microbiological evaluations on fecal samples showed a lower value for *E. coli* in LO ($P<0.01$) and CO groups ($P<0.05$) and a lower value of *Enterococcus* spp. in both LO and CO groups ($P<0.01$) compared to the CN group. In conclusion the tested plant extracts can contribute to improve growth performance and control intestinal microbiota, having a potential as new feed additives for weanling piglets.

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Key Words: Plant extract, Feed additives, Weanling piglet