

Nonruminant Nutrition: Amino Acids and Energy

M155 Influence of energy concentration of the diet and terminal sire line on growth performance and carcass and meat quality of pigs slaughtered at 115 kg of BW. G. Coca¹, M. P. Serrano¹, L. Cámara¹, P. Guzmán¹, J. D. Berrocoso¹, J. Coma², and G. G. Mateos*¹, ¹Animal Science Department, Universidad Politécnica de Madrid, Madrid, Spain, ²Vall Company, Lleida, Spain.

In total, 480 pigs (48 ± 5.15 kg BW) were used to investigate the effects of net energy (NE) concentration of the diet (2,350, 2,400, 2,450, and 2,500 kcal/kg) and terminal sire line (PIC L62 vs. Pietrain) on growth performance and carcass and meat quality of gilts and boars slaughtered at 115 kg BW. Pigs were fed according to a 2-phase feeding program using diets based on cereals, rapeseed meal, and soybean meal. Within each feeding period the lys:NE (g/Mcal) ratio was the same for all diets (3.8 vs. 3.5 respectively). Cumulatively, feed intake was reduced ($P < 0.001$) and G:F was improved ($P < 0.001$) as the level of NE of the diet increased but ADG and carcass and meat quality traits were not affected by diet. Crossbreds from PIC L62 sire line had higher ADFI and ADG ($P < 0.001$) than crossbreds from Pietrain sire line but G:F was not affected. Carcasses from Pietrain crossbreds were leaner ($P < 0.001$) and tended to have higher shoulder ($P < 0.08$) yield and less intramuscular fat ($P < 0.05$) than carcasses from PIC L62 crossbreds. Fat at m. gluteus medius was higher ($P < 0.001$) for PIC L62 crossbreds than for Pietrain crossbreds. Boars had better ADG ($P < 0.01$) and G:F ($P < 0.001$) and higher shoulder yield ($P < 0.001$) and less carcass yield ($P < 0.001$) and fat at m. gluteus medius ($P < 0.01$) than gilts. Also, boars tended to have less intramuscular fat ($P < 0.08$) in m. longissimus dorsi than gilts. In conclusion, an increase in NE concentration of the diet did not affect ADG or carcass quality of pigs. Therefore, an increase in energy content of the diet might not be justified under most economic circumstances. PIC L62 crossbreds had better growth performance but fatter carcasses than Pietrain crossbreds and gilts had higher carcass yield than boars. Consequently, gilts from PIC L62 crossbreds are preferred when carcasses are destined to the dry-cured industry.

Key Words: carcass quality and growth performance, sex and sire line, net energy concentration

M156 The utilization of energy by pigs differing in estimated growth potential. A. D. Beaulieu*¹, D. A. Gillis¹, J. N. Shea¹, J. P. Marriott¹, and J. F. Patience², ¹Prairie Swine Centre Inc., Saskatoon, SK, Canada, ²Iowa State University, Ames.

A significant challenge in pork production is managing the variability within a cohort of pigs. Our objective was to compare the utilization of dietary energy for growth and protein deposition among pigs selected at nursery exit based on growth potential (GP). Treatments, arranged as a $3 \times 2 \times 2$ factorial were 3 GPs, 2 dietary energy concentrations (NE; 2.18 or 2.40 Mcal NE/kg) and 2 intake levels (IN; 100 or 85% of ad libitum). Dietary energy was increased with canola oil and substituting wheat for barley. Each wk for 8 wks, 15 barrows were selected at nursery exit (about 62 d of age, DOA) from 3 litters and divided into a fast (0.46 ± 0.04), average (0.40 ± 0.04) or slow (0.34 ± 0.04 kg/DOA \pm SD) GP group. Within GP, pigs were randomly allocated to 1 of the 4 NE by IN treatments or to an initial slaughter group (ISG). Dietary treatments began at 90 kg BW. Pigs were slaughtered at 90 (ISG) or 120 kg BW. Growth rate between 90 and 120 kg BW was unaffected by

GP or NE ($P > 0.10$) and decreased by lower IN (0.86 vs. 1.01 kg/d; $P < 0.01$). GP did not affect feed intake ($P > 0.10$) which was increased when pigs were fed 2.18 vs. 2.40 Mcal NE/kg or 100% IN ($P < 0.05$). Feed efficiency was similar among treatments ($P > 0.10$). Efficiency of energy utilized for BW gain (Mcal NE/kg) was unaffected by GP and NE but tended to be higher at the 85 vs. 100% IN ($P = 0.06$). The efficiency of energy utilized for protein deposition (g CP/Mcal NE) was increased or tended to be increased by low NE ($P < 0.05$) or low IN ($P = 0.09$). The rate of protein deposition was increased at low NE (161 vs. 137 g/d; $P < 0.05$), tended to be increased by higher IN ($P = 0.09$) and was unaffected by GP ($P > 0.10$). Pigs fed 100% IN or 2.40 NE had an increased rate of lipid deposition ($P < 0.05$) which was unaffected by GP ($P > 0.10$). The rate and efficiency of protein deposition from 90 to 120 kg BW were increased by a lower NE. Pigs selected for GP at nursery exit, however, were similar during finishing with respect to rate and efficiency of growth and protein deposition. Separating pigs into GP classes at nursery exit will not aid management of variability in the finishing barn.

Key Words: swine, variability, dietary energy

M157 Effect of starch level in pig diets on digestible energy value of crude glycerin using the mobile nylon bag technique. C. A. Ordoñez-Gomez*^{1,2}, C. Ariza-Nieto¹, and G. Afanador-Tellez², ¹CORPOICA, Bogota, Colombia, ²Universidad Nacional de Colombia, Bogota, Colombia.

In recent years, crude glycerin production has increased exponentially, which has led to a reduction of its price, making it possible for this co-product to reduce feed production costs in the pig industry. The aim of this study was to evaluate the effect of starch level on the digestible energy (DE) value of crude glycerin. Eight barrows (46 kg initial body weight and fitted with a duodenal T-cannula) were used to estimate DE of crude glycerin derived from diets containing 2 starch levels (10 and 12%) and 5 crude glycerin levels (0, 2.5, 5.0, 7.5, 10%). Therefore, 10 mixed diets were formulated and evaluated by the mobile nylon bag technique. A total of 320 nylon bags were used for DE value determination (32 per diet). In vitro digestion of the bags was carried out in pepsin-HCl solution with 450 IU pepsin/L at pH 2.0 and 37°C for 4 h. In the in vivo phase, 8 nylon bags were inserted into the duodenal cannula of each pig daily, during feeding times (800, 1030, 1300, and 1530 h). The nylon bags used in the study were excreted within 24 h of insertion and were carefully isolated from feces with a dry paper towel, then were frozen (-20°C) and freeze-dried for gross energy determination. The amount of material remaining in the nylon bag after passage through the digestive tract was used to calculate energy digestibility. The DE value of each bag was corrected for the DE of corn starch. Data were analyzed by a multiple linear regression model using PROC REG of SAS (v9.0). The slope of the regression line indicated the DE for crude glycerin, while the regression intercept indicated the effect of starch level. Results showed no interaction between the level of starch in the basal diet and the digestible energy value of crude glycerin ($P = 0.239$). The apparent DE of crude glycerin fed to pigs was 3251 kcal/kg DM ($R^2 = 0.578$; $P < 0.001$). According to the results of this study, the level of starch in pig diets does not affect the digestible energy value of crude glycerin.

Key Words: digestible energy, crude glycerin, pig

M158 Dynamic changes in blood flow, oxygen consumption and metabolite responses to acute arginine supplementation in growing-finishing pigs. B. E. Tan¹, Y. L. Yin^{*1}, X. F. Kong¹, and G. Y. Wu^{1,2}, ¹*Institute of Subtropical Agriculture, The Chinese Academy of Sciences, Chansha, Hunan, China*, ²*Department of Animal Science, Texas A&M University, College Station.*

Arginine plays an important role in regulating nutrient metabolism. This study was conducted to determine the dynamic changes in blood metabolite responses to acute arginine supplementation in growing-finishing pigs using a blood catheter technique. Eight barrows (Duroc × Large White × Landrace) with an average initial BW of 70 kg were surgically fitted with chronic catheters in the portal vein, ileal vein and carotid artery and were randomly allocated to 2 groups to receive alanine (103 mg/kg body wt, isonitrogenous control) or L-arginine-HCl (61 mg/kg body wt) by the portal vein. Blood flows were measured with infusion of p-aminohippuric acid (PAH) into the ileal vein, and blood samples were obtained every 0.5 h for 4 h to determine oxygen consumption by portal vein-drained organs (PVDO) and concentrations of blood metabolites. Compared with alanine treatment, arginine infusion increased portal vein blood flow at 30, 60 and 90 min after infusion, but decreased ($P < 0.05$) PVDO at 60, 90, 120 and 150 min after infusion. Plasma concentrations of glutamate (at infusion times of 180 and 240 min) and arginine (at infusion times of 60, 120, 180 and 240 min) in arginine-infused pigs were higher ($P < 0.05$) than those of alanine-infused pigs at the same infusion time. However, arginine infusion decreased ($P < 0.05$) plasma cystine concentrations at infusion times of 60, 120, 180 and 240 min and valine at infusion times of 60 and 120 min compared with alanine treatment. Plasma concentrations of insulin and glucagon at infusion times of 30, 60 and 90 min were higher, and free fatty acids at infusion times of 60, 90 and 120 min were lower, compared with pigs both in alanine treatment at the same infusion time and at the pre-infusion (baseline) time ($P < 0.05$). These results suggest that acute arginine supplementation improves blood flow and reduces PVDO oxygen consumption, thereby enhancing amino acid availability for utilization. Insulin and glucagon may also play important roles with arginine infusion by transiently regulating nutrient metabolism.

Key Words: pig, nutrition, amino acids

M159 Dietary valine:lysine ratios of 0.80 and 0.85 did not differ performance of primiparous sow and nursing large litters. S. M. Hong,^{*} P. Y. Zhao, and I. H. Kim, *Department of Animal Resource & Science, Dankook University, Cheonan, Choongnam, South Korea.*

An experiment using 18 primiparous sows (Landrace × Yorkshire) to determine the effect of dietary valine:lysine ratios on performance in primiparous sows and litter. Sows were randomly assigned to 1 of 2 experimental diets (9 replicate pens per treatment and 1 sow per pen) containing different valine:lysine ratios of 0.80 or 0.85. Corn-soybean-wheat based diets were formulated to achieve the dietary treatments (0.86% SID lysine, and 0.69% or 0.73% SID valine). All diets were formulated to have 3.45 Mcal ME/kg and contained vitamins and minerals that exceeded NRC (1998) recommendations. The experiment lasted for 21 d. On d 107 of gestation, sows were moved into farrowing crates in an environmentally regulated farrowing house. Farrowing crates (2.1 × 0.6 m) contained an area (2.1 × 0.6 m) for newborn pigs on each side, and the temperature in the farrowing house was maintained at a minimum of 20°C. After farrowing, daily feed allowance increased gradually, and sows had ad libitum access to feed by wk 2. Overall, body weight loss (41.8 vs. 37.7 kg), backfat loss (5.5 vs. 7.9 mm), and ADFI (5.39 vs. 5.72 kg) of sows were not affected ($P > 0.05$) by different dietary valine:lysine ratios. No difference ($P > 0.05$) was noted in estrus interval (5.5 vs.

5.8 d). There was no difference ($P > 0.05$) in average body weight of piglets on the day of birth (1.39 vs. 1.26 kg) and d 21 (7.14 vs. 6.99 kg) between treatments. The numbers of weaned piglets (11.75 vs. 11.67), piglet survival rate (97.03 vs. 98.15%), weaning litter weight (83.60 vs. 81.49 kg), litter weight gain (67.25 vs. 66.76 kg), piglet gain (5.75 vs. 5.73 kg) and piglet daily gain (240 vs. 239 g) were not affected ($P > 0.05$) by dietary treatments. In conclusion, dietary valine:lysine ratios of 0.80 and 0.85 had no effects on lactation performance of primiparous sow and their offspring.

Key Words: lactation performance, primiparous sows, valine:lysine ratio

M160 Sequence of apparent ileal digestible lysine for growing-finishing gilts. G. C. Rocha^{*1}, F. C. O. Silva², R. F. M. Oliveira¹, L. Alebrante¹, A. Saraiva¹, and J. L. Donzele¹, ¹*Federal University of Viçosa, Viçosa, MG, Brazil*, ²*EPAMIG, Viçosa, MG, Brazil.*

This study was conducted to evaluate sequences of apparent ileal digestible lysine (AIDL) for gilts from 63 to 153 d of age. Eighty gilts (AGPIC 425 × Camborough 25), were used in a randomized complete block design to evaluate 5 AIDL level treatments with 3 phase-feeding per treatments (9–8–7; 10–9–8; 11–10–9; 12–11–10 and 13–12–11 g/kg from 63 to 103, 103 to 133 and 133 to 153 d of age, respectively). Each treatment was replicated with 8 pens (1.87m²/pig) with 2 pigs each. The basal diet for each phase contained corn, soybean meal and no supplemental industrial amino acids. Four additional diets (each phase) were formulated by adding L-lysine HCl 78% and when necessary DL-methionine 99%, L-threonine 98%, L-tryptophan 98%, L-valine 96.5% and L-isoleucine 99% replacing the starch. At the beginning and the end of each phase, pigs and feeders were weighed to assess ADG, ADFI, final BW and feed to gain ratio (F:G). From 63 to 103 d the AIDL levels (9, 10, 11, 12 and 13 g/kg) influenced linearly ($P < 0.05$) the ADG (945, 956, 965, 981 and 1004 g) of the pigs, while the F:G (2.12, 2.00, 2.00, 1.97 and 1.99) was improved ($P < 0.05$) quadratically to 1.97 at a level of 11.8 AIDL g/kg, and with no effects ($P > 0.05$) on the ADFI and the final BW. There was no effect ($P > 0.05$) of the sequences of AIDL on the gilts growth performance between 63 to 133 d, and 63 to 153 d. Sequences of diets containing 9-8-7 of AIDL g/kg fed from 63 to 103, 103 to 133 and 133 to 153 d, respectively, meet the AIDL requirements of growing-finishing gilts from 63 to 153 d of age.

Table 1. Growth performance of gilts from 63 to 153 days

Item	Apparent ileal digestible lysine, g/kg					SEM
	9-8-7	10-9-8	11-10-9	12-11-10	13-12-11	
Initial BW, kg	24.4	24.5	24.2	24.2	24.3	0.54
Final BW, kg	114.1	113.2	112.6	114.4	114.2	1.86
ADFI, g	2311	2267	2279	2322	2331	44.38
ADG, g	996	988	978	1004	997	17.14
F:G, g/g	2.32	2.29	2.33	2.31	2.34	0.02

Key Words: amino acids, performance, requirements

M161 Feed efficiency and carcass grade can be improved in finishing pigs by increasing the standardized ileal digestible lysine to metabolizable energy ratio. J. A. Jendza^{*} and S. K. Baidoo, *University of Minnesota, Waseca.*

Two trials were conducted to evaluate the effect of increased standardized ileal digestible (SID) lysine to ME ratio on growth performance and carcass characteristics in finishing pigs. Trial 1 fed 256 mixed sex pigs

with an initial BW of 99.2 kg (SD = 8.9 kg) for 4 wk. Pigs were housed 8 to a pen in a completely randomized design with 8 pens per treatment. Treatments consisted of a 72.8% corn/22% soy basal diet containing 7.5 g SID lysine and 3,401 kcal ME/kg of feed supplemented with 0, 1.2, 2.4, and 3.6 g lysine HCl/kg for treatments 1 to 4, respectively. At the end of 4 wk, pigs were individually identified and carcass characteristics recorded. Carcass grade was a composite measure of hot carcass weight and percent lean. Grading scores ranged from -7.5 to +10, with lighter and fatter pigs receiving lower scores than heavier and leaner pigs. With pen as the experimental unit, dietary treatments had no effect on any measure of growth performance or carcass quality. Trial 2 used 317 pigs, housed by sex 7 or 8 to a pen, with an initial BW of 90.4 kg (SD = 6.5 kg) for 4 wk. Treatments were based on a 72.9% corn/22% soy basal diet containing 7.85 g SID lysine and 3,404 kcal/kg of feed. This basal was then supplemented with lysine HCl to achieve SID lysine to ME ratios of 2.3, 2.6, 2.9, and 3.2 g SID lysine/Mcal ME. Crystalline DL-methionine, L-threonine and L-tryptophan were also added to maintain their respective ratios to lysine in the basal diet. Growth performance and carcass characteristics were recorded at the end of 4 wk. Average daily gain and ADFI were not affected by dietary treatment, nor were most carcass characteristics. However, linear improvements were detected in feed efficiency and carcass grade ($P < 0.05$). Feed efficiency increased from a low of 0.313 to a high of 0.329. Carcass grade increased from a low of 6.2 to a high of 6.86. There was also a trend to increase hot carcass weight ($P < 0.10$). In summary, carcass grade and feed efficiency of finishing pigs can be improved by feeding a higher SID lysine to ME ratio as long as care is taken to maintain adequate concentration of the other essential amino acids to lysine.

Key Words: swine, standardized digestible lysine, carcass characteristics

M162 Chemical composition of dietary fat affects fat and energy digestibility when supplemented to lactating sows. D. S. Rosero*¹, J. Odle¹, R. D. Boyd², and E. van Heugten¹, ¹*Department of Animal Sciences, North Carolina State University, Raleigh*, ²*Hanor Company Inc., Franklin, KY*.

Levels of free fatty acids (FFA) and saturation of supplemental fat affects fat digestibility, which may be particularly important in lactating sows which require high amounts of nutrients. This hypothesis was tested using 85 mature sows assigned randomly to a 4 × 5 factorial arrangement of treatments and a control diet with no added fat. Factors included: 1) FFA level: 0, 18, 36 and 54% and 2) Iodine value (IV): 77, 88, 100, 112 and 124. Diets were corn-soybean meal based, and contained 3.42 g standardized ileal digestible lysine/Mcal ME. Dietary fat was supplemented at 6% and different FFA and IV levels were obtained by blending 4 fat sources: choice white grease (FFA = 0.3%, IV = 74.8, GE = 9469 cal/g), choice white acid grease (FFA = 57.8, IV = 79, GE = 8266), soybean-cotton seed oil (FFA = 0.1, IV = 67.5, GE = 9442) and soybean acid oil (FFA = 67.5, IV = 112.9, GE = 9196). Titanium dioxide was added to diets (0.5%) and used as a marker to determine digestibility of fat and energy. After 6 d of adaptation to treatment diets, fecal grab samples were collected from sows during the following 4 d (d 10 to 13 of lactation), twice per day. Digestibility of fat from ingredients in the control diet was 31.5%. Digestibility of the supplemented fat increased with levels of IV (quadratic, $P < 0.001$; 74.4, 84.5, 85.2, 82.9 and 73.53 for IV of 76, 88, 100, 112 and 124, respectively), and decreased with increasing levels of FFA (linear, $P < 0.001$; 87.4, 81.6, 74.0 and 77.3% for 0, 18, 36 and 54%). Apparent digestible energy content of the diet decreased with higher levels of FFA (quadratic, $P = 0.007$; 88.8, 88.2, 87.4 and 88.6%) and increased with increasing levels of IV (quadratic, $P = 0.017$; 87.6, 87.5, 88.9, 89.2 and 88.2%). Digestibility of supplemental fat was described by: Fat digestibility = $-78.45 - 1.59 \times$ FFA

+ $3.75 \times$ IV + $0.007 \times$ FFA² - $0.02 \times$ IV² + $0.01 \times$ FFA × IV, $r^2 = 0.47$. Digestibility of energy content of the diet was described by: Digestible energy = $73.48 - 0.12 \times$ FFA + $0.31 \times$ IV + $0.001 \times$ FFA² - $0.001 \times$ IV², $r^2 = 0.19$. In conclusion, higher levels of FFA negatively affected fat and energy digestibility. Also, saturation of the fat affected digestibility in a quadratic manner when fed to lactating sows.

Key Words: lactating sows, free fatty acids, saturation

M163 Feeding phytonutrients to chickens: The relationship between energy availability and growth performance. D. Bravo*¹, V. Pirgosliev², and S. P. Rose³, ¹*Pancosma, Geneva, Switzerland*, ²*Avian Science Research Centre, Scottish Agricultural College, Ayr, UK*, ³*National Institute of Poultry Husbandry, Harper Adams University College, Newport, UK*.

A total of 400 male day-old Ross 308 chicks were used in a floor pen study to investigate the effects of dietary supplementation of a mixture of carvacrol, cinnamaldehyde and capsaicin (XT, Pancosma S.A.) on dietary apparent metabolizable (AME), dietary net energy for production (NEp), and bird growth performance. Four diets (maize- or wheat-soybean based and with or without XT in a 2 × 2 factorial arrangement) were offered to the birds from 0 to 21 d of age. The diets were formulated to be adequate in protein (215 g/kg diet) but marginal in AME (2890 kcal/kg), and slightly higher in non-starch polysaccharides than recommended in the control diets supplemented with XT (100 g/t). The diets were provided in mash form ad libitum throughout the experiment. The treatments were allocated in a randomized complete block design with each treatment having 10 replicate floor pens with 10 birds per pen. The pens were bedded with used litter. Feeding wheat-based diets resulted in lower AME ($P < 0.05$) but higher NEp ($P < 0.05$), and feed efficiency ($P < 0.05$). Irrespective of cereal type, XT supplementation improved AME, NEp and feed efficiency ($P < 0.05$). There was a lack ($P > 0.05$) of cereal source by XT interaction suggesting that similar responses may be expected when XT is added to both, maize or wheat-based diets. Linear regression analysis was used to assess the relationship between determined dietary energy and bird growth performance. Dietary NEp was more highly correlated with performance criteria than dietary AME and seems to be a more sensitive way to evaluate broiler response to phytonutrients supplementation.

Key Words: phytonutrients, broiler, energy availability

M164 An evaluation of glutamine feed supplementation on the immune response, intestinal morphology, and growth performance of broilers at various stages of development. S. Khempaka* and W. Molee, *School of Animal Production Technology, Institute of Agricultural Technology, Suranaree University of Technology, Muang, Nakhon Ratchasima, Thailand*.

Banned antibiotic feed additives classed as growth promoters in poultry feed, have resulted in increased incidence of disease and depressed growth performance. Glutamine (Gln) may be an alternative feed additive to resolve these problems, since many beneficial effects of it have been reported in animals. Gln is the principle metabolic fuel for small intestine enterocytes, lymphocytes, macrophages and fibroblasts and is considered an essential amino acid in some species under inflammatory conditions. In a previous study we found that the addition of 1% Gln provided the highest efficacy without any negative effects on dry matter, organic matter and ash digestibility and nitrogen retention. Therefore, the purpose of this study was to evaluate the effect of glutamine supplementation at various stages of development on the immune response,

intestinal morphology and growth performance of broilers. Three hundred, day-old male chicks were randomly assigned in a completely randomized design into 5 treatments with 3 replicates of 20 birds per treatment. Dietary treatment groups consisted of a control and the control supplemented 1% Gln that was fed to broilers for 7, 14, 21 or 28 d of age. The birds were raised through 42 d of age. Feed and water were provided ad libitum throughout the experimental period. Significant differences among treatment were assessed by Duncan's new multiple range-test at $P < 0.05$. Orthogonal contrasts were used to evaluate treatment effects of control vs. mean of glutamine supplementation period. The addition of Gln at a level of 1% provided no significant benefits in most parameters studied, including growth performance, and immunoglobulin measured in serum and small intestinal tissue samples ($P > 0.05$). However, chicks receiving 1% Gln for 7 and 14 d had significantly wider villi in the duodenum compared with chicks fed the control diet ($P < 0.05$). In which the mean value of villus wide in chicks fed Gln for 7 and 14 d of age compared with control were 24 vs 55 and 35 vs 63.5 μm , respectively. Thus, it was concluded that the most advantageous time to add Gln to the diet of newborn chicks is from 0 to 14 d of age, beyond which point 1% added dietary Gln has little to no effect.

Key Words: broiler chicken, glutamine, intestinal morphology

M165 Velocity of L-methionine incorporation into the blood plasma of broiler chickens at the first week of age. A. C. Stradiotti^{1,4}, C. Ducatti², J. R. Sartori¹, J. A. Bendassolli³, V. C. Pelícia¹, P. C. Araujo¹, M. K. Maruno¹, L. V. C. Girão¹, F. G. Luiggi¹, R. Fasanaro¹, M. M. P. Sartori², J. C. Denadai², E. T. Silva², C. R. Souza-Kruliski², and A. C. Pezzato¹, ¹São Paulo State University, Faculty of Veterinary Medicine and Animal Science, Botucatu Campus,

Botucatu, Brazil, ²São Paulo State University, Institute of Bioscience, Botucatu Campus, Botucatu, Brazil, ³University of São Paulo, Center of Nuclear Energy in Agriculture, "Luiz de Queiroz" Campus, Piracicaba, Brazil, and ⁴FAPESP.

Studying the metabolic pathway of methionine using a carbon-13 enrichment protocol to measure kinetics of this amino acid in various tissues of birds may provide a greater understanding of methyl group metabolism. The aim of this study was to use stable isotope methodology to assess the rate of incorporation of labeled methionine in blood plasma of broilers aged 1–7 d old. A total of 51 one-d-old male Cobb chicks were housed (density = 12 birds/m²) and selected with an initial BW of 45 ± 1.125 g. The diet was formulated based on corn and soybean meal and supplied ad libitum. To promote tissue enrichment, we used a dosage of 29 μmol of L-[¹³C₁]methionine/kg BW/h, administered orally within 6 h (99 atom% ¹³C; Cambridge Isotope Laboratories, Inc.). At the times 0 (control), 0.5, 1, 2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 24, 48, 72 and 96 h after initial dosing, 3 birds per time point were slaughtered for sampling of blood plasma for carbon isotope ratio analysis using a mass spectrometer. The isotope ratios obtained were analyzed by a first-order exponential equation expressed as: $\delta^{13}\text{C}(t) = \delta^{13}\text{C}(f) + [\delta^{13}\text{C}(i) - \delta^{13}\text{C}(f)] e^{-kt}$, which enables calculation of the half-life of carbon-13 ($t = \ln 2/k$), obtained using a software package (OriginPro 8 Professional). Maximum enrichment occurred 8 h after oral administration of enriched solution. The results of $\delta^{13}\text{C}$ blood plasma to the maximum enrichment resulted in the following equation: $\delta^{13}\text{C} = -15.60 - 3.24 e^{-0.2291t}$, with a carbon half-life calculated as 3.03 h and $R^2 = 0.93$, representing the velocity of incorporation of methionine into embedded tissue. Thus, the time required for 50% of orally-administered methionine to be metabolized is approximately 3 h at this dose and age of bird.

Key Words: labeled carbon, methyl-13C, turnover