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Practical information for progressive poultry professionals

DL-MET
A superior Methionine source for broilers

MYCOTOXINS
How they threaten bird health and performance

SUSTAINABLE TECHNOLOGIES
A look at how they can benefit performance

LAYING SYSTEMS
We look at options from around the world

BIOSECURITY
How modern day practices relate to the plague village

INFECTIOUS BRONCHITIS
Key points for effective disease control

DL-Met: a superior methionine source for broiler production

The production and nutrition of farm animals has always been in focus, but perhaps never more so than today. With rising global demand for meat products, consumers increasingly interested in sustainable food choices and pressure on industries to reduce carbon footprint, the animal protein industry is looking at ways to lower its emissions and feed an ever-growing population sustainably.

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These are not insignificant challenges, and they are set against a harsh backdrop of economic volatility, price rises and supply chain disruption.

Animal protein producers are constantly looking for ways to improve animal health, welfare and productivity while optimising costs and profitability.

Animal nutrition is key. If we look at poultry production over the past five to six decades, we have seen a constant rise in broiler output while at the same time, the crude protein content in birds' diets has been reduced.

This has led to a lowering of nitrogen excretions per bird and consequently a reduction in the environmental burden of production (through reduced resource consumption) – all while maintaining the nutritional and welfare needs of the flock.

Amino acids

So, how has this been possible? It is largely thanks to continuous improvements in animal nutrition – in particular, effective amino acid (AA) supplementation – together with better feed analysis, thanks to tools like Aminonir, and more availability of feed grade amino acids.

Naturally, this has gone hand-in-hand with improved understanding of the optimal feed levels of digestible essential AA – namely glycine and serine – for the different feeding phases, and of the potential and limitations of AA in feed formulation.

Animal growth, meat deposition and/or feed conversion can all be adversely affected if the concentration of one feed AA is lower than the recommended level, for example.

Precise calculations and nutritional recommendations can be obtained using tools such as Aminochick and Aminohen for broiler and layer hens, respectively. One key nutritional value to be considered is that of methionine (Met) sources, used to balance Met and cysteine (Cys) supply of broilers.

Both Met and Cys are the so-called first-limiting amino acids (for example, those in shortest supply and therefore the first to become deficient in the animal's diet) in common broiler feed formulation.

Broilers' Met and Cys needs cannot be met by common macro-components for compound feeds and the absence or undersupply of these AA can cause significant performance losses in the barn.

However, producers can close this gap by supplementing broiler diets with methionine sources.

The use of DL-methionine in poultry diets is considered essential for optimising growth and performance, given the animals cannot synthesise the required amounts of Met and that there are insufficient natural sources of Met to fulfil their dietary needs.

Dry vs liquid: what's best?

While DL-methionine (DL-Met) is used worldwide to supplement the required levels of Met+Cys in animal feed, liquid methionine hydroxy analogue (MHA-FA) is also commercially available.

The two differ in that DL-Met is pure Met in dry form while MHA-FA is, from a chemical point of view, in fact an acid in liquid form and so can, at best, exert an AA effect.

We know from previous studies that DL-Met has an ileal digestibility of 100% and so, in principle, the entire amount of DL-Met added to the diet is available to the broiler for protein synthesis.

Numerous investigations have been conducted to establish the methionine efficiency of MHA-FA; an extensive study published in a scientific publication together with a meta-analysis in 2020 has shown

Continued on page 9

Table 1. Average final weights and daily weight gain for three cropping dates and overall.

	Final body weight (kg/animal)				Daily body weight gain (g/day)			
	Thinning 1	Thinning 2	Main Harvest	Total	Thinning 1	Thinning 2	Main Harvest	Total
Control with MHA-FA								
Mean value	1.601	2.003	2.874	2.434	53.84	57.75	68.10	63.99
CV [a]	2.8%	3.4%	4.5%	4.1%	2.9%	3.4%	3.4%	3.3%
Experiment with DL-Met								
Mean value	1.596	1.998	2.869	2.421	53.65	57.58	68.00	63.79
CV [a]	4.4%	3.9%	4.2%	4.1%	4.5%	3.9%	3.3%	3.6%
p-value [b]	0.88	0.89	0.92	0.76	0.88	0.89	0.92	0.85

a = CV: coefficient of variation.
b = p-value: probability of error according to Student's T-test. DL-Met variant has one barn excluded due to technical problems with Hopper scales.

Continued from page 7
that MHA-FA is less available than 100% but only 63% as effective for broiler growth, meat set and feed conversion compared to DL-Met.

Evonik therefore recommends a biological efficacy of 65% for MHA-FA relative to DL-Met in monogastric livestock and aquaculture feeds. Overestimating the relative biological efficacy of MHA-FA in broiler feed runs the risk of the animals getting less Met than assumed, weakening performance.

Trial results

To determine whether the recommended biological efficacy of 65% for MHA-FA holds up in practice, the University of Applied Sciences Osnabrück, Germany, undertook an investigation at a broiler fattener in Lower Saxony.

The trial involved 408,500 mixed-sex Ross 308 broiler chickens housed simultaneously and evenly distributed among five houses per dietary variation. In each case:

- Five houses were routinely fed the standard diet containing MHA-FA.
- Five houses were fed the same diet formulation, but MHA-FA was replaced with DL-Met at a weight-to-weight ratio of 100:65.

In total, 110 batches of compound feed were produced and sampled. Analyses impressively confirmed a high agreement of the analysed AA contents with the expected values. Moreover, the analysis of MHA-FA and free methionine in the feed samples basically confirmed expectations and the experimental concept.

This shows that detailed knowledge and understanding of the nutrient composition of the individual components of diets allows a very precise implementation of the feeding concept.

	Body weight (kg/animal)	Feed consumption (kg/consumption)	Feed per gain (kg/kg)	Mortality (%)
	Total	Total	Total	Total
Control with MHA-FA				
Mean value	2.434	3.631	1.503	2.44
CV [a]	4.1%	4.8%	0.8%	25.8%
Experiment with DL-Met				
Mean value	2.421	3.598	1.498	2.82
CV [a]	4.1%	2.5%	1.9%	26.8%
p-value [b]	0.76	0.62	0.77	0.47

a = CV: coefficient of variation.
b = p-value: probability of error according to Student's T-test.

Table 2. Average final weight feed consumption, feed conversion ratio, and mortality, according to slaughterhouse reports.

As seen in Table 1, the two feed variants had no influence on broiler performance at any stage.

Similarly, the final average performance data (Table 2) showed no differences for feed intake, feed conversion or mortality ($p>0.05$); mortality shows a relatively high variation coefficient for both variants, but overall losses varied between 1.9 to 4.1% over the 10 houses.

Furthermore, daily monitoring of feed and water consumption showed no significant differences between the feed variants, thus validating the recommendation of a 65% biological efficacy of the MHA-FA over DL-Met (Fig. 1).

The study also confirmed excellent footpad health – a strong indicator of not only good animal health and welfare but also a high utilisation of feed protein or relatively low N excretion.

With high nitrogen excretion comes increased water excretion via urine, which often results in poorer bedding quality and thus footpad health.

The results indicated an average nitrogen excretion of 43g/animal for both trial groups, resulting in a nitrogen utilisation of 62% of dietary protein (nitrogen) for deposition as body protein.

Conclusion

In summary, there were no performance differences in broilers under large-scale commercial conditions when replacing MHA-FA with DL-Met in a ratio of 100:65, underlining that this concept works especially under practical conditions.

It can also be concluded that overestimating the nutritional value of MHA-FA (a biological efficacy of more than 65% compared to DL-Met) can result in an inadequate supply of Met+Cys to broilers and, in turn, worsening performance.

As well as ensuring a consistent and high performance, this concept can also yield cost savings in feed production.

According to our analyses, an average MHA-FA supplementation of 2.95kg/t was realised. Following the tested recommendation, this can be replaced by 1.92kg/t of DL-Met without affecting broiler productivity.

The commercial price ratio of methionine sources is often 80% or higher. With a DL-Met price of €2.50 /kg, the MHA-FA price should be classified as €2.00/kg. To calculate the costs of the average supplementation from this, MHA-FA costs €5.90/t feed (2.95kg/t * €2.00/kg) and DL-Met costs €4.80/t (1.92kg/t * €2.50/kg), which equals a saving of €1.10/t feed when using DL-Met.

This corresponds to an almost 19% reduction in supplementation cost - a significant saving for producers looking to reduce operating costs and maximise barn profitability.

DL-Met is a superior choice as a methionine source than MHA-FA, given its greater nutritional value, higher bioefficacy and absorbability.

Demand for methionine is increasing across the globe, because of rising demand for meat consumption caused by improved living standards and a growing population.

By adding DL-Met to animal feeds, producers can reduce raw protein content and lower the environmental impact of production, whilst ensuring good animal health and welfare. ■

Fig. 1. Daily feed intake (left) and water intake (right) per bird averaged over the feeding variants with corresponding standard deviations.