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Effect of Protein Level on Alevins Growth and Intestinal Villi Development of Tilapia (*Orechromis aureus*)

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Abstract: Aquaculture is important protein production system, mainly through Tilapia species usage. The quality of dietary protein is an important factor influencing the growth performance of fish, which limits the intestine development. Six hundred two days old Tilapia alevins *Oreochromis aurecus*, were divided in groups of 100 (repetition) in commercial ponds, to evaluate 2 levels of protein in feed (40 *vs.* 50%). Parameters measured were, body weight, size (long) villi development in the small intestine. Results showed that the parameters from animals fed with 50% protein were significantly higher than those found in the alevins receiving the feed with 40% protein ($p<0.05$). On the other hand, the age impact was most important in general for all the individuals. Small intestine villi showed a bigger development with 50% protein in feed. In conclusion, feed containing 40% protein, at the age fingerlings could delay corporal and intestinal villi development.

Key words: Tilapia alevin, protein, intestinal villi, body development

INTRODUCTION

In the last years, considerable amount of peer reviewed scientific information on aquaculture was published (Waidbacher, 2006) especially of fish like trout, catfish and tent, unfortunately not enough was found on *Oreochromis* (tilapia) (Ruohonen, 1999). This lack is mainly related to the assessment of the efficiency on the use of proteins as body tissue and on internal organ development (Baglole, 1997) where they are involved with vital metabolic processes (Abimorad, 2007). The latter process can be achieved by the utilization of nutritive rations which allow an efficient use of protein for somatic development, production and profitability of rapid growing animals such as fishes (Peres and Oliva, 2005).

Research made by Riche *et al*. (2004) with *Oreochromis niloticus* reported that feeding three times a day resulted in a 84.7% feed efficiency which was higher in comparison with five times (49.4%) observation that may be related with the intestinal villi development stimulation. Moreover, it is important to understand that fish intestinal villous structure is quite similar to that of birds, these animals share the brush border over the luminal surface of the intestinal epithelium called microvilli (Gordon and Hecht, 2002) in addition they have similar folds (NRC, 1993).

On the other hand, the nutriments digestion, mainly proteins, generates substances which act as trophic factors of the gastrointestinal barrier (Zaiss *et al*., 2006) however, little information was found on the effect of the content of protein in the feed and its relationship with the somatic and small bowel structural development of *Oreochromis* (Al-Ahmad, 1988) .

MATERIALS AND METHODS

Ponds were built and located at a latice north 19°15', length west 104°04'; altitude of 900 m over the sea level. Weather was warm-humid with low humidity and mean annual temperature was 22°C, precipitation was 750 mm. Climate classification was Aw_0 and Aw_0 (w) according to Köpen.

Ponds were made of clay and measured; width 10×30 m long and 1.5 m in depth. The ponds were divided in 12 sections of 1 m^3 each, where 50 alevins were introduced for the study. The quality of the running water was monitored using the system Hidrolab® model 1990 and averaged; temperature of 26°C, oxygen content higher than 3 ppm and pH 6.6 to 7.5. Small PVC cages were made for each replicate which were submerged in the pond.

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Dietary treatments were 40 and 50% protein (4% fat and 5% crude fiber). Alevins were sampled (n = 10) at 10, 20, 40 and 60 days of age and the body weight and length were immediately determined. Jejunum was sampled for histological development of the absorptive surface using the hematoxilin-eosin technique. A Motic 356 microscope was used to measure the villi. Data were subject to variance analysis as repeated measurement using the SAS package, stablishing an alpha of 0.05 to declare differences among the age and protein level.

RESULTS AND DISCUSSION

The day 10 alevins fed with 40% protein had a mortality rate of 18%, meanwhile those fed with 50% protein level had a mortality of 9.2% ($p<0.05$), however age and protein level interaction was no detected ($p>0.05$).

The body weight of fishes (alevins- juveniles) averaged 29.3 and 15 mg for 40 and 50% protein, respectively ($p<0.05$), statistical effect of age were observed ($p<0.05$, Table 1). The parameter was not affected significantly by the interaction of age×protein level in the feed ($p>0.05$).

On the other hand the body length was 26.3 and 21.7 mm, for the 40 and 50% of protein in the ration, respectively ($p>0.05$) and with slight variation due to the age of the tilapia fingerlings ($p<0.05$). No significant interaction age×protein level was observed ($p>0.05$).

Villi length was 20% longer with the 50% protein in the feed ($p<0.05$) and such difference was maintained until day 20, then was slightly reduced with the age of the alevins. The first ten days the villi formation and gut surface started (Fig. 1). But, with the 40% protein in the feed the maturation was slower ($p<0.05$). At day 20 jejunum epithelia configuration was notably developed and the Goblet cell are present. However, with the 40% of feed protein the development has only reached 60% ($p<0.05$). On the other hand, at the day 60 alevins fed with 40% protein had 90% of the observed with 50% protein ($p>0.05$).

Table 1: Changes of fingerling (alevins) of Tilapia fed 2 levels of protein

	Age, days				
	10	20	30	40	60
Body weight, g					
40%	0.1±0.02a	0.30±0.08a	0.51±0.23a	2.26±1.46a	2.87±1.18a
50%	0.1±0.02a	0.15±0.11b	0.36±0.27a	1.98±0.98a	3.66±2.28a
Body length, cm					
40%	1.90±0.15a	2.60±0.31a	3.50±0.60a	5.00±1.00a	5.60±0.80a
50%	1.90±0.15a	2.17±0.48b	4.37±1.01b	4.85±0.79a	6.03±1.13a
Intestine villi length, μ					
40%	301.70±27	372.47±52	387.53±27	402.60±52	542.31±28
50%	364.00±29	475.30±53	427.60±32	379.90±80	546.90±37

[a-b]Different letter in the column means statistical difference among treatments ($p<0.05$)

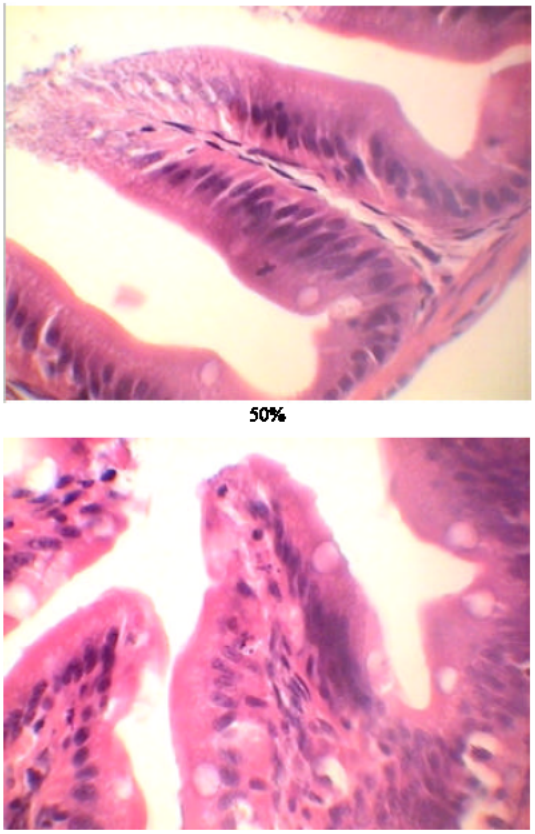

Fig. 1: Intestinal villi of tilapia alevins of 10 days of age fed 2 levels of protein

Frierson and Foltz (1992) comparing the absorptive surface of tilapia reported that it corresponder to the villi a 90% of the latter activity. Giri *et al.* (2003) using Clarias catfish observed an improvment of the fish development with the increasing of protein level in the feed.

CONCLUSION

In the present study it was found that, prior 30 days of age tilapia fingerlings need 50% of protein in the feed due to its relationship with body development and intestinal villi maturity. The latter would have a strong economical impact in intensive tilapia farms.

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