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Poultry No. 1577

Validating the formulation of broiler diets on a standardized ileal digestible amino acid basis under Eastern Canadian conditions

Conclusions

- A 38-day broiler trial was conducted in which diets were either formulated on total or on standardized ileal digestible amino acid basis.
- Formulating a complex diet containing low digestible feed ingredients on total amino acid basis impaired broiler performance during the grower phase.
- Formulating that complex diet on a standardized ileal digestible basis returned broiler performance to the level achieved by the control corn-soybean meal diet.

Objective

Not all of the total amino acids in a particular feed ingredient can be utilized by a broiler for protein synthesis due to a certain proportion not being absorbed, which results in excretion in the feces. As a result, diets formulated on a crude protein or total amino acid basis may not provide the amino acids needed by a broiler for optimal growth or carcass performance. Nutritionists can account for this by formulating broiler diets on a digestible basis. Knowledge about amino acid digestibility in raw materials enables the nutritionist to more accurately use locally available ingredients, especially by-products, and to benefit from reduced safety margins in their formulations.

We have previously reported that formulating diets on a digestible basis is essential to maintaining animal performance when using low digestible feed ingredients, such as feather meal, meat and bone meal, corn DDGS, etc, increases (Facts and Figures #1539). The objective of the current trial, which was conducted in cooperation with JEFO Nutrition, Aliments Breton, and the University of Manitoba, was to validate the concept that broilers fed diets formulated on a standardized ileal (**SID**) digestible basis could perform equal to or better than those fed diets formulated on a total amino acid basis in Eastern Canadian broiler production conditions.

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Experimental design

A total of 1,984 male ROSS 308 day of hatch broilers were distributed to 64 floor pens with 31 birds each (0.7 ft²/650 cm² per bird) in a 3-phase 38-d growth trial. Three experimental diets were fed to the broilers: 1) corn-soybean meal diet formulated on total AA basis; 2) corn-soybean meal-meat and bone meal +15 % corn-based DDGS (total AA basis); 3) corn-soybean meal-meat and bone meal +15 % corn-based DDGS (SID AA basis). Treatments 1 and 2 were replicated 22 times each with 11 replications of each sex, whereas treatment 3 was replicated 20 times with 10 replications of males and females, respectively.

The growing conditions were based on typical broiler production conditions in Eastern Canada, and the growth phases were starter (0-14d); grower (14-25d); and finisher (25-38d). The diets for the starter phase are provided in Table 1. The diets were similar in ingredient and nutrient content with the exception of total or SID AA as those used in commercial production in Eastern Canada. The corn, wheat, soybean meal, meat and bone meal (**mbm**), and corn DDGS were analyzed for their total AA content, and these analyses were used for diet formulation. The SID coefficients for these same ingredients were from Evonik-Degussa's "Standardized ileal amino acid digestibility in broilers" brochure published in 2005. The diets for the grower and finisher phases (not shown) were formulated in a similar manner. The grower diets provided 3,160 kcal ME (13.23 MJ) per kg of diet and 0.86/0.78, 0.85/0.74, & 0.89/0.78% total/SID Met + Cys and 1.15/1.04, 1.15/0.99, & 1.20/1.04% total/SID Lys, respectively. The finisher diets provided 3,240 kcal ME (13.56 MJ) per kg of diet and 0.81/0.74, 0.80/0.69, and 0.85/0.74% total/SID Met + Cys and 1.08/0.98, 1.08/0.93, and 1.14/0.98% total/SID Lys, respectively. Diets were fed as crumbles (starter) or pellets (grower, finisher) depending on the growth phase in accordance with local practice, and water and feed were provided ad libitum throughout the trial.

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Table 1: Composition of Starter Phase Experimental Diets (0-14d), as-is basis.

Treatment	Corn-soy (total AA)	Corn-soy-mbm (total AA)	Corn-soy-mbm (SID AA)
Ingredients, %			
Corn	46.86	45.29	43.34
Wheat	12.50	12.50	12.50
Soybean meal, 48 % CP	33.10	17.10	18.80
Corn DDGS	--	15.00	15.00
Meat and bone meal, 52 % CP	--	8.00	8.00
Fat	2.90	--	--
DL-Methionine	0.23	0.19	0.21
Biolys®	0.06	0.33	0.35
L-Threonine	0.08	0.10	0.11
Vitamins, minerals, etc.	4.27	1.49	1.69
Calculated composition:			
Energy, kcal ME/kg	3,015	3,015	3,015
Energy, MJ ME/kg	12.6	12.6	12.6
Crude protein, %	21.0	21.0	21.0
Total Lys, %	1.23	1.23	1.29
Total Met, %	0.57	0.57	0.60
Total Met+Cys, %	0.91	0.91	0.95
Total Thr, %	0.85	0.85	0.89
SID Lys, %	1.12	1.07	1.12
SID Met, %	0.55	0.52	0.55
SID Met+Cys, %	0.84	0.80	0.84
SID Thr, %	0.73	0.69	0.73

Body weights, feed consumption, and mortality for calculation of average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency were collected at the end of each dietary phase and overall. Data were analysed by ANOVA and differences between treatments with $p < 0.05$ were considered significant (LSD).

Results

Protein and total amino acid contents of all dietary treatments were confirmed by analyses. The combined sex growth performance results are summarized in Table 2. During the grower phase (d14-28), ADG and feed efficiency of broilers fed the corn-soy-mbm diet formulated on a total AA basis were decreased compared with those fed the corn-soy diet. Conversely, formulating the corn-soy-mbm diet on a SID basis returned ADG and feed efficiency of those broilers to levels

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similar to those fed the corn-soy diet. Otherwise, there were no differences in growth performance or mortality in any other growth phase or overall.

Table 2: Effects of formulating diets on total or standardized ileal digestible basis on growth performance of 38-d Ross 308 broilers^{1,2}.

Treatment		Corn-soy (total AA)	Corn-soy-mbm (total AA)	Corn-soy-mbm (SID AA)	PSEM
Initial BW	(g/bird)	42.7	42.4	42.2	0.15
BW d14	(g/bird)	426.3	426.3	418.6	4.26
BW d25	(g/bird)	1217.6 ^a	1181.7 ^b	1216.1 ^a	20.5
BW d38	(g/bird)	2289.7	2222.8	2308.7	53.5
ADG d1-d14	(g/bird)	27.4	27.4	26.9	0.30
ADG d14-d25	(g/bird)	71.9 ^a	68.7 ^b	72.5 ^a	1.59
ADG d25-d38	(g/bird)	89.3	86.8	91.0	3.05
Overall ADG	(g/bird)	60.7	58.9	61.3	1.45
ADFI d1-d14	(g/bird)	37.8	36.8	37.3	0.42
ADFI d14-d25	(g/bird)	105.9	106.4	107.0	1.84
ADFI d25-d38	(g/bird)	158.1	160.0	164.0	4.22
Overall ADFI	(g/bird)	97.1	97.4	99.1	1.89
F:G d1-d14	(g/g)	1.381	1.341	1.389	0.016
F:G d14-d25	(g/g)	1.477 ^a	1.557 ^b	1.480 ^a	0.018
F:G d25-d38	(g/g)	1.787	1.862	1.816	0.038
Overall F:G	(g/g)	1.603	1.659	1.623	0.017
Mortality d1-d14	(%)	3.72	3.00	5.86	-
Mortality d15-d25	(%)	0.14	0.57	0.31	-
Mortality d 26-d38	(%)	0.71	0.85	1.42	-
Total mortality	(%)	4.57	4.42	7.59	-

¹Data are the means of 22 or 20 replications per treatment (11 or 10 replicates per sex), and each replication contained 31 broilers.

²BW: average body weight; ADG: average daily gain; ADFI: average daily feed intake; F:G: Feed per gain; PSEM: pooled standard error of means.

^{a,b}Means with different superscripts differ P < 0.05.

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The data from this trial indicate that growth performance can be maintained when diets are formulated on a SID basis, especially when low digestible feed ingredients are included in a diet. These results validate the use of SID in commercial production as a means to maintain animal performance and potentially improve performance consistency in broiler production.



Headquarters
 Evonik Degussa GmbH
 Feed Additives
 Rodenbacher Chaussee 4
 63457 Hanau-Wolfgang
 Germany

PHONE +49 6181 59-6783
FAX +49 6181 59-6734

Feed Additives –
 amino acids and more.
 feed.additives@degussa.com
 www.aminoacidsandmore.com

Europe & Middle East Africa
 Evonik Degussa GmbH
 Feed Additives
 Rodenbacher Chaussee 4
 63457 Hanau-Wolfgang
 Germany

PHONE +49 6181 59-6766
FAX +49 6181 59-6696

North America
 Evonik Degussa Corporation
 Feed Additives
 1701 Barrett Lakes Blvd.,
 Suite 340
 Kennesaw, GA 30144, USA

PHONE +1 678 797-4300
FAX +1 678 797-4313

Latin America
 Evonik Degussa GmbH
 Feed Additives
 Rodenbacher Chaussee 4
 63457 Hanau-Wolfgang
 Germany

PHONE +49 6181 59-6761
FAX +49 6181 59-6695

North Asia
 Degussa (China) Co., Ltd
 Feed Additives
 16F Sunflower Tower
 37 Maizidian Street, Chao
 Yang District Beijing 10026

PHONE +86 10 85 27-6400
FAX +86 10 8527-5986

Asia South
 Evonik Degussa (SEA) Pte Ltd
 Feed Additives
 3 International Business Park
 #07-18 Nordic European Centre
 Singapore 609927

PHONE +65 6890-6861
FAX +65 6890-6870

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