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Swine No. 1473

Optimizing supplemental Lys, Thr, Trp and Met use in diets for 20 to 40-kg growing pigs

Key Information

- Adding 0.52 % supplemental Biolys® to a corn-soybean meal diet had no negative effects on growth performance of growing pigs provided that supplemental Thr, Met, and Trp also are available.
- When Biolys® is supplemented above 0.52 % in a corn-soybean meal diet, Val, Ile, or another AA seem to limit growth performance of pigs.
- Additional research is needed to determine the limiting order of amino acids in a corn-soybean meal diet when supplemental AA exceed the levels used in this trial.

Introduction and Objective

With the first 4 limiting amino acids (AA) in corn-soybean meal (C-SBM) diets for swine commercially available, it is worthwhile to determine the maximum level of these AA can be used before the next (5th) limiting AA reduces performance. In addition to potential diet cost savings, increasing the use of supplemental AA can reduce dietary crude protein (CP) levels and improve nitrogen utilization, which can lead to a reduction in nitrogen excretion. The objective of this research, which was conducted at the **Louisiana State University Agricultural Center**, was to determine the dietary concentration of the four commercially available supplemental AA (Lys, Thr, Met, and Trp) that can be added to diets for 20 to 40-kg growing pigs without negatively affecting growth performance.

Materials and Methods

One-hundred pigs (Yorkshire x Landrace x Duroc) were allotted to treatments on the basis of weight, sex, and ancestry in randomized complete block designs. There were 5 treatments (0, 0.23, 0.38, 0.52, and 0.66 %; Table 1), which were created by titrating Biolys® (and supplemental Thr, Met, and Trp) as needed. This titration was accomplished by setting minimum ingredient inclusion limits for Biolys®.

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The diets were C-SBM based, and they were formulated on a standardized ileal digestible (SID) basis with all AA maintained in ideal protein ratios to SID Lys (NRC, 1998). The corn and SBM were analyzed for their AA content, and these analyses were used for diet formulation. All diets were formulated to contain 0.83 % SID Lys, which was previously determined to be the SID Lys requirement of these pigs. An ideal protein pattern was maintained for the essential AA that met or exceeded those set by NRC (1998). Relative to SID Lys, these ideal protein ratios used were: Thr (65), Met (27), TSAA (60), Trp (18), Val (67), and Ile (54). Based on the NRC (1998) requirements, the diet with 0.66 % Biolys[®] was calculated to be deficient in both Val and Ile (ideal ratios = 67 & 54, respectively), but these AA were not added.

Each treatment was replicated with 4 pens of 5 pigs per pen, and the experiment lasted 28 days. Feed and water were provided ad libitum throughout each experiment, and all pigs were housed in a totally enclosed building with metal slotted floors in 1.32 m x 2.44 m pens.

Table 1: Composition of diets with graded levels of supplemental Biolys[®], Thr, Trp, and Met, as-fed basis¹

Supplemental Biolys [®] , %	0	0.23	0.38	0.52	0.66
Ingredient, %					
Corn	69.16	73.71	76.45	79.20	81.88
SBM, 47.5% CP	27.18	22.25	19.23	16.18	13.22
Minerals/vitamins	3.66	3.76	3.82	3.88	3.94
Biolys [®]	–	0.23	0.38	0.52	0.66
L-Threonine	–	0.02	0.06	0.10	0.14
DL-Methionine	–	0.04	0.07	0.09	0.12
L-Tryptophan	–	–	0.01	0.02	0.04
Calculated composition:					
ME, kcal/kg	3,237	3,239	3,241	3,242	3,242
ME, MJ/kg	13.54	13.54	13.54	13.54	13.54
Crude Protein, %	18.18	16.44	15.39	14.35	13.34
SID Lys, %	0.830	0.830	0.830	0.830	0.830
SID Thr, %	0.591 (71)	0.540 (65)	0.540 (65)	0.540 (65)	0.540 (65)
SID Met, %	0.252 (30)	0.268 (32)	0.281 (34)	0.295 (36)	0.308 (37)
SID TSAA, %	0.504 (61)	0.498 (60)	0.498 (60)	0.498 (60)	0.498 (60)
SID Trp, %	0.184 (22)	0.159 (19)	0.149 (18)	0.149 (18)	0.149 (18)
SID Val, %	0.736 (89)	0.656 (79)	0.606 (73)	0.556 (67)	0.508 (61)
SID Ile, %	0.662 (80)	0.581 (70)	0.532 (64)	0.482 (58)	0.433 (52)

¹ Values in parenthesis represent the ratio of AA to Lys, SID basis, in the diets.

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Before allotment to treatment and at the termination of each experiment, blood was collected from each pig to determine plasma urea nitrogen (PUN) concentration. The first collection (PUN1) served as a baseline for the collection at the end of the experiment (PUN2). Body weights and feed consumption for calculation of average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (gain:feed) were collected on days 0, 14 and 28.

Data were statistically analyzed by ANOVA as randomized complete block designs using the GLM procedures in SAS (SAS Inst. Inc., Cary, NC), and the pen of pigs was the experimental unit. The PDIFF option of SAS was used to compare individual diets to each other, or contrasts statements were used.

Table 2: Growth performance and plasma urea nitrogen of pigs fed graded levels of supplemental Biolys[®], Thr, Trp, and Met^{1,2}

Supplemental Biolys [®] , %	0	0.23	0.38	0.52	0.66	PSEM
Initial BW, kg	24.1	23.9	24.1	24.2	24.4	0.2
14 day BW, kg	33.2	32.5	33.3	32.9	32.8	0.4
28 day BW, kg	44.0	43.2	44.0	43.4	42.3 ⁵	0.6
Day 0 to 14						
ADG, g	652	611	659	618	600	27
ADFI, g ³	1283	1293	1349	1376	1413	37
Gain/feed ³	0.525	0.483	0.497	0.458	0.431	0.013
Day 14 to 28						
ADG, g ³	832	825	822	805	731	30
ADFI, g	2035	1972	1905	1903	2001	62
Gain/feed ⁴	0.411	0.418	0.432	0.424	0.365	0.015
Overall						
ADG, g ³	739	714	740	708	663 ⁵	17
ADFI, g	1632	1620	1616	1630	1696	35
Gain/feed ^{3,4}	0.457	0.443	0.460	0.435	0.392 ⁵	0.010
PUN, mg/dL ³	11.14	8.55 ⁵	6.54 ⁵	4.73 ⁵	3.19 ⁵	0.40

¹ Data are means of 4 replications of 5 pigs per pen (reps 1 and 2 had 3 barrows and 2 gilts; reps 3 and 4 had 2 barrows and 3 gilts).

² BW: average body weight; ADG: average daily gain; ADFI: average daily feed intake; PUN: plasma urea nitrogen; PSEM: pooled standard error of means.

³ Linear effect (P < 0.05).

⁴ Quadratic effect (P < 0.05).

⁵ Significantly different (P < 0.10) from ø inclusion treatment

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Results and Discussion

Overall, final BW, ADG and gain:feed of pigs fed the diet containing 0.66 % supplemental Biolys[®] were significantly reduced compared with pigs fed diet 1 (no supplemental AA; Table 2). The pigs fed the diet containing 0.52 % added Biolys[®] had numerically lower ADG compared with pigs fed diet 1. Plasma urea nitrogen was reduced in all treatments compared with pigs fed diet 1. This result was expected because of a step-wise decrease in crude protein as the level of supplemental AA increased in the diets.

In conclusion, the results of this research indicate that 0.52 % supplemental Biolys[®] can be added to a C-SBM diet with no negative effects on growth performance provided that supplemental Thr, Met, and Trp also are available. Pigs fed the diet with 0.52 % supplemental Biolys[®] had growth performance that was not significantly different from the diet without Biolys[®] supplementation, but there was a tendency for reduced gain and efficiency. Pigs fed the diet with 0.66 % supplemental Biolys[®] had reduced growth performance suggesting that Val or Ile may have become limiting in that treatment.

Source

Southern, L. (2007): Response of growing pigs (20 to 50 kg) to low crude protein diets supplemented with amino acids. LSU Trial report # P07-229.

Reference

NRC. 1998. Nutrient Requirements of Swine. 10th rev. ed. Natl. Acad. Press, Washington, DC.



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