



# Histidine – is it the third limiting amino acid?

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Fine-tuning and balancing diets for essential amino acids has become a common practice during recent years. In general, lysine and methionine are the main limiting amino acids in dairy cow diets. Histidine has been identified as the first limiting amino acid mainly in cows fed grass silage-based diets. However, new research shows histidine may be a limiting amino acid in corn silage-based diets as well.

In a series of studies conducted at The Pennsylvania State University's Dairy Teaching and Research Center, researchers evaluated the effects of histidine supplementation of low-protein diets on lactation performance of high-producing dairy cows. In the first work (2015), the authors supplemented a metabolisable protein (MP) deficient diet, already supplemented with rumen-protected methionine, with 50g of a rumen-protected histidine product (bioavailability = 54%).

The diet, based on corn silage (43.3% of DM), was formulated to contain 15.5% of protein in dry matter (DM) basis and provide 96% of the MP requirements (according to the dairy National Research Council; NRC, 2001). The results, published in the Journal of Dairy Science, showed that supplementing histidine:

- Increased DM intake (28.3 vs 26.6 of kg DM/day).
- Increased milk protein content (3.26 vs. 3.16%).
- Increased milk protein yield (1.46 vs. 1.37kg/day).
- Tended to increase glucose in blood (80.4 vs. 74.6mg/dL).

Similarly, in the second study (2016), the authors supplemented a

protein-deficient diet (98% of the MP requirements) with 120g of an experimental rumen-protected histidine product (bioavailability = 18%). This diet contained 42% of corn silage and 14.5% of protein in DM basis. In summary, feeding protected histidine:

- Tended to increased DM intake (29.2 vs. 28.4 kg of DM/day).
- Increased milk protein content (3.11 vs 3.00%).
- Increased histidine concentration in blood (44.3 vs 26.3 $\mu$ M).

Finally, in the last study (2017), cows fed a MP deficient diet were supplemented with 400g of blood meal. Blood meal is an excellent source of histidine. The corn silage-based diet was formulated to contain 16.2% of protein in DM and to supply digestible histidine at 2.5% of MP requirements.

In this case, supplementing histidine by feeding blood meal:

- Increased DM intake (28.5 vs 25.4kg of DM/day).
- Increased milk yield (40.5 vs 37.57kg/day).
- Increased energy-corrected-milk yield (37.4 vs 34.4/day).
- Increased milk protein yield (1.18 vs 1.07kg/day).
- Increased histidine concentration in blood (90.9 vs 37.3 $\mu$ M).

These findings indicate that histidine may stimulate feed intake and milk protein production in dairy cows fed a diet based on corn silage.

