

Regulation of muscle carnosine and anserine levels by dietary methionine

Kanta Sato ¹, Shinichi Kai ², Hina Koseki ², Sharula ¹, Saki Shimamoto ¹, Shinobu Fujimura ¹

¹ Graduate School of Science and Technology, Niigata University, Niigata, Japan, ² Niigata Agro-Food University, Niigata, Japan

Objectives: Carnosine (Car) and anserine (Ans), ones of the imidazole dipeptides, are abundantly present in the meats. Car is biosynthesized from β -alanine (β -Ala) and histidine (His), on the other hands, Ans is biosynthesized by methylation of Car. Carnosine N- methyltransferase, the enzyme involved in the methylation of Car to Ans, requires the presence of S-adenosylmethionine (SAM), the metabolite derived from methionine (Met), for its activity (McManus, 1962; Boldyrev and Severin, 1990; Bauer and Schulz, 1994). Ans is also biosynthesized from β -Ala and N π -methylhistidine (N π -MeHis). We obtained the possibility that dietary amino acids might be involved in imidazole dipeptides synthesis by feeding experiment using broilers based on NRC (1994) nutrient requirements (Kai et al., 2017). The objective of this study was to investigate the effect of dietary Met on productivity and on the level of the imidazole dipeptides, based on the ROSS nutrient requirements (2019).

Materials and Methods: Experimental animals and diets 21-day-old female chunky strain broilers were allocated to two groups: Control group, broilers fed a diet Met level fulfilled (Met100%); Low-Met group, broilers fed a diet Met level 75%. Chickens fed each diet for 10 days. All nutrition levels fulfilled the requirements of the Ross Nutrition Supplement (2019).

Measurements At the end of the trial, feed intake and body weight were measured for productivity. Blood samples, and breast muscle were collected. Free amino acids and the dipeptide levels of plasma and muscle were determined by HPLC.

Results and Discussion: Productivity Met intake was significantly decreased in the Low-Met diet ($P < 0.01$). Body weight gain ($P = 0.06$) and feed intake ($P = 0.06$) showed a tendency to decrease in the Low-Met diet. There were no significant differences in the yield of breast muscle and the yield of liver between the two diets.

Free Amino acids and the dipeptides in plasma Free Met concentration was significantly decreased in the Low-Met diet ($P < 0.01$). On the other hands, Car and Ans were not detected. This absence of the dipeptides agrees with our previous study (Kai et al., 2015) **Free Amino acids and the dipeptides in breast muscle** Free Met level was significantly decreased in the Low-Met diet ($P < 0.01$) similar to plasma, on the other hands, free N π -MeHis was significantly increased in the Low-Met diet ($P < 0.05$). Car and Ans levels in muscle fed the Low-Met diet tend to increase ($P < 0.10$). The total level of Ans and Car was significantly increased in the Low-Met diet ($P < 0.05$). The ratio of Ans to Car was significantly decreased in Low-Met diet. It is appeared that dietary Met levels are involved in the imidazole dipeptides synthesis in muscle, particularly in the total level of Car and Ans.

Conclusion: Our data obtained in this study indicated that feed with insufficient level of Met compared to the requirement increased the total level of the dipeptides in muscle, as oppose to the decline of body weight gain and feed intake. Further study to determine the appropriate level of dietary Met for both of the enhanced levels of the dipeptides in muscle and higher productivity is required.

Reference:

Paper

1. Kai S, Watanabe G, Kubota M, Kadowaki M, Fujimura S. (2015). Effect of dietary histidine on contents of carnosine and anserine in muscles of broilers. *Animal science journal* 86, 541-546.

Proceedings

2. Kai S, Okawa K, Watanabe G, Kubota M, Kadowaki M, & Fujimura S. (2017). Effect of dietary lysine on the levels of imidazole dipeptides and mRNA expression of the metabolizing enzymes in muscles of broiler chicks. *International Congress on Carnosine and Anserine*. 12-14 September 2017, Louisville, KY, USA.
3. Kai S, Watanabe G, Kubota M, Kadowaki M, Fujimura S. (2015), Effect of dietary methionine on metabolism of carnosine and anserine in muscles of broiler chicken. *61st International Congress of Meat Science and Technology*, 23-28th August 2015, Clermont-Ferrand, France.

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