Betaine has been used in broiler nutrition for many years. Studies have shown that betaine improves production performance, can replace other methyl group donors such as choline and methionine, can assist birds during heat stress and improves slaughter characteristics. Also known as trimethylglycine. It was first discovered in sugar beets, but it is also present in other plants, animals and seafood. However, sugar beets contain exceptionally high levels of betaine, which accumulate in condensed soluble (116,000 mg/kg; Eklund et al., 2005). Nowadays, betaine is also available in several purified forms: anhydrous, monohydrate and betaine hydrochloride. Some questions have been raised as to whether the osmoregulatory properties of betaine hydrochloride are similar to those of betaine anhydrous.

To study this question, an in vitro trial was setup to mimic gastric passage. De Kruipe (University of Ghent, 2010, unpublished) evaluated the biological equivalence of different betaine sources: monohydrate and anhydrous produced by extraction versus betaine hydrochloride and anhydrous produced by chemical synthesis.

The products were dissolved in a solution of water and hydrochloride at pH 2.3 (gastric conditions) and then were analyzed by using high-performance liquid chromatography-electrospray ionization mass spectrometric and direct mass spectrometric analyses.

Results showed that, irrespective of the ion form and production method (natural extraction versus chemical synthesis), different sources of betaine gave the same analytical results (same retention time pairs). Therefore, no difference in biological activity or osmoregulatory function should be expected. Because both molecules are identical after gastric passage, no differences between betaine hydrochloride and betaine anhydrous as an effective feed additive could reasonably be expected.

Poultry production

El-Khatib et al. (2000) and Ratnayanto et al. (2009) comprehensively reviewed the dietary effects of feeding betaine to poultry. Results for nutrient digestibility, animal performance, metabolism and improvement in carcass leanness were reviewed and reported (Table 1). These peer-reviewed papers illustrate the benefits of betaine as a feed additive for improving animal performance and slaughtering characteristics.

Studies included in these two reviews were conducted with a particular scientific theory, and animal responses were the result of one of betaine’s modes of action, which are both influenced by the concentration of other methyl donors in the diet and the presence of either an osmotic or metabolic stress.

Methyl donor

Dietary supplementation of betaine may reduce the requirement of other methyl donors such as methionine and choline (Siljander-Rasi et al., 2003). However, this theoretical application must be subjected to considerable analysis before practical implementation (Matthews et al., 2001; Zhan et al., 2006).

The sparing effect of methionine and choline has been thoroughly investigated in poultry and, to a lesser extent, in pigs. Pesti et al. (1979) showed that added betaine and methionine can replace each other in broiler chick diets. Florou-Paneri et al. (1997) showed that between 30% and 60% of the supplemental methionine can be substituted by betaine without negative effects on performance.

A more conservative replacement approach was evaluated in non-peer-reviewed articles by Lessing and Van der Klijs (2007) and Cresswell (2010). Both experiments studied the bioequivalency of betaine and choline/methionine in broiler diets, whereas choline was fully replaced and methionine decreased by 25-30% of daily requirements. Within this range of replacement, no differences in broiler performance were observed.

In line with the results found by Cresswell, feeding strategies were tested by Excentials BV (an Orffa subsidiary) to get more insight in application strategies.

This trial was performed at PME in Pune, India, by Dr. Rama Rao (2011, unpublished) and showed improved performance and carcass yield for all treatments. Moreover, this trial offered an insight into different application strategies.

In the experiment, 2,000 Cobb broiler birds were divided over four treatments with two replicates each. The control diets were typical corn/