THE EFFECT OF DIFFERENT NSPase LEVELS IN THE DIET OF NILE TILAPIA (*O. NILOTICUS*) ON GROWTH PERFORMANCE, FEED UTILIZATION, AND SELECTED PARAMETERS REFLECTING ENERGY METABOLISM AND GUT INTEGRITY.

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Introduction

When using high inclusion levels of plant based ingredients in fish feed, the presence of Anti-Nutritional Factors (ANF) needs to be taken into consideration. Non Starch Polysaccharides (NSP) are recognized as true ANF, causing impaired growth performance and feed utilization. The mode of action of NSP in fish is still not completely understood and is probably multi factorial (Sinha et al., 2011). Increasing digesta viscosity and thereby hindering the action of endogenous digestive enzymes, altering the composition of the gut microbiota, trapping of bile salts which results in elevated excretion and thus affecting cholesterol balance,…are some of the hypothesized mechanisms involved.
NSPase could counteract these negative effects but on the other hand NSPase have the potential of negatively affecting product quality; by liberating the "trapped" energy from NSP itself or through an increased VFA production, the energy level of the diet could be increased. Too high energy levels in the diet can result in undesired fat deposition as visceral fat or in the fillet. Therefor the energy balance and product quality is also studied in this research.
In a previous trial several NSPase formulas (selection based on the used ingredients) were tested. The best performing formula was selected for this experiment.
The goal of this experiment was to determine which concentration results in the best performance in Nile tilapia and to investigate which of the selected parameters are affected.

Materials & Methods

The growth trial was performed in a RAS comprising 12 tanks of 150 l. Each tank was stocked with 35 Nile tilapia juveniles, individually tagged, with an ABW of 35.0 ± 0.3g (average ± SD) at day 0. A light/dark regime of 12h/12h was maintained and the temperature during the trial was 27.8 ± 0.7 °C (average ± SD).

Four diets were tested in triplicate. The control diet was formulated using Bestmix™ to contain 25.8% of digestible protein and 2 890kcal.kg^{-1} of digestible energy and a total NSP level of 24.4%. The main ingredients and the inclusion levels used were: 30.5% soybean meal, 28.8% wheat bran, 12.5% rapeseed meal, 7% rice bran, 7% wheat flour and 6% corn gluten meal. The control diet was coated with 2.5% of a 2/3 soy oil and 1/3 fish oil mixture, containing no NSPases. For the remaining 3 diets, the NSPase complex, developed by Aveve Biochem, was mixed in the oil and coated onto the pellets at 3 different concentrations: 200ppm, 400ppm and 600ppm.

Total trial duration was 9 weeks. Fish were fed ad libitum for 8 hours per day using automatic feeders. Uneaten pellets were quantified and feed intake was corrected. At 3, 6 and finally 9 weeks all fish were individually weighed and measured. Following parameters were determined: survival, Average Body Weight (ABW), Average Body

Weight Gain (ABWG) and Feed Intake (FI) from which SGR (Specific Growth Rate) and FCR (Feed Conversion Ratio) were calculated. Values are expressed as average ± SD.
During the 4 final days of the experiment, faeces were collected in order to determine the digestibility coefficients for protein, fat, carbohydrates and energy.
At 9 weeks, 6 fish per tank were euthanized and digesta, blood and tissue samples were taken for further analysis. Following parameters were determined: digesta viscosity, HSI and VSI, fat and glycogen content of the liver, dry matter, protein, fat and ash content of fillet, plasma glucose, plasma cholesterol, gut histology and 4 immunological parameters (IL1, IL6, SAP and CRP).

Results

The results for growth and FCR were presented during the EAS2015 poster session by Meeus et al. (2015). Calculation of the growth parameters and statistical analysis were based on tank averages (Kruskal-Wallis test followed by Mann-Whitney U test if significant differences were obtained). The fish were however individually tagged and analysing the data using a linear mixed model strongly increases the statistical power of the experiment. The difference between the 2 methods on statistical outcome will be discussed.
Summarizing the results for growth performance, the 400ppm treatment significantly performed better than the control group: the values of ABW were respectively 201.3±4.0g and 176.6±7.0g, the values of ABWG were 166.2±4.0g and 141.7±7.2g and the values of SGR were 3.12±0.04%.d-1 and 2.89±0.08%.d^{-1}. An unexpected observation was that the 600ppm treatment performed worse than the 200ppm and 400ppm treatments, at the same level of the control treatment.
FI was not significantly different between treatments with a p-value of 0.056. Although non-significant, clear trends are visible with FI values for the control and the 400ppm treatment of 207.7±15.8g and 236.1±1.8g. FCR was not significantly different between treatments (p=0.612).
Furthermore results of the above mentioned parameters will be presented.

Discussion

The 400ppm treatment results in a 14% higher average body weight compared to the unsupplemented diet. This NSPase formula and concentration improves growth performance in Nile tilapia to a considerable extent.
Although just non-significant, feed intake seems to be affected by the dietary treatment: fish fed the 400ppm supplemented diet tend to be able to ingest more feed. The results on the selected parameters will be discussed in relation to the performance data.

Conclusion

Growth performance of Nile tilapia fed with a diet containing elevated levels of NSP can be improved by supplementing the diet with NSPase. The NSPase need to be well chosen and the correct dose needs to be used

References

Meeus W., J. Adriaen, T. Abeel, L. Kuterna, E. Vanderbeke, P. Bossier and B. Goddeeris. 2015. The use of Non Starch Polysaccharide degrading enzymes in tilapia (o. niloticus) nutrition: determining dose response.

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