

Original article

Growth and digestive enzyme activity of Nile tilapia fed with diet containing fermented grass from cow stomach

Worawit Chukwannuan * and Sudaporn Tongsiri

Faculty of Fisheries Technology and Aquatic Resources, Maejo University, Chiang Mai, 50290, Thailand

* Correspondence: tonphai77@gmail.com; Tel.: +66-83-120-9699

Keywords: Nile Tilapia feed, Growth, Digestive enzyme activity, Fermented grass from cow stomach.

Received: 17 July 2017 / Accepted: 17 September 2017

© 2017 by the authors.

Introduction

Nile tilapia is one of the most economically important freshwater fish; however, the cost of feed is the main obstacle factor for their profitable and sustainable cultivation. The culturing process should be improved by low-cost feed development from farming by-products. The grass fermentation in cow stomach is the low-cost raw material which could be used for feed ingredient. The proximate compositions of grass fermentation in cow stomach such as protein, lipid, fibre, ash, moisture and carbohydrate were 16.90, 0.14, 0.33, 17.27, 13.25, and 52.10%, respectively [1]. The aim of this investigation was to study the growth of Nile tilapia fed with grass fermentation in cow stomach supplemented in the feed at a ratio percentage of 0 (control), 5 (GF5), 10(GF10), and 15(GF15). The characteristics of digestive enzymes in the Nile tilapia fed with the experimental feeds were also investigated. These studied could provide knowledge for future development of low cost fish feed for Nile tilapia.

Materials and methods

The grass fermentation in cow stomach was added in the fish feed at a ratio percentage of 0 (control), 5 (GF5), 10 (GF10), and 15 (GF15). The Initial weight of Nile tilapia was 20 g, the fish were randomly put into 12 cages (1×1×1m) and CRD was used in this experiments, 4 formulas of isoenergy diets were prepared as follows: 0 (control), 5 (GF5), 10 (GF10), and 15 (GF15). 90-days were conducted in the experiment. The digestive organs such as intestine was cleaned, weighted, and then homogenized on dry ice with phosphate buffer pH 7. The homogenate was centrifuged at 10,000 rpm at 4°C for 10 min and supernatant was collected and stored at -80°C. Protein contents of intestinal extracts were determined using the method described by [2].

The proteinase activity was assayed using azocasein as substrate based on [3]. The specific activity was expressed as the number of proteinase units per mg of

protein. One unit of proteinase activity was defined as the amount of enzymes determined giving an increase of per min per mg protein. For pH profile study, the reaction mixture was performed at room temperature and at various pH levels (2-12).

Results

The formulation and proximate composition of experimental diets (% dry weight) was shown in Table 1. The grass fermentation in cow, respectively. All diets were no different in calculated proximate composition and gross energy.

Table 1. Formulation and proximate composition of experimental diets (% dry weight)

Ingredients(% as fed)	Feed formula			
	Control	GF5	GF10	GF15
Fish meal (51%)	15	15	15	15
Soybean meal (44%)	33	35	35	35
Rice bran (14%)	30	16	18	8
Broken rice (13%)	21	25	16	18
Grass fermentation (16.9%)	-	5	10	15
Vegetable oil	-	3	5	8
Premix	1	1	1	1
Total (Kg)	100	100	100	100
Protein (30%)	30	30	30	30
Gross energy (kcal/100g)	403	398	395	391

The results of growth performances were shown in Table 2. There were no significant difference in initial weights ($P>0.05$). At the end of the experiment, the survival rates were not significant differences ($P>0.05$). The final weights, the average increased weights, and average daily weight gains of fish in treatment GF10 were highest, 44.71 ± 1.34 g., 22.28 ± 1.33 g. and 0.14 ± 0.00 g/fish/day, and were significantly different ($P<0.05$). In addition, the feed conversion rate was lowest and was significantly different ($P<0.05$).

The pH profile of the total proteinase specific activity in intestine of Nile tilapia fed with the experimental diets was shown in Fig. 1. The highest the total proteinase specific activity were observed in pH 10 and 12 on treatment GF10. At pH 8-12 provided

The JSFS 85th Anniversary-Commemorative International Symposium
“Fisheries Science for Future Generations”

Symposium Proceedings, No. 09010

higher enzyme activities than pH 2-7. The condition for total proteinase specific activity was the alkaline form. The acidic proteinase and neutral proteinase were shown the lower value than alkaline proteinase. The most suitable condition for total proteinase specific activity would be alkaline pH.

Table 2. Initial weight, Final weight, Weight gain, average daily gain, feed conversion rate and survival rate of Nile tilapia fed with experimental diets for 90 days

Parameter	Feed formula			
	control	GF5	GF10	GF15
Initial weight (g)	22.4±0.00 ^a	22.4±0.00 ^a	22.4±0.00 ^a	22.4±0.00 ^a
Final weight (g)	36.68±0.57 ^a	39.23±0.75 ^{ab}	44.71 ± 1.34 ^c	41.48±1.5 ^{bc}
Weight gain (g)	14.25±0.56 ^a	16.80±0.74 ^a	22.28 ± 1.33 ^b	19.06±1.51 ^{ab}
Average daily gain (g/fish/day)	0.09±0.00 ^a	0.11±0.00 ^a	0.14 ± 0.00 ^b	0.12±0.01 ^{ab}
Feed Conversion Rate	4.31±0.03 ^{ab}	4.43±0.03 ^b	4.08 ± 0.09 ^a	4.05±0.04 ^a
Survival Rate (%)	66.67±2.58 ^a	61.67±2.58 ^a	60.00±4.47 ^a	61.6±2.58 ^a

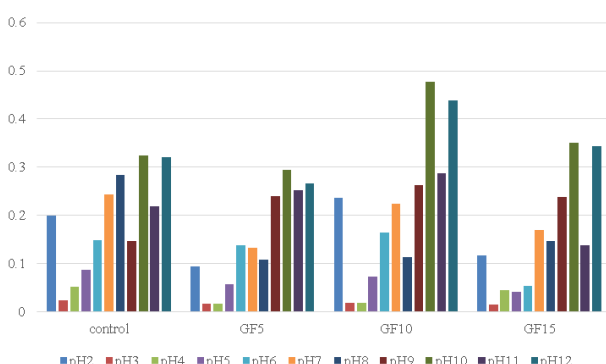


Fig. 1. The total proteinase specific activity (mU min⁻¹ mg protein⁻¹) in intestine extract of Nile tilapia fed with experimental diets for 90 days.

Discussion

The grass fermentation in cow stomach contained the 16.90% proximate protein. These materials could be used for low cost material in fish feed. The 10% of grass fermentation in cow stomach added in the feed showed the highest final weight, the average increased weights, and average daily weight gain which were significantly different ($P < 0.05$). The result of this experiment was the same as Pimpa et al. [4], Thongprajukaewa et al. [5] and Pandit et al. [6] as well. The total proteinase specific activity, was found to be highest among the extract enzymes from the intestine in the fish fed with GF10 at pH values of 10 and 12. In conclusion, the highest growth performance of tilapia fed with the diet containing 10 percentage of grass fermentation in cow stomach which contributed to the

higher digestive enzyme. The diet containing 10% of grass fermentation in cow stomach was suitable for culturing Nile tilapia.

Acknowledgements

We would like to thank Faculty of Fisheries Technology and Aquatic Resources, Maejo University for the funding to join to the JSFS 85th Anniversary-Commemorative International Symposium

References

1. Visitiporn S (2003) Ruminant Nutrition. Suranaree University of Technology. Nakhon Ratchasima. 97 (in Thai)
2. Lowry HO, Rosebrough, NJ, Farr AL, Randall RJ (1951) J Biol Chem 193: 265–275
3. Areekijserree M et al. (2004) Aquaculture 234: 575–578
4. Pimpa B et al. (2009) Agricultural seminar for year 2009. Faculty of Agriculture, Khon Kaen University, pp. 221–223 (in Thai)
5. Thongprajukaewa K et al. (2015) Aquaculture 439: 45–52
6. Pandit N et al. (2004) Sixth International Symposium on Tilapia in Aquaculture