T189 Importance of sampling diets on the precision of ME studies with swine. G. J. M. M. Lima*, L. C. Ajala, and C. M. Marques, *Embrapa, Brazil.*

Energy balance studies with swine provide data of high variability. The main sources for it are animals and feed. Most studies are done with number of replicates (barrows) per treatment varying from 4 to 12 to improve energy estimate. However, there are no references of how many feed samples should be collected and analyzed. Errors in feed mixing and feed analysis can affect ME estimation. This study was carried out to evaluate the error of determining ingredient ME considering just one feed sample. Therefore, 16 energy balance studies were carried out with 32 ingredients. A total of 384 barrows (50 kg wt, in average) were used. Pigs were kept in individual conventional metabolic cages. Each trial (24 barrows, progeny of the same boar) consisted of one basal diet and 3 test ingredients replacing part of the basal diet. Tested ingredients, number of different batches of each ingredient and inclusion levels in the basal diet were, respectively: poultry viscera and feather meal (VFM), 5 batches, 20%; dry yeast from sugarcane fermentation (DY), 4 batches, 30%; yellow corn (C), 21 batches, 30%; and heated whole soybeans (WSB), 2 batches, 10%. The adaptation period lasted 7 d, followed by 5 d of total collection of urine and feces, separated. Iron oxide was added to feed as marker. Five samples of each test diet were gathered during the collection period. Ingredient ME values were calculated using each individual analyzed feed sample. Based on each sample, estimated ME values for the same batch were different ($P < 0.0001$), regardless the ingredient. Range among batch ME (kcal/kg DM) varied from: 3925 to 4326 for VFM; 3369 to 3572 for DY, 3668 to 4287 for C and 3933 to 4334 for WSB. The difference between the smallest and largest ME estimate (kcal/kg DM), considering individual sampling from a single ingredient batch, reached up to 1811 for VFM, 529 for DY, 236 for C and 1116 for WSB. These results demonstrate the importance of repeating sampling of test diets and use their average value to improve precision of ME estimate of feed ingredients.

Key words: digestibility, feedstuffs, methodology

T190 Influence of dietary net energy concentration provided during the finishing period on carcass, meat and fat characteristics of heavy gilts. M. A. Latorre*[1,2], J. Suárez[1], M. A. Sanz[2], G. Ripoll[2], and M. Joy[2], *[1]Universidad de Zaragoza, Spain, [2]Centro de Investigación y Tecnología Agroalimentaria de Aragón, Zaragoza, Spain.*

A total of 60 Duroc × (Landrace × Large White) gilts were used to study the influence of increasing the energy concentration in diet during the finishing period on carcass, meat and fat characteristics. The experimental diets were based on barley, wheat, corn and soybean meal, contained 13.5% CP and 0.70% lysine and were provided from 100 to 130 kg BW. Pigs were slaughtered at heavy weight because were intended for dry-cured ham industry. There were 3 treatments with 3 NE levels; 2,280, 2,350, and 2,420 kcal NE/kg of feed. Therefore, the NE:lysine ratio was not constant in the experimental diets (CP was 13.5% in all cases and NE was increasing). Each treatment was replicated 4 times and the experimental unit was the pen constituted by 5 pigs allocated together. SAS package was used to analyze data statistically. The model included dietary treatment as main effect and the REG procedure was used on each trait to analyze the responses to diet. The increase of NE in the diet did not modified ($P > 0.05$) pH or carcass or ham size but decreased carcass weight ($P < 0.01$) and carcass yield ($P < 0.05$) and tended to increase ($P < 0.10$) the fat thickness between the third and forth last ribs and at the gluteus medius muscle level. The increase of NE content in diet decreased ($P < 0.01$) the yield of main trimmed lean cuts (shoulder+ham+loin+sirloin) in carcass due to a decrease ($P < 0.01$) of the ham yield. Meat characteristics were not affected by dietary treatment ($P > 0.05$). Also, only some fatty acids were modified ($P < 0.001$) by NE content in diet decreasing as NE increased; C20:0, C21:0, C22:0 and C20:4. We can conclude that the effect of increasing the NE in diet provided during the finishing period on carcass, meat and fat quality of pigs were scarce. However, an increase of NE content from 2,280 to 2,350 kcal/kg might be interesting in the case of pigs intended for dry-cured products when a minimum carcass fat thickness is a criterion to select the carcasses.

Key words: dietary net energy, carcass and meat quality, pigs

T191 Metabolizable energy and digestibility of carbohydrates in cereal grains fed to growing pigs. S. K. Cervantes-Pahm* and H. H. Stein, *University of Illinois, Urbana.*

The objective of the experiment was to measure the ME and the apparent ileal (AID) and the apparent total tract (ATTD) digestibility of carbohydrates (CHO) and total dietary fiber (TDF) in 8 cereal grains. The 8 cereal grains were yellow dent corn (YD), NutriDense corn (ND), de-hulled barley, de-hulled oats, polished rice, rye, sorghum, and wheat. Each cereal grain was included in 1 diet and titanium dioxide (0.5% was included in each diet as an indigestible marker. Twenty-four ileally cannulated pigs (BW = 30.7 ± 3.2 kg) were randomly allotted to the 8 diets in a completely randomized design. Pigs were fed experimental diets during 3 14-d periods. In each period, 3 pigs were fed each diet for a total of 9 observations per diet and no pig was fed any diet more than once. Pigs were placed in metabolism cages and fecal samples were collected quantitatively from d 6 to 11 and ileal samples were collected on d 13 and 14 of each period. Results of the experiment indicated that ME in de-hulled oats was greater ($P < 0.01$) than in ND, barley, and rice. The ME in sorghum was not different from the ME in YD and rye. The AID of CHO was greatest ($P < 0.01$) in polished rice and least ($P < 0.01$) in sorghum. The ATTD of CHO in rice was greater ($P < 0.01$) than in all other grains and the ATTD of CHO in wheat was least ($P < 0.01$) among the grains. The AID of TDF in YD, ND, de-hulled barley, and rye were not different, but were greater ($P < 0.01$) than in de-hulled oats and rice. The AID of TDF in de-hulled barley was also greater ($P < 0.01$) than in sorghum and wheat. The ATTD of TDF was less ($P < 0.01$) in polished rice than in all other cereal grains, but no differences among the other grains were observed. In conclusion, rice had the greatest ATTD of CHO, but de-hulled oats had the greatest ME among all cereal grains.

Table 1. ME and digestibility of carbohydrates in cereal grains

Item	ME, kcal/kg	AID CHO	AID, TDF	ATTD, CHO	ATTD, TDF
YD	3,443^{bc}	81.4^{cd}	12.1^{ab}	95.3^{bc}	54.7^{a}
ND	3,507^{b}	88.0^{b}	10.4^{ab}	94.5^{c}	50.4^{a}
Barley, DH	3,504^{b}	80.3^{cd}	24.0^{a}	95.6^{bc}	44.6^{a}
Oats, DH	3,661^{a}	83.6^{c}	−70.5^{e}	96.8^{b}	13.3^{a}
Rice	3,513^{b}	96.8^{a}	−6.3^{d}	98.4^{a}	−55.8^{b}
Rye	3,327^{d}	75.8^{e}	10.8^{abc}	94.8^{c}	62.8^{a}
Sorghum	3,388^{cd}	66.5^{f}	5.8^{bcd}	91.8^{d}	33.0^{a}
Wheat	3,471^{b}	78.8^{de}	−5.0^{cd}	89.8^{e}	27.3^{a}
SEM	31	1.2	4.9	0.6	25.6
P-value	0.001	0.001	0.001	0.001	0.01

CHO was calculated as DM − (CP + crude fat + ash).

Key words: carbohydrates, cereal grains, energy

T192 Nutritional value of acerola meal for broiler chickens. L. H. Zanetti*[1], V. C. da Cruz[1], G. do Valle Polycarpo[2], A. C. Pezzato[2], J. R. Sartori[2], V. B. Fascina[2], R. F. de Oliveira[1], A. L. C. Brichi[1], M. L. Poiatti[1], O. J. Sabbag[1], F. Vercese[2], and F. B. de Carvalho[2], *[1]São Paulo State University, Dracena Campus, Dracena, São Paulo, Brazil, [2]São Paulo State University, Botucatu Campus, Botucatu, São Paulo, Brazil.*

This study was carried out at the experimental aviary of the Sao Paulo State University, Botucatu Campus, Brazil. A metabolism assay with 100 8- to 16-d-old male Cobb broiler chicks was carried out using the method of total excreta collection. The birds were stored in 20 cages that were previously adapted with plastic covered trays to collect excreta. The experimental design was entirely random with 4 treatments and 5 replications of 5 birds per experimental unit. Acerola meal (AM) was substituted at 10, 15 and 20% of reference feed formulated with corn and soybean meal. The GE values were obtained using a colorimetric pump of 4.143 kcal/kg, and from these results the apparent ME (AME) was calculated and apparent corrected by the nitrogen balance (AMEn) of AM. The bromatological analyses determined the DM, CP, ether extract (EE), mineral matter (MM), crude fiber (CF), NDF, and ADF. The values of AME and AMEn decreased linearly ($P < 0.05$) as AM addition to the diet increased (AME = 1,215.88 – 24.37x; $R^2 = 0.33$ and AMEn = 1,313.72 – 31.86x; $R^2 = 0.35$). The recommended value of AME and AMEn for the use of AM in the nutritional matrix of broiler chickens′ feed was the one of the treatment with 20% AM addition, corroborating the literature where the greater the feed ratio in the reference feed, the more precise its determination is. The values of AME and AMEn decrease as the AM additions increase. It can be inferred that the values of AME and AMEn for AM are 754 kcal/kg and 756 kcal/kg, respectively. The results of the chemical and bromatological composition of AM used in the experiment for the other analyses were: 89.15% (DM), 8.36% (CP), 4.57% (EE), 3.19% (MM), 46.27% (CF), 50.86% (NDF), and 41.33% (ADF).

Key words: bromatological composition, industrial by-product, metabolism

T193 Concentration of DE and ME in fermented soybean meal, conventional soybean meal, and fish meal fed to weanling pigs. O. J. Rojas* and H. H. Stein, *University of Illinois, Urbana.*

An experiment was conducted to measure the concentration of DE and ME in US-produced fermented soybean meal (FSBM), conventional soybean meal (SBM-CV), and fish meal fed to weanling pigs. A corn-based diet consisting of 96.4% corn was formulated. Three additional diets were formulated containing corn and each of the experimental ingredients (FSBM, SBM-CV, and fish meal, respectively.) Thirty-six growing barrows (initial BW: 22.0 ± 3.85 kg) were placed in metabolism cages and allotted to a randomized complete block design with 4 diets and 9 pigs per diet. Feces and urine were collected for 5 d after a 5 d adaptation period. The ATTD and concentrations of DE and ME were calculated in fish meal and the 2 soybean meals using the difference procedure. Results indicated that the ATTD of energy in SBM-CV was 91.1% which was greater ($P < 0.001$) than in corn (88.0%) and fish meal (84.1%), and the ATTD of energy in FSBM (89.4%) was greater ($P < 0.001$) than in fish meal. The concentrations of DE and ME in SBM-CV were 4,608 and 4,144 kcal/kg DM, which was greater ($P < 0.001$) than the DE and ME in FSBM (4,223 and 3,678 kcal/kg DM, respectively), corn (3,921 and 3,768 kcal/kg DM, respectively), and fish meal (3,819 and 3,361 kcal/kg DM, respectively). However, FSBM contained more ($P < 0.001$) DE than corn and fish meal and more ($P < 0.001$) ME than fish meal. In conclusion, the concentration of DE and ME are less in FSBM than in SBM-CV. However, DE and ME are greater in FSBM than in fish meal.

Key words: energy, fermented soybean meal, soybean meal

T194 The effect of n-3 fatty acid supplementation on growth performance, nutrient digestibility, blood profiles, meat quality and lean and adipose tissue fatty acid profiles in finishing pigs. J. P. Wang*, B. U. Yang, and I. H. Kim, *Dankook University, Cheonan, Choongnam, South Korea.*

This study was conducted to evaluate the effect of dietary n-3 fatty acid supplementation on growth performance, nutrient digestibility, blood profiles, meat quality and fatty acid profiles of lean and adipose tissue in finishing pigs. A total of 150 crossbred barrows (initial BW = 55.7 ± 1.4 kg) were randomly allotted into 1 of 3 treatments by their BW and litters (10 replicate pens per treatment, 5 pigs per pen). The 3 treatments were corn-soybean diet with 0% (CON), 1.5% (T1), and 3% (T2) of unrefined tuna oil at the cost of corn, and the diet were isolysinic and isocaloric by manipulation of soybean meal and fat source (soy oil). The trial lasted 12-wk, and the pigs were killed to measure the carcass characteristics at the end of experiment. Data were subjected to the GLM procedure of SAS. During the entire experiment, none of the tuna oil treatments had effects on growth performance and apparent total tract nutrient digestibility (ATTD) of DM, nitrogen and energy. No differences were shown on the blood total cholesterol, high density lipoprotein cholesterol (HDL), low density lipoprotein cholesterol (LDL), and triglycerides among treatments in this experiment. The pigs in T2 treatment had lower loin muscle area than CON treatment (45.91 vs. 51.46 cm^2, $P < 0.05$). Water holding capacity (WHC), ultimate (24 h) pH value, as well as backfat thickness were not different between treatments. There was a decrease ($P < 0.05$) in palmitric acid (T1:24.99, T2:25.27 vs. CON:26.26%) in lean tissue, whereas n-6 fatty acids (T1:2.73, T2:3.03 vs. CON:3.15%) largely decreased ($P < 0.05$). Dietary supplementation of tuna oil (at 3%) feeding resulted in a lower docosahexaenoic acid concentration, and total n-3 fatty acid contents in adipose tissue ($P < 0.05$). These results show that the inclusion of tuna oil (rich in n-3 fatty acids) had no negative effects on growth performance and the n-3 fatty acids ingested can be deposited in lean and adipose tissue in fattening pigs.

Key words: finishing pig, meat quality, n-3 fatty acid