Productive formulation is the end result of proper nutrient requirements being set and those nutrient levels being met by the assembly of ingredients to meet those nutrient needs. Only when these processes work collectively can accurate formulation take place. Computer formulation software has improved the ease, frequency, and speed of diet changes. This ease and speed plus the demands of our society can lead to diet implementation with minimal amount of review. The expansion of knowledge particularly in the area of amino acids has resulted in formulation with more nutrient minimums than in the past. The increased availability and cost effectiveness of co-products/by-products offer challenges to swine nutritionists to utilize these products while maintaining cost effective performance. A key first step in formulation is to ensure that nutrient loadings for the ingredients in the formulation software are correct. While this may seem like a simple task, small errors in keystrokes, decimal placements, or unit conversions can have profound impact. While reviewing analytical data at regular time periods provides current values, an important decision is how to use those values. Two approaches are commonly used: One, the analytical means for the ingredient nutrient loadings in conjunction with some margin of safety built into the nutrient minimums on the formula side. One downside to this approach is it does not appreciate the more consistent ingredients or discriminate against the more variable ones. The second approach is to take the mean of a value over a given period of time, then subtract a multiple of the standard deviation, commonly one half the standard deviation of the value. This method discounts the more variable ingredients and allows formula nutrient minimums to be set closer to the pig's requirement. A variety of examples can be used to illustrate how small changes in key nutrients can influence not only diet cost, but also animal performance. The impact of animal performance is difficult to measure due to inherent variation, but it is well proven that deficient nutrients levels will inhibit animal performance.

Nonruminant Nutrition: Nursery Nutrition

188 Effects of replacing commonly used specialty protein sources with crystalline amino acids on growth performance of nursery pigs from 6.8 to 11.3 kg. J. E. Nemechek,* M. D. Tokach, S. S. Dritz, R. D. Goodband, J. M. DeRouchey, and J. L. Nelssen, *Kansas State University, Manhattan.*

A total of 282 nursery pigs (PIC TR4 × 1050; initially 6.6 kg) were used in a 28-d growth trial to determine the effects of replacing high amounts of specialty protein sources with crystalline amino acids on growth performance. On d 3 after weaning, pigs were allotted to 1 of 6 treatments arranged as a 2 × 3 factorial with 7 replications per treatment. Five pens housed 7 pigs per pen and 2 pens housed 6 pigs per pen for each treatment. Treatment diets were fed from d 0 to 14 with a common diet fed from d 14 to 28. Treatment diets were corn-soybean meal-based with 10% dried whey and were formulated to 1.30% SID lysine and minimum amino acid:Lys ratios for Met and Cys (58%), Thr (62%), Trp (16.5%), Val (65%), and Iso (52%) and a maximum total Lys:CP ratio of 7.35%. The factorial included either low or high levels of crystalline amino acids and 3 specialty protein sources (fish meal, meat and bone meal, or poultry meal). Low and high crystalline amino acid diets contained 4.5 or 1% fish meal, 6 or 1.2% meat and bone meal, and 6 or 1% poultry meal, respectively. Pigs and feeders were weighed weekly to calculate ADG, ADFI, and G:F. There were no interactions ($P > 0.32$). From d 0 to 14, there were no differences ($P > 0.19$) between protein sources for ADG (251, 235, and 248 g), ADFI (374, 359, and 374 g), or G:F (0.67, 0.66, and 0.66). Increasing the level of crystalline amino acids fed during phase 1 improved ($P < 0.04$) ADG (255 vs 234) due to a tendency ($P < 0.14$) for improved ADFI (378 vs 360 g) and G:F (0.68 vs 0.65). During the common diet period (d 14 to 28), specialty protein source fed from d 0 to 14 did not influence ($P > 0.09$) ADG (519, 494, and 515 g) or ADFI (828, 814, 851 g), but pigs fed fish meal from d 0 to 14 had improved ($P < 0.03$) G:F (0.63, 0.61, 0.61) compared with pigs previously fed other specialty protein sources. There were no differences ($P > 0.38$) in growth performance from d 14 to 28 between the pigs previously fed different levels of crystalline amino acids. These results indicate that high amounts of fish meal, meat and bone meal, and poultry meal can be replaced in nursery pig diets when balancing for minimum amino acid ratios and a maximum Lys:CP ratio with no negative effect on growth performance.

Key Words: amino acid, nursery pig

189 Effect of partial or total replacement of dried whey permeate (DWP) with a blend of sugars and cooked cereals (Candy Oats, CO) on week-one feed intake and growth performance of weanling pigs. J. W. Charal,* A. M. Waguespack, V. D. Naranjo, T. D. Bidner, and L. L. Southern, *Lousiana State University, Agricultural Center, Baton Rouge.*

Two experiments were conducted to determine the effect of partial or total replacement of DWP (80% lactose) with CO (60% total sugars and 25% cooked oat-based cereals) on wk-1 daily feed intake and growth performance of weanling pigs. Diets were fed d 0–7 for phase 1, d 7–14 for phase 2, d 14–21 for phase 3, and d 21–35 for phase 4. In Exp. 1 (6 reps of 4 pigs per pen; BW = 6.4 ± 0.8 kg; 21 ± 2 d of age) and Exp. 2 (4 reps of 4 pigs per pen, BW = 6.2 ± 1.0 kg; 22 ± 1 d of age) pigs were assigned to 5 dietary treatment groups as follows: A) DWP, no SRO (total sugars provided by DWP and no steam rolled oats (SRO); B) no DWP + SRO; C) DWP + SRO; D) 50CO (50% replacement of the total sugars provided by DWP in diet C and reduced SRO); and E) 100CO (100% replacement of the total sugars provided by DWP and further reduction of SRO). During phase 4, all pigs were fed a common corn-soybean meal diet. The levels of total sugars were 16, 8, and 3% for phases 1, 2, and 3, respectively (except no DWP + SRO diet). The data from the 2 experiments were combined for analysis. Pigs fed the 50CO diet ate more feed ($P < 0.10$) on individual days during the first week post-weaning compared with pigs fed the other 4 diets (d 1–3 compared with DWP with no SRO; d 1–7 with no DWP + SRO; d 1–6 with DWP + SRO; and d 1, 6, and 7 compared with 100CO diet). Daily gain was greater ($P < 0.10$) in pigs fed the 50CO diet compared with pigs fed 100CO, DWP with no SRO, DWP + SRO, and no DWP + SRO diets during phase 1 (236, 216, 211, 211, and 179 g/d, respectively), 21 d (371, 355, 349, 340, and 326 g/d; respectively), and through d 35 (481, 452, 444, 438, and 430 g/d; respectively). The response in ADG was due to an increase ($P < 0.10$) in ADFI. Gain:feed was not affected ($P > 0.10$) by diet in any period. This study indicates that CO can partially or totally replace DWP and SRO in diets for weanling pigs.

Key Words: sucrose, lactose, oats, pigs