The use of black soldier fly as an alternative ingredient in fish feed

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BACKGROUND

Insects can be used as an alternative protein source in fish feed (1)

In Europe, 7 insect species are allowed to be used in aquafeed, including the black soldier fly (*Hermetia illucens*) (2017/893)

The black soldier fly is one of the insect species with the greatest potential due to its short life cycle, ability to be reared on waste streams, and high crude protein (38.3 – 52.3 %DM) and lipid (21.8-38.6% DM) content

However, black soldier fly larvae also contain chitin, which can act as an anti-nutritional factor when included in fish feed (2)

PURPOSE

To modify the chitin content in insect meal by mechanical separation and to identify the digestibility of a low and high chitin black soldier fly meal as ingredient in Nile tilapia (*Oreochromis niloticus*) feed

MATERIALS AND METHODS

Nile tilapia

Tilapia (41.20 ±1.68 g) were randomly distributed over 9 identical tanks with a stocking density of 12 fish per tank. Each tank was assigned one of the three experimental diets – control, low chitin and high chitin. The fish were acclimated to the tank and diet for two weeks, followed by a 10 day digestibility trial.

Diet

Meals of black soldier fly larvae were mechanically separated into two fractions: a low (1.8%) and high (15.0%) chitin meal. Diets were formulated in a similar way as the control diet, with the exception that the black soldier fly meals partially replaced the different protein sources.

	Diet		
Ingredient (%)	Control	Low chitin	High chitin
Wheat flour	37.58	28.19	28.19
Soybean protein concentrate	25.00	18.75	18.75
Black soldier fly meal low chitin		25.00	
Black soldier fly meal high chitin			25.00
Poultry meal	8.00	6.00	6.00
Feather meal	8.00	6.00	6.00
Haemoglobin	8.00	6.00	6.00
Fishmeal LT	5.00	3.75	3.75
Rapeseed oil	3.00	2.25	2.25
Monoammoniumphosphate	2.02	1.52	1.52
Salmon oil	2.00	1.50	1.50
Titanimoxide	1.00	0.75	0.75
Vitamin premix	0.25	0.19	0.19
Mineral premix	0.15	0.11	0.11

RESULTS

The inclusion of low and high chitin meals from black soldier fly larvae reduced the dry matter and protein digestibility, whilst the ash digestibility was higher in the low chitin diet compared to the control and high chitin meal diet.

	Diet			
Digestibility (%)	Control	Low chitin	High chitin	P-value
Dry matter	87.85±0.13^{c}	86.15±0.57^{b}	82.14±0.44^{a}	<0.001
Ash	44.71±0.24^{a}	50.78±2.42^{b}	45.70±2.54^{a}	0.013
Lipid	93.67±0.45	94.46±0.66	93.67±0.39	0.162
Protein	94.45±0.15^{c}	92.95±0.24^{b}	89.44±0.26^{a}	<0.001

DISCUSSION

The dry matter and protein digestibility decreased with higher inclusion of chitin in the diet– as chitin consists nitrogen, these results might show that Nile tilapia cannot digest chitin. However, it may also be that chitin acts as an anti-nutritional factor and therefore reduces the protein digestibility.

Further research will be performed on the chitinase activity in the gastro-intestinal tract to identify whether Nile tilapia have the enzymes to degrade chitin and their activity.

Additionally, the digestibility of chitin and amino acids will be investigated to identify whether the reduced protein digestibility is a result of the anti-nutritional properties of chitin or the nitrogen in chitin itself.

CONCLUSIONS

The dry matter and protein digestibility were decreased with higher inclusion of chitin indicating that the nitrogen present in chitin is not available or it could mean that chitin acts as an anti-nutritional factor.

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