

## コイにおけるアミノ酸飼料からの飼育水への窒素損失率に及ぼす CMC の効果

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## Short Paper

## Effect of CMC on Nitrogen Loss from Amino Acid Diets for Carp

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In the previous study,<sup>1)</sup> it was found that high percentage of amino acid is dissolved from an amino acid diet into water during mastication by carp, and assumed that feed efficiency of an amino acid diet is low compared with a protein diet in consequence.

Sodium carboxymethylcellulose (CMC) is generally used as a binder in diets for fish. There are various viscosity in CMC. It is expected that CMC with higher viscosity has a better effect on the prevention of dissolving dietary amino acids into water. The present study examined effects of CMC on nitrogen loss from amino acid diets and feed efficiency in carp.

The composition of the test diet is given in Table 1. Three kinds of CMC (CMC-A, B and C)\*<sup>2</sup> were used as a binder for test diets.

Carp *Cyprinus carpio* (mean wt. 3 g) were distributed into five 45 l tanks with 26 fish per tank. The five experimental diets were presented in three equal feedings (at 3.5 hour intervals) at a rate of 5% of body weight per day. Fish were weighed every two weeks during the four week feeding trial and the daily allowance was adjusted accordingly.

In order to determine the nitrogen loss from the test diets by carp, the following experiment was undertaken. Ten carp with a mean weight of 6 g, were stocked in a 5 l-beaker with aeration, and were fed a commercial diet for two weeks to acclimate to the environmental conditions. Subsequently, the each test diet was fed to the fish for one week at a rate of 3% (three equal feedings) of body weight per day. After 2-days fasting, the fish were transferred to another 5 l-beaker and were rested for one hour. Test diet was then fed to the fish at a rate of 1.0% of total body weight. The time for feeding was fixed as 10 min. A sample of the water in the beaker was taken 15 min after final feeding. Nitrogen content in the sample water was determined by the micro-Kjeldahl method, and total nitrogen content in 5 l-beaker was calculated. As a blank value, nitrogen content in water just before feeding was determined. In the case of the casein diet (diet 1) group, whole water (5 l) at 15 min after feeding was filtered through a filter paper to collect casein which was diffused in water, and the nitrogen content in residue was also determined. The percentage loss of nitrogen from test diet during feeding by carp was calculated.

The results of 4 week-feeding experiment and nitrogen loss from test diets are given in Table 2. Diet 1 (casein) showed excellent feed efficiency, and low percentage loss of nitrogen from diet. From the results of diet 2, 3 and 4 (CMC groups), it can be said that CMC with high viscosity (in diet 4) has a better effect on the prevention of amino acid loss than low viscosity-CMC (in diet 2), and give higher feed efficiency. As compared with the casein diet, percentage

Table 1. Composition of the test diets (g/100 g diet)

	Diet number (binder)				
	1 (CMC-B)* <sup>2</sup>	2 (CMC-A)* <sup>1</sup>	3 (CMC-B)* <sup>2</sup>	4 (CMC-C)* <sup>2</sup>	5 (Agar)
Casein, vitamin-free	50	—	—	—	—
Amino acid mixture* <sup>4</sup>	—	50	50	50	50
Dextrin	29.5	29.5	29.5	29.5	29.5
Pollack liver oil	6	6	6	6	6
Vitamins* <sup>1</sup>	3	3	3	3	3
Minerals* <sup>1</sup>	4	4	4	4	4
Agar-agar	—	—	—	—	7.5
CMC	7.5	7.5	7.5	7.5	—
5 N-NaOH (ml)	—	25	25	25	25
Distilled water (ml)	65	—	—	5	275
	Viscosity (c.p. at 1%) Active content (%) Degree of substitution (mol/C <sub>6</sub> )				
* <sup>1</sup> CMC-A:	15	99.1	—	0.88	—
* <sup>2</sup> CMC-B:	84	99.5	—	0.71	—
* <sup>3</sup> CMC-C:	10200	99.2	—	0.66	—

\*<sup>4</sup> Yamada and Yone.<sup>1)</sup>

Table 2. Results of feeding experiment and nitrogen loss from test diets during feeding by carp

	Diet number				
	1	2	3	4	5
Feed efficiency (%)					
0-2 weeks	136.2	2.4	13.1	24.1	37.9
2-4 weeks	129.8	8.8	21.3	41.9	58.0
Total-N					
in diet	(D)* <sup>1</sup>	53.9	40.9	37.9	38.1
in water before fed	(B)* <sup>2</sup>	1.0	1.1	1.1	0.9
after fed	(A)* <sup>2</sup>	4.1* <sup>3</sup>	31.7	28.7	23.6
% loss of N from diet	(L)* <sup>3</sup>	5.8	74.8	72.8	59.6

\*<sup>1</sup> Total nitrogen (mg) in the test diet fed to the ten fish in the beaker.\*<sup>2</sup> Total nitrogen (mg) in 5 l of water in the beaker before (B) or after (A) fed.\*<sup>3</sup> L=(A-B)÷D×100.\*<sup>4</sup> Total nitrogen (mg) in both water and residue.

loss of nitrogen from the four amino acid diets were extremely high.

Recently, Murai<sup>3)</sup> has reviewed about amino acid metabolism on carp and proposed that amino acid unbalance in the plasma resulted from variation in absorption rate of amino acids may be responsible for poor utilization of crystalline amino acids by carp. Also, he examined free amino acid in excretion of carp fed amino acid diets and suggested that the poor utilization by carp resulted from excretion of amino acids rather than stimulated catabolism of amino acids absorbed. Our results obtained from the previous study<sup>1)</sup> and the present study are directly contrary to his results.<sup>2,3)</sup> The discrepancy may be caused by the differences in diet compositions. Further work must be done with due regard to this.

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## References

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