^{15}N AS INDICATOR OF THE ASSIMILATION OF FISH MEAL, HOUSEFLY MAGGOT MEAL AND PEA SEED MEAL PROTEIN IN THE DIET OF *OREOCHROMIS NILOTICUS*

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Background

Fish meal is the most important protein source for fast growing aquaculture industry. However, fish meal is a limited resource whose production volume has remained stable from the late 1980s at approximately 6 million metric tonnes per annum. This resource limitation and the continuous growth of aquaculture production forces to look for adequate alternative protein sources in aquafeeds. For effective substitution of fish meal an evaluation of possible alternative aquafeed ingredients should provide data related to their nutritional value, as well as digestibility of the main nutrients. Laboratory determination (direct measurement: aquatic metabolism chamber; indirect measurement: collection of faeces or by stripping) of dietary nutrients in the digestive tract or faeces of fish provide approximations of temporary nutrient digestibility, absorption and assimilation in fish body. Considering new methods in fish digestion studies we examined the potential of ^{15}N labelled protein sources to evaluate the digestibility and trace the absorption of protein nitrogen in the digestive tract of *Oreochromis niloticus*.

Materials and methods

Fish meal (FM), housefly maggot meal (HFMM) and pea seed meal (PSM) were labelled with ^{15}N before they were incorporated into standard compound isonitrogenous (crude protein content 30 %) flake diets (Table 1). Four groups of fish (*Oreochromis niloticus*; 47.5g ± 7.83g) were fed (1,5 % of body weight) with one of the experimental diets at the same starting time. After 15 minutes, 2, 4, and 6 hours 3 fishes were separated and observed in detail. Whole stomach and gut with content were extracted and stored frozen until analysis.

Table 1: Formulation of experimental diets (g kg^{-1} DM).

	Diet 1	Diet 2	Diet 3
Pea seed meal	-	-	**426.1**
Housefly maggot meal	-	**454.5**	-
Fish meal	**511.5**	-	296.9
Fish oil	35.9	35.3	102.4
Vitamins/Minerals	40.0	40.0	40.0
Potato starch	392.6	450.2	114.6
Kleber	20.0	20.0	20.0
Total	1000	1000	1000
Concentration of ^{15}N g^{-1}			
Organic Substance	0.795 mg	0.466 mg	0.078 mg

Results

During the examination period 2 to 6 hours 31.5 ± 1.3 % in FM, 59.1 ± 3.7 % in HFMM and 118.5 ± 11.6 % (mean ± SE) of ^{15}N in PSM ($P<0.05$) were found in the digestive tract (stomach and gut) with content compared to 15N concentrations 15 minutes after feeding. Fish meal showed a faster stomach passage within the first 2 hours and higher absorption rate over 6 hours compared with HFMM and PSM diets. HFMM and PSM revealed a higher ^{15}N concentration in the stomach between 2 and 6 hours as in the gut which indicated a prolonged retention time (Figure 1; 2; 3).

Figure 1: ^{15}N concentration in stomach and gut of fish fed diet 1 (fish meal).

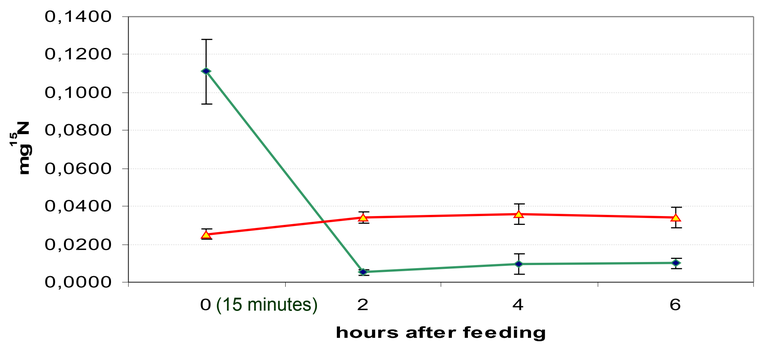


Figure 2: ^{15}N concentration in stomach and gut of fish fed diet 2 (housefly maggot meal).

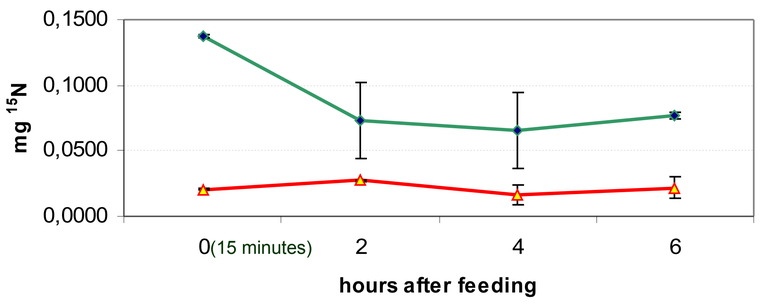
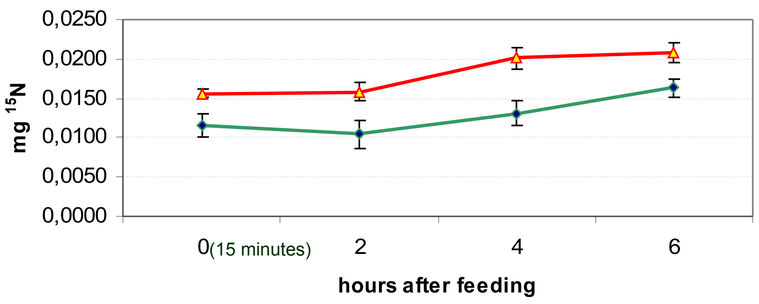
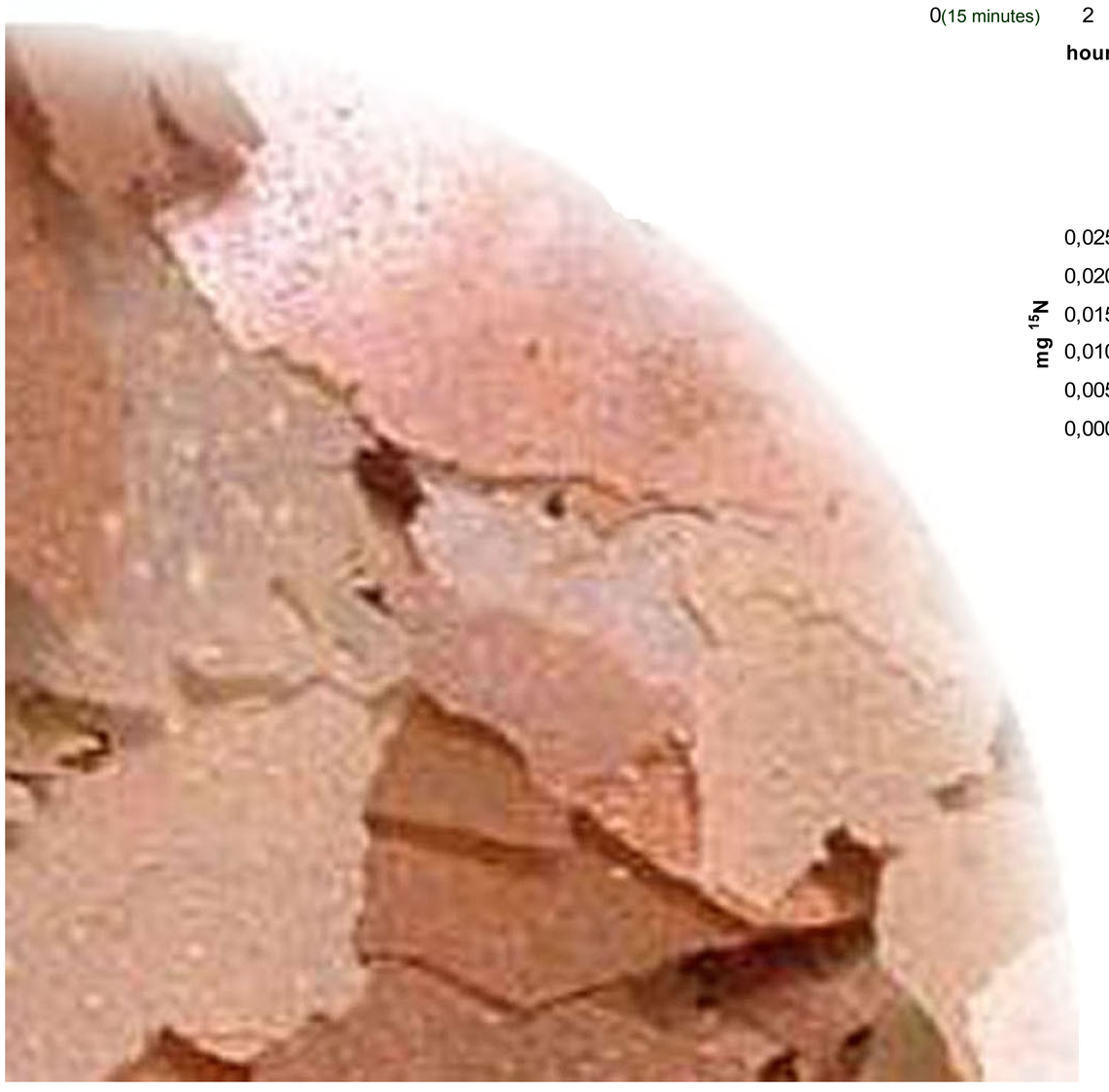


Figure 3: ^{15}N concentration in stomach and gut of fish fed diet 3 (pea seed meal).





Conclusions

Digestibility and absorption of HFMM and PSM proteins might be influenced by the hard digestible substances (e.g. chitin, crude fibre, lignin,) as well as the supplied amount of ^{15}N. The ^{15}N tracer experiment provided a quantitative comparison of the digestibility and absorption of nitrogen from FM, HFMM and from PSM in different parts of the digestive tract when fed to *Oreochromis niloticus* as ingredients of a compound diet. The use of enriched protein sources has obvious merits for future studies. Further investigations are necessary to determine the rate of nutrient assimilation (and depletion) in *Oreochromis niloticus* tissues and organs in relation to their diet.