Effect of dietary supplementation of dried bonito by-product on carnosine and anserine in broiler chicken muscle

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Objectives: Carnosine (β-alanyl-L-histidine: Car) and anserine (β-alanyl-1-methyl-L-histidine: Ans) are a class of imidazole dipeptides. They play many beneficial roles, for example, antioxidant capacity, anti-fatigue action, buffering capacity, blood glucose lowering and so on. Histidine (His) is an important amino acid in fish and poultry, and is an important constituent for synthesis of imidazole dipeptides. Some reports show that dietary His affects the muscular Car and Ans levels (Kai et al., 2015; Qi et al., 2021). Bonito contains a large amount of His. The objective of this study was to investigate the effect of dietary dried bonito byproduct as a source of His of broiler chicken muscle.

Materials and Methods:

[*Experimental animals and diets*] 28-day-old female chunky strain broilers were allocated to three groups: Control group, broilers were fed a diet without dried bonito by-product; Dried bonito 3% group, broilers were fed a diet with 3% dried bonito by-product; Dried bonito 5% group, broilers were fed a diet with 5% dried bonito by-product. Chickens were fed each diet for 10 days. All nu- trition levels fulfilled the requirements of the Ross Nutrition Supplement (2019).

[*Measurements*] At the end of the trials, feed intake and body weight were measured for productivity. Blood samples were taken, and breast muscle samples were collected. Free amino acid and dipeptide contents of plasma and muscle were determined. Malondialdehyde (MDA) content was also measured in muscle.

Results and Discussion:

[*Growth performance*] Body weight gain and feed intake were not different among each group. However, Feed efficiency was sig- nificantly increased in the dried bonito 5% group compared with the control group ($P<0.05$).

[*Free amino acids and dipeptides in plasma*] Free His concentration in plasma was stepwisely increased by addition of dried bonito by-product ($P<0.05$). In contrast, free β-Ala was stepwisely decreased as dietary dried bonito by-product increased ($P<0.01$). Either Car or Ans was not detected in plasma of each group. Free 1M-His content was significantly increased in the dried bonito 5% group compared to the control group ($P<0.01$).

[*Free amino acids and dipeptides in muscle*] Compared with the control group, muscular Car content was markedly increased in the dried bonito groups ($P<0.01$), and muscular Ans was also significantly increased in the dried bonito groups ($P<0.05$). However, free His and 1M-His were not changed in breast muscle of the dried bonito 3% group. In addition, free His and 1M-His of muscle were significantly increased in the dried bonito 5% group compared to the control group ($P<0.05$). In contrast, free β-Ala of muscle was decreased by addition of dietary dried bonito by-product ($P<0.01$).

[*MDA content in muscle*] MDA concentration in muscle was not different between the control and the dried bonito 3% group. However, MDA content was markedly decreased in the dried bonito 5% group ($P<0.05$). In this study, the effect of dietary dried bonito by-product on the Car and Ans contents in muscle was investigated with respect to improvement of meat production and meat quality. Ans and Car of muscle in the dried bonito groups were markedly increased. In humans, Car and Ans were hydrolyzed by carnosinase in blood. In this study, Car and Ans in chicken plasma were not detected in all groups. Free His content in plasma was increased with dietary dried bonito by-product levels. Our results suggested that the significant increase in the level of muscu- lar Car and Ans might be explained by dietary His synthesis both peptides in muscle. In the present study, the increase rate of both peptides, particularly Car, was specifically higher compared with other researches using dietary His supplementation (Qi et al., (2021): 0.065-0.195%; Kai et al., (2015): 0.35%; Kralik et al., (2015): 0.3-0.5%). In our study, dietary His was increased by 0.137- 0.228% by using dried bonito by-product, indicating that increasing the synthesis rate of Car and Ans by using dietary dried bonito by-product would be better than using dietary His. On the other hand, MDA concentration in muscle was successfully decreased by the addition of 5% dried bonito in diet. Car and Ans have a strong antioxidant capacity. It was considered that dietary 5% dried bonito by-product affect the MDA content by increasing muscular Car and Ans. MDA content was not changed in the dried bonito 3% group might be explained by the increase of Car and Ans was not enough to prevent from lipid peroxidation.

Conclusions: We found that Car and Ans contents in muscle were increased by dietary dried bonito. Meanwhile, supplementation with dried bonito induced a decrease in MDA content in breast meat. Feed efficiency was increased in 5% dried bonito diet. It is expected that the dietary dried bonito by-product would be a good source for the improvement of meat quality.

Key words: Dietary dried bonito, Anserine, Carnosine, Broiler meat