How to generate savings in swine feed and increase profitability

Methionine is the third limiting amino acid in swine diets. An important role of methionine is being the first amino acid for the formation of the polypeptide chain essential for building body protein.

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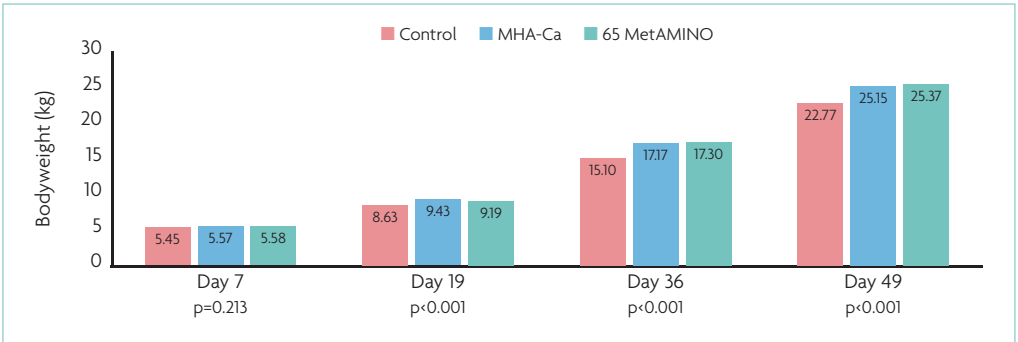

Fig. 1. Effect of 100 parts of MHA-Ca and 65 parts of MetAMINO (DL-methionine) on body weight of nursery pigs. There were 16 pens per treatment and 27 pigs per pen.

Methionine's role in the body goes beyond protein synthesis. It is the precursor of different molecules that play a role in the immune system, antioxidants, lipid oxidation, transcription activation, and cell proliferation. Therefore, how we balance dietary methionine can greatly influence the growth and health of a pig.

The inclusion of feed grade supplemental methionine sources in the formulation of pig diets is common, but often overlooked.

As nutritionists, it is important to re-validate the nutritional value of methionine sources and adjust current nutritional practices for maximising profit. Different sources of supplemental methionine used to balance swine diets are DL-methionine (99%), DL-2 hydroxy-4-methylthio-butyrate acid, also known as MHA (methionine hydroxy analog) free acid (MHA-FA; 88%) or its calcium salt (MHA-Ca; 84%), and L-methionine (99%).

L-methionine is a newer ingredient and, due to its molecular similarities to DL-methionine (50% L-methionine and 50% D-methionine), it has been easy to understand its similar nutritional value with DL-methionine and apply in feed formulation. A significant amount of research has been dedicated to dose-response trials to estimate the relative bioavailability of MHA compared to DL-methionine where studies have reported average bioavailability near 65%. For instance, based on nitrogen retention as response criteria, the bioavailability of MHA-FA and MHA-Ca compared to DL-Met on a product-to-product basis was 65% and 63%, respectively in growing pigs.

The lower bioavailability of MHA could have been due to the fact it is not an amino acid in biochemical terms, and both the D- and L-isomers of MHA must be converted to L-Methionine via transamination, whereas DL-Met is composed of 50% D-Met and 50% L-Met and only the D-isomer of DL-Met must be converted.

In addition, MHA is more slowly absorbed throughout the digestive tract associated with more exposure to microbial degradation in the small intestine and less available for absorption.

Dose-response trials can be difficult and costly to conduct, especially under commercial conditions where the number of replications can be a constraint.

A simplified validation approach is to replace 65 parts of DL-methionine with 100 parts of MHA on a product-to-product basis in pig diets and compare pig performance responses.

Table 1. Economic evaluation of pigs fed dietary treatments using 100 parts of MHA-Ca and 65 parts of MetAMINO (DL-methionine).

Item	Control	MHA-Ca	65 MetAMINO
Initial BW (kg)	5.02	5.02	5.02
Final BW (kg)	22.77	25.15	25.37
Revenue per pig ($[1])	**57.68**	**65.48**	**66.19**
Feed per pig (kg)	30.38	30.68	31.48
Feed cost ($/kg[2])	0.273	0.278	0.276
Feed cost per pig ($)	8.29	8.54	8.67
Income over feed cost ($/pig)	49.39	56.93	57.51
Marginal contribution MetAMINO over MHA-Ca ($/pig)			0,58
Profit for 10,000 pigs ($)	–	–	5,792
Pig losses (%[3])	1.31	0.63	1.25
Additional profit for 10,000 pigs counting pig losses ($)			5,756

[1]Based on the Q1 2020 average price of 3.34 $/kg for feeder pigs of 5.4kg BW and 3.27 $/kg for feeder pigs of 18.1kg BW (USDA Feeder Pig Quarterly Report). [2]The feed price is a weighed price based on feed intake in each phase and the cost of feed of each phase. Cost of the control diet were 606.01, 460.73, 213.15, and 202.46 for phase 1, 2, 3, and 4, respectively. The cost of the MHA-Ca and MetAMINO diets were estimated by the addition of the cost of the control diet plus the analysed content of MHA-Ca and MetAMINO multiplied by the price of the ingredient ($1.68 and $2.1 per kg of MHA-Ca and DLM, respectively). [3]Pig losses referred to pigs that were removed from the experiment or died.

Remove complexity: 65:100 validation design

A study was conducted in 2019 in a commercial research farm in the Midwest of the US. A total of 1,296 gilts and barrows (PIC 1050×359, Hendersonville, TN) of 20 days of age and initial body weight of 5.02 ± 0.20kg were evaluated in a 49-day performance study with four phases. Pigs were allotted to pens in groups of 27 pigs. Gilts and barrows were balanced within the pen.

The 48 pens were assigned to one of the three dietary treatments. Diets consisted of:

- Negative control: 70% of the SID Met+Cys:Lys requirements [Control].
- 100 parts MHA-Ca: treatment one + supplemented MHA-Ca to achieve 100% of the SID Met+Cys:Lys requirements (assuming full bioavailability of concentrated product) [MHA-Ca].
- 65 parts DL-methionine: treatment one + supplemented MetAMINO (Evonik's brand for DL-methionine and it was supplemented at 65% of supplemented MHA-Ca used in treatment two) [65 MetAMINO].

Diets were formulated to meet or exceed NRC (2012) recommendations for all amino acids, except for methionine in the control diet, and net energy for pigs in the BW range of 5-7, 7-11, 11-18, and 18-25kg, for phase 1, 2, 3 and 4, respectively.

Diets were corn-soybean meal-whey based in phases one and two and corn-soybean meal based diets in phases three and four. MHA-Ca diets

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were formulated to contain 0.29, 0.28, 0.26 and 0.26% MHA-Ca to achieve 0.58, 0.58, 0.56, and 0.56% of SID Met+Cys:Lys for phase 1, 2, 3, and 4, respectively.

Whereas,65 MetAMINO diets were formulated to contain 0.19, 0.18, 0.17 and 0.17% DL-methionine for phase one, two, three, and four, respectively. Diets were manufactured by a commercial feed mill.

Study results

The nutrient analysis of the diets demonstrated that the achieved DL-methionine to MHA-Ca ratio was 66% for the overall study. At the end of phase two (day 19), three (day 36), and four (day 49), pigs fed the control Met-deficient diet had lower body weight compared to pigs fed the diet containing MHA-Ca or DL-methionine (Fig. 1). In addition, no statistical difference was observed on body weight at the end of phase one, two, three, and four between pigs fed 100 parts of MHA-Ca or 65 parts of DL-methionine.

The overall performance, from day 0-49, demonstrated that pigs fed the control Met-deficient diet had statistically lower ADG and poorer FCR compared to pigs fed diets supplemented with MHA-Ca or 65 MetAMINO (Fig. 2). There was no difference in ADFI among treatments. Pigs fed 100 parts MHA-Ca and 65 parts DL-methionine did not differ in final ADG and FCR.

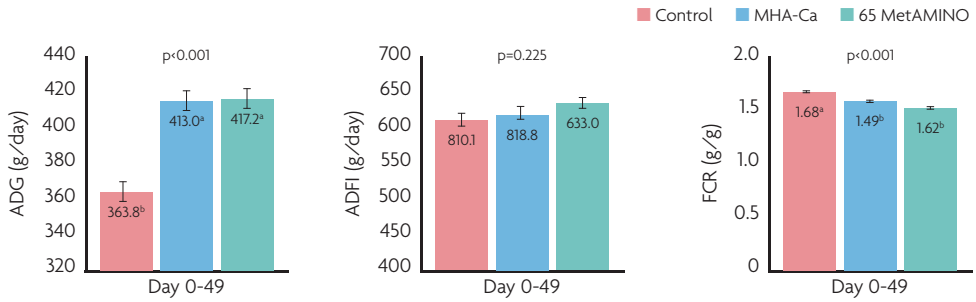

Fig. 2. Effect of 100 parts of MHA-Ca and 65 parts of MetAMINO (DL-methionine) on ADG, ADFI, and FCR of nursery pigs from 0-49 days post-weaning. There were 16 pens per treatment and 27 pigs per pen. [a,b]means within the same period with no common superscript differ (p≤0.05).

The results of this trial are also in agreement with Rademacher et al. (2004), Zimmermann et al. (2005), Santos et al. (2007) and Htoo and Morales (2012). For instance, Zimmermann et al. (2005), used pigs from 20-30kg of body weight. Pigs were fed one of the three dietary treatments, control (deficient in methionine), MHA free acid, and DL-methionine at 65 parts of the MHA used in treatment two. They observed lower performance for the control group and no difference in ADG (488 vs. 501kg/d) and FCR (1.48 vs. 1.48g/g) between the pigs fed MHA or 65 parts DL-methionine, respectively.

The present trial was designed to feed MHA-Ca to achieve 100% of the SID Met+Cys:Lys requirements. It was demonstrated that pigs can achieve the same performance with DL-methionine at 65% of MHA-Ca.

Investigating the performance of the methionine sources at the SID Met+Cys:Lys level used in a swine operation has practical and relevant implications to generate savings.

The economic evaluation, using the current trial results, indicates a higher income over feed cost (+0.58 US$/pig) by using MetAMINO at 65 parts of MHA-Ca compared with using MHA-Ca (Table 1). To expand the profitability analysis for producing 10,000 nursery pigs and adjusting for the pig losses, an additional profit of US$5,756 can be achieved by using MetAMINO at the dietary inclusion of 65 parts of MHA-Ca.

Overall, the current trial results demonstrated that the 65 parts of DL-methionine can replace 100 parts of MHA-Ca and achieve the same pig performance and increase profit for the pig production operation. ■

References are available from the authors on request