Effect of Guanidinoacetic Acid on the performance of slow growing broilers

Modern broiler breeds are characterised by their rapid growth and high feed efficiency. However, these high performing genetics are associated with numerous welfare concerns, including low activity levels, leg damage and contact dermatitis. Furthermore, intensive production systems with fast growing broilers present increased cases of muscle abnormalities like woody breast and white striping and eventually poorer meat quality.

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Fig. 1. Hubbard JA 757.

As animal welfare is getting more and more in the consumer's centre of attention the demand for slow-growing chicken meat is increasing.

Recently, several major companies and retailers signed the European Chicken Commitment, in which they pledge to only source broilers reared to higher welfare standards by 2026.

One core objective of these standards is the rearing of birds that demonstrate higher welfare outcomes compared to standard fast-growing broiler breeds.

Chicken in semi-intensive systems are given more time to attain maturity and therefore slow-growing broilers have the potential to provide tastier meat of superior quality.

However, slower growth results in increased feed consumption and costs and reduced meat quantity. Therefore, these chickens are less profitable and efficient.

New research is looking into solutions to reduce feed quantities and costs while keeping the birds' growth on the same level to maintain the improved welfare and quality.

Enhancing the birds' creatine status could be one measure to support this goal. Therefore, the present study investigated whether the addition of Guanidinoacetic Acid (GAA) could improve the feed conversion in a typical slow growing breed.

The role of creatine in animal feed

The animal's demand of creatine can be supplied directly from animal protein or by endogenous synthesis.

The latter is based on the amino acids arginine, glycine and methionine in a two-step synthesis in kidneys and liver. Creatine is then mainly stored in muscle tissue.

Decreasing amounts of protein from animal origin in feeds, particularly in the EU, led to a lack of creatine in broiler diets.

Even if processed animal proteins are included the creatine levels in such diets will be highly variable and not sufficient to optimise the creatine levels in muscle. This is putting a greater burden on de novo synthesis in growing broilers to maintain physiological creatine levels, but won't be enough to result in beneficial effects on performance.

Creatine, together with phosphocreatine, is involved in the cellular energy metabolism. It functions as a backup to the ATP- (adenosine triphosphate) ADP- (adenosine diphosphate) cycle to store and metabolise energy when required, by supplying phosphate groups to ADP to recycle ATP.

In general, about 1.7% of the entire creatine pool is irreversibly converted to creatinine each day and excreted. Therefore, creatine must be continuously replaced. The need for creatine is age-dependent, higher amounts are needed by growing animals for muscle growth versus adults.

Table 1. Body weight (BW) development during the four feeding periods and overall.

	Day 0	Day 10	Day 21	Day 35	Day 56
BW (g) Control	43.0	224	602	1,212	2,538
BW (g) Creamino	43.0	223	600	1,152	2,536
p-value (BW)	≥0.05	≥0.05	≥0.05	<0.05	≥0.05

The role of GAA

GAA has one role in the body: it is the only metabolic precursor of creatine formed in the first synthesis step in the kidneys. Also, it is the better source of supplemental creatine for animal feed because supplemental creatine is not heat stable and has inferior processing properties.

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	Day 0-10	Day 10-21	Day 21-35	Day 35-56	Day 0-56
ADG (g) Control	18.1	34.4	43.6	63.1	44.6
ADG (g) Creamino	18.0	34.3	39.5	65.9	44.5
p-value (ADG)	≥0.05	≥0.05	<0.05	<0.05	≥0.05
DFI (g) Control	22.0	53.0	89.0	148	92.0
DFI (g) Creamino	21.0	53.0	82.0	147	89.0
p-value (DFI)	≥0.05	≥0.05	<0.05	≥0.05	≥0.05
FCR Control	1.20	1.55	2.05	2.35	2.06
FCR Creamino	1.18	1.54	2.08	2.23	2.00
p-value (FCR)	≥0.05	≥0.05	≥0.05	<0.05	<0.05

Table 2. Average daily gain (ADG), daily feed intake (DFI) and feed conversion ratio (FCR) in the four feeding periods and overall.

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GAA is converted to creatine in the liver, transported via the blood stream and predominantly stored in muscle tissue. Subsequently, muscle has greater energy stores and can perform better.

Alzchem has invented the feed additive Creamino (containing >96% GAA) which is approved in most countries of the world and is widely used in commercial diets to improve the growth performance, energy utilisation and save feed cost.

Creamino in slow growing broilers

480 Hubbard JA 757 (mixed sex) broiler chickens were used in a 56 days long trial (Poultry Research Center, The Netherlands) to investigate whether GAA improves the performance parameters of slow growing broilers. The chickens were distributed over two groups, a control and a trial group (0.06% Creamino), each comprising 12 pens with 20 birds. The birds received crumbled feed in the starter phase (day 0-10), and pelleted feed in the grower I (10-21), grower II (day 21-35) and finisher phase (day 35-56). The commercial corn, wheat, soybean meal diets were formulated based on Hubbard recommendations for slow growing broilers.

Feed intake (FI), and body weight (BW) gain were recorded per pen and per phase. Feed conversion ratio (FCR) and average daily gain (ADG) were calculated according to the feeding phases.

This study clearly confirmed that adding GAA to diets of slow growing broilers improved performance parameters. Over the whole fattening period of 56 days the birds receiving feed supplemented with 0.06% Creamino showed a by six points decreased FCR (Table 2).

Since ADG was near identical over the whole rearing period the birds needed less feed to achieve the same growth performance (Table 2). GAA as a source of creatine was proven to have consistent effects on FCR in broilers in many pervious scientific and field trials. Slow growing broiler breeds therefore seem to react similarly to their high performing counterparts. Also, many official guidelines for marketing slow growing birds define maximum levels for ADG.

Since the supplementation of GAA resulted in lower feed quantities needed per kg of gain it seemed to be a very suitable additive for the production of slow growing broilers. ■

Conclusion

In this study examining slow growing broilers GAA improved FCR while keeping ADG on target levels.

Similar to the high performing broiler breeds, slow growing birds seemed to be sensitive to supplementation of GAA as a source of creatine. This is a result of an improved cellular energy reservoir. Creatine is very important to better meet the physiological energy requirements of broilers.

Creamino as a source of creatine can bring this nutrient back in your diet and further improve the production of slow-growing broilers by increasing the efficiency of the birds.