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Effect of Selected Diets on the Growth and Survival of Snakehead Fish (*Channa striatus*) Fry

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ABSTRACT

Twenty-five days feeding trial was conducted to evaluate the growth and survival of *Channa striatus* fry fed with three types of fresh foods (bloodworm, trash fish and *Acetes* shrimps). Ten fry were stocked in each aquarium (46×46×37 cm) and fed *ad libitum* twice a day (1000 and 1700 h). All treatments were triplicate. The fry fed trash fish showed a significantly ($p<0.05$) higher weight gain percentage (376.50±20.74%) than those fed with *Acetes* shrimp (233.05±10.18%) and bloodworm (199.08±17.25%). The final mean total lengths of fry fed with trash fish, bloodworm and *Acetes* shrimps were 7.91±0.23, 7.28±0.23 and 7.21±0.17 cm, respectively. Fry fed with trash fish also showed the best Specific Growth Rate (SGR) value (6.24±0.17% day^{-1}) followed by *Acetes* shrimp (4.81±0.12% day^{-1}) and bloodworm (4.33±0.22% day^{-1}). The best Food Conversion Ratio (FCR) value (3.63±0.27) was found among fish fed with trash fish compared to those fed *Acetes* shrimp (7.41±0.88) and bloodworm (11.48±1.51). It could be concluded that trash fish was an excellent feed for *C. striatus* fry in term of growth, weight gain and FCR.

Key words: Growth, weight gain, food conversion ratio, fry rearing, *Channa striatus*

INTRODUCTION

Striped murrel snakehead (*Channa striatus*) is a freshwater, carnivorous fish that belongs to the family Channidae. It can be found naturally in beels, haors, ponds, swamps and ditches (Sarowar *et al*., 2010). It is one of commercial important, freshwater fish, usually sold fresh in the markets and highly priced because of its good and delicate taste (Qin and Fast, 1998). The fish is also known for its high pharmaceutical value and for many decades have been used traditionally to reduce the post-natal and post-surgery pains (Mat Jais *et al*., 1994; Baie and Sheikh, 2000). The presence of fatty acids like prostaglandin and thromboxane contribute to hasten the recovery of wound and internal injuries (Yaakob and Ali, 1992). Polyunsaturated fatty acids can regulate prostaglandin synthesis and can influence the immune system (Bowman and Rand, 1980). Snakehead contains 17 fatty acids including a high amount of arachidonic acid (AA), a polyunsaturated omega-6 fatty acid which is important for internal and external healing (Mat Jais *et al*., 1994). Snakehead also has all the essential amino acids for wound healing, especially glycine, which is important for the formation of human skin collagen (Mat Jais *et al*., 1994).

C. striatus is an important commercial aquaculture fish in Thailand, Philippines, Cambodia and Vietnam (Wee, 1982) and makes up 13% of the marketable freshwater fishes in India

(Chakrabarty, 2006; Aliyu-Paiko *et al.*, 2010). Its high demand and market price make the species a good aquaculture candidate to culture (Sarowar *et al.*, 2010).

Proper domestication, fry feeding, rearing and culture technique of the species should be standardised to sustain culture operation of any fish species (Sarowar *et al.*, 2010). So far, there has been little information regarding the nutrition of *C. striatus* (Qin and Fast, 1997). Usually, fish farmers feed the snakehead with trash fish and cattle blood mixed with wheat flour or spent grains and rice bran (Wee, 1982; Victor and Akpocha, 1992). Most farmers in Thailand feed snakehead using trash fish mix with rice bran, vitamins and minerals and sometimes added with antibiotics during the first month (Boonyaratpalin *et al.*, 1985). Thus, this experiment was carried out to evaluate the different type of feeds (bloodworm, trash fish and *Acetes* shrimp) in term of acceptability, growth and survival rate of *C. striatus* fry.

MATERIALS AND METHODS

Tank set up: Wild *C. striatus* fry were collected from a stream in Ulu Langat, Selangor and 10 fry were stocked in each nine 46×46×37 cm aquaria. The experiment was located at the Wet Laboratory, Department of Aquaculture, Faculty of Agriculture, Universiti Putra Malaysia, Serdang, Selangor. All aquaria were connected to a centralized recirculating biofiltering system. Upper side of aquaria was covered properly with net to prevent fish from jumping out. The fry were acclimatized to the culture condition for 7 days prior to start the experiment. During this period, fry were fed with bloodworm twice a day *ad libitum*.

Experimental diets and feeding: Three types of diets, bloodworm, trash fish and *Acetes* shrimps were evaluated in this study. The trash fish and *Acetes* shrimps were chopped into 1 mm particle size. All the diet were kept frozen in the refrigerator and thawed before being fed to the fry. The chemical compositions of these diets are shown in Table 1.

Each treatment was randomly assigned to a tank and replicated three times. *Ad libitum* feeding was done twice per day at 1000 and 1700 h. Uneaten food were removed 30 min. after each feeding. At the end of the experiment, all fry were sacrificed and proximate analyses of the carcass were conducted.

Data collection: Water quality parameters were measured weekly. Fish were weekly sampled for growth performances of fish in terms of body weight (g) and total length (cm). Dead fish were removed and counted daily and the survival rate was calculated at the end of experiment. Survival rate, Specific Growth Rate (SGR), weight gain (%) and Food Convention Ratio (FCR) were calculated using the following formulae:

$$\text{Survival (\%)} = \frac{N_i - N_f}{N_i} \times 100$$

Table 1: Chemical composition of diet given to snakehead fry on dry matter basis

Treatments	Moisture (%)	Protein (%)	Lipid (%)	Fiber (%)	Ash (%)
Bloodworm	88.80	68.93	3.93	0.50	5.29
Trash fish	72.77	77.20	2.77	0.25	4.80
Acetes shrimp	74.78	66.68	4.01	3.04	4.98

Where:
N_i = Initial total number of fry
N_f = Total number of larvae at the end of experiment

$$\text{SGR (\% day}^{-1}) = \frac{100\ (\text{In } W_2 - \text{In } W_1)}{T}$$

Where:
W_1 = Initial weight of fry
W_2 = Final weight of fry
T = Time in days

$$\text{Weight gain (\%)} = \frac{\text{Final weight} - \text{Initial weight}}{\text{Initial weight}} \times 100$$

$$\text{Food conversion ratio (FCR)} = \frac{\text{Wet feed intake (g)}}{\text{Wet weight gain (g)}}$$

$$\text{Protein efficiency ratio (PER)} = \frac{\text{Wet weight gain (g)}}{\text{Total protein intake}}$$

Statistical analysis: All data were subjected to one way analysis of variance (ANOVA) using SPSS software version 11.5 and differences between treatment used in the experiment were compared using Duncan's multiple range test at $p<0.05$ level of significance. All percentage data were arcsine transformed prior the analysis.

RESULTS

Water quality parameters measured throughout the experimental period are summarized in Table 2. Dissolved oxygen (DO) ranged from 3.63 to 3.78 mg L^{-1}. The pH values were very stable and ranged from 6.50 to 6.52. Water temperature also remained stable throughout the experiment and ranged from 29.73 to 29.76°C. Ammonia levels ranged between 1.69 to 1.75 ppm. The water quality parameters in aquaria between treatments showed no significant difference since the aquaria were connected to a centralized recirculation system.

Growth performances of *Channa striatus* fry fed with selected diets are presented in Table 3, Fig. 1 and 2. Initial mean body weights and total lengths among *C. striatus* fry were similar and showed no significant differences ($p<0.05$) between the treatments used. After 25 days of feeding, the final mean weight of *C. striatus* fry fed with trash fish (4.63±0.41 g) was significantly higher ($p<0.05$) higher than those fed with bloodworm (3.12±0.19 g) and *Acetes* shrimps (3.19±0.26 g). Final mean total length of fry fed with trash fish was also

Table 2: Water quality parameters recorded in treatment aquaria containing *Channa striatus* fry fed with selected diets for 25 days

Diets	DO (mg L^{-1})	pH	Temperature (°C)	NH_3-N (ppm.)
Bloodworm	3.78 ± 0.16^a	6.50 ± 0.02^a	29.75 ± 0.22^a	1.69 ± 0.17^a
Trash fish	3.71 ± 0.15^a	6.52 ± 0.02^a	29.73 ± 0.23^a	1.75 ± 0.13^a
Acetes shrimps	3.63 ± 0.10^a	6.50 ± 0.03^a	29.76 ± 0.22^a	1.75 ± 0.13^a

Values (Mean±SE) means with same superscript in the same column are not significantly different at $p>0.05$

Table 3: Growth and survival of *Channa striatus* fry fed with different diet for 25 days

Treatment	Initial mean weight (g)	Final mean weight (g)	Initial mean length (cm)	Final mean length (cm)	Weight gain (%)	SGR (% day^{-1})	Survival rate (%)	FCR	PER
Bloodworm	1.05±0.07[a]	3.12±0.19[b]	5.07±0.13[a]	7.28±0.15[a,b]	199.08±17.25[b]	4.33±0.22[b]	98.67±0.91[a]	11.48±1.51[a]	0.16±0.01[c]
Trash fish	0.98±0.10[a]	4.63±0.41[a]	4.93±0.16[a]	7.91±0.23[a]	376.50±20.74[a]	6.24±0.17[a]	97.33±1.53[a]	3.63±0.27[c]	0.38±0.01[a]
Acetes shrimp	0.96±0.08[a]	3.19±0.26[b]	4.91±0.06[a]	7.21±0.17[b]	233.05±10.18[b]	4.81±0.12[b]	93.33±3.19[a]	7.41±0.88[b]	0.26± 0.00[b]

Values (Mean±SE) within the same column followed by different superscript are significantly different at p<0.05

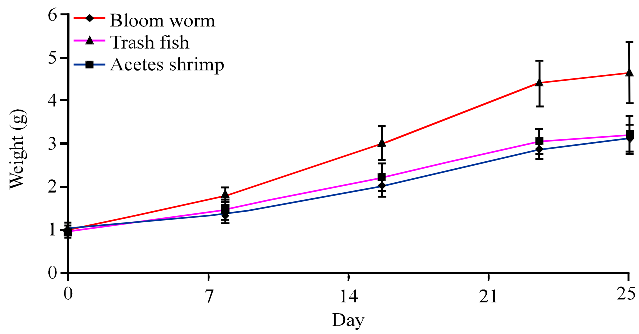

Fig. 1: Body weight of *Channa striatus* fry fed with selected diets for 25 days

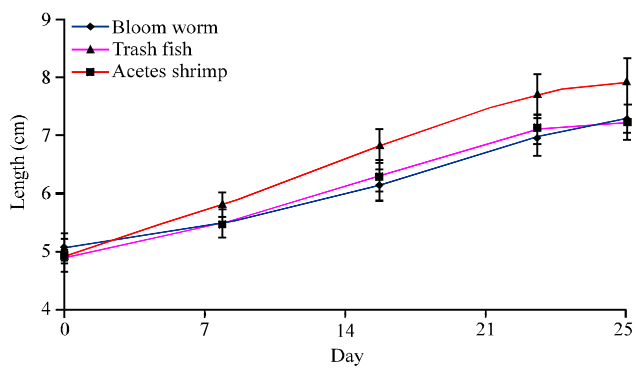

Fig. 2: Total length of *Channa striatus* fry fed with selected diets for 25 days

significantly higher (7.91±0.23 cm) than fry fed with *Acetes* shrimps. However, fry fed with bloodworm exhibited no significant difference (7.28±0.15 cm) in final mean length to those with trash fish and *Acetes* shrimps. No significant difference (p>0.05) with regard to weight gain among fry fed with bloodworm (199.08±17.25%) and *Acetes* shrimps (233.05±10.18%) were observed. However, there was a significantly higher gain (376.50±20.74%) in weight of fry fed with trash fish compared with the two other treatments. Fry fed with trash fish showed the best SGR value (6.24±0.17% day^{-1}) followed by those fed with *Acetes* shrimps (4.81±0.12% day^{-1}) and bloodworm (4.33±0.22% day^{-1}).

The result indicated no significant differences (p>0.05) in survival among all treatments. The best FCR (p<0.05) was observed in fry fed with trash fish (3.63±0.27), followed by fry fed with *Acetes* shrimps (7.41±0.88) and bloodworm (11.48±1.51). A similar trend was also observed in PER.

Proximate composition in terms of moisture, crude protein, crude lipid, fiber and ash content of *C. striatus* fry fed with the selected diet are presented in Table 4. The highest percentage of moisture was measured in bloodworm (74.22±0.04%) followed by trash fish (74.03±0.08%) and

Table 4: Carcass composition (dry matter basis) of snakehead *C. striatus* fry fed with three selected diets

Treatments	Moisture (%)	Protein (%)	Lipid (%)	Fiber (%)	Ash (%)
Bloodworm	74.22±0.04^{a}	78.64±0.32^{a}	8.26±0.11^{a}	0.76±0.01^{a}	6.78±0.08^{a}
Trash fish	74.03±0.08^{b}	74.18±0.83^{b}	4.90±0.29^{c}	0.45±0.02^{a}	5.39±0.25^{b}
Acetes shrimps	72.23±0.08^{c}	72.66±0.17^{b}	5.99±0.07^{a}	2.07±0.77^{a}	5.42±0.06^{b}

Values (Mean±SE) with different superscript in the same column are significantly different at $p<0.05$

Acetes shrimps (72.23±0.08%). The lowest protein was noticed in the fry fed with *Acetes* shrimps (72.66±0.17%) followed by trash fish (74.18±0.83%) and bloodworm (78.64±0.32%). Fry fed with bloodworm has significantly higher ($p<0.05$) lipid (8.26±0.11%) than other treatments. There were some variation but insignificant in the fiber content of fry fed with the experimental diets. Ash content was found the highest in fry fed with bloodworm (6.78%).

Channa striatus fry accepted all test diets and fry seemed sluggish and rested for sometime at the bottom of aquaria after each meal.

DISCUSSION

The dissolved oxygen level in the rearing water was quite low because the aquaria was not supply with continuously aeration since the *C. striatus* fry are tended to jump out with aeration. However the aquaria was suppled with a slow flowing water and connected to a centralized recirculating biofiltering system. Rahim *et al.* (2009) stated that *C. striatus* can live in the poor water quality up to 2.62 mg L^{-1} of dissolved oxygen. The ammonia level was high due to use of frozen live food. Besides the biofiltering system did not work as efficiently. As desired *C. striatus* can stand harsh environment with low dissolved oxygen and high ammonia (Ng and Lim, 1990; Qin *et al.*, 1997).

Composition showed that dietary protein did not effect the protein content of *C. striatus*. Bloodworms that contained 68.93% of protein gave the highest body protein value in the *C. striatus* fry compared with two other diets. This was due to the highest digestibility of bloodworm. Sugden (1973) stated that bloodworm has 73.6% digestibility. Body liquid increased with an increase in dietary lipid. Similarly a higher dietary fiber led to higher fiber in fish tissue.

This study showed that diet can significantly influence the growth performance of *C. striatus* fry. Diets can affect the feed ingestion and assimilation of fish. The highest growth performance in term of final mean weight, weight gain percentage and specific growth rate were recorded in fry fed with trash fish followed by *Acetes indicus* and bloodworm. Sarowar *et al.* (2010) found that live tubificid worms contribute higher weight and length growth of *C. striatus* fry compared to fry fed with silver carp fry and artificial feed. Kumar *et al.* (2008) concluded that the best live feed for growth and survival of *C. striatus* larvae is mosquito-standardised bloodworm or chironomid larvae when compared to bloodworm and plankton. Chironomid larvae are one of the most important live foods for pike perch and carps (Steffens, 1960; Shim, 1988). Ronyai and Ruttkay (1990) have successfully carried out an experiment on larval rearing of European catfish (*Silurus glanis*) fed *Chironomus* and *Tubifex*. Degani (1991) reported that live food can speed the growth of juvenile *Trichogaster trichopterus* compare to a formulated feed as live food contains a high consumption rate, palatability and good chemical composition. In the present experiment, frozen bloodworm has been used instead of live ones. This could have significantly affected its contributions towards fish growth.

Food conversion ratio (FCR) and protein efficiency ratio (PER) are important in estimating feed efficiency and cost since protein play major cost of most prepared feeds. The protein fraction should be optimally utilized on protein synthesis instead of energy for fish movement. The knowledge of the optimal level of protein and protein-sparing effects of non-protein source can assist farmers in reducing feed cost (Shiau, 1997). The best FCR and PER were recorded in fry fed with trash fish followed by *Acetes* shrimps and bloodworm. Trash fish can't contribute to lower feeding cost in snakehead culture since feed cost accounts for more than half of the total variable operating cost in aquaculture (Jantrarotai and Jantrarotai, 1993). In Thailand, farmers fed the snakehead with trash fish and cattle blood mixed with wheat flour or spent grains and rice bran (Wee, 1982; Boonyaratpalin *et al*., 1985; Victor and Akpocha, 1992) in order to speed growth of snakehead and minimise feed cost.

CONCLUSION

Trash fish was a recommended feed for *Channa striatus* compared to bloodworm and *Acetes* shrimps.

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REFERENCES

Aliyu-Paiko, M., R. Hashim and A.C. Shu-Chien, 2010. Influence of dietary lipid/protein ratio on survival, growth, body indices and digestive lipase activity in snakehead (*Channa striatus*, Bloch, 1793) fry reared in re-circulating water system. Aquacult. Nutr., 16: 466-474.

Baie, S.H. and K.A. Sheikh, 2000. The wound healing properties of *Channa striatus*-cetrimide cream- tensile strength measurement. J. Ethnopharmacol., 71: 93-100.

Boonyaratpalin, M., E.W. McCoy and T. Chittapalapong, 1985. Snakehead culture and its socio-economics in Thailand. Annual Report, Fisheries and Aquaculture Department, Thailand.

Bowman, W.C. and M.J. Rand, 1980. Textbook of Pharmacology. 2nd Edn., Blackwell Scientific Publications, Oxford, UK.

Chakrabarty, N.M., 2006. Murrels and Murrel Culture. Narendra Publishing House, Delhi, India, Pages: 12.

Degani, G., 1991. The effect of diet, population density and temperature on growth of larvae and juvenile *Trichogaster trichopterus* (Bloch and Schneider 1901). J. Aqua. Trop., 6: 135-141.

Jantrarotai, W. and P. Jantrarotai, 1993. On-Farm Feed Preparation and Feeding Strategies for Catfish and Snakehead. In: Farm-Made Aquafeeds, New, M.B., A.G.J. Tacon and I. Csaves (Eds.). FAO-RAPA/AADCP, Bangkok, Thailand, pp: 101-119.

Kumar, D., K. Marimuthu, M.A. Haniffa and T.A. Sethuramalingam, 2008. Effect of different live feed on growth and survival of striped murrel *Channa striatus* larvae. E.U. J. Fish. Aquatic Sci., 25: 105-110.

Mat Jais, A.M., R. McCullock and K. Croft, 1994. Fatty acid and amino acid composition in Haruan as a potential role in wound healing. Gen. Pharmacol., 25: 947-950.

Ng, P.K.L. and K.K.P. Lim, 1990. Snakeheads (Pisces: Channidae): Natural History, Biology and Economic Importance. In: Essays in Zoology: Papers Commemorating the 40th Anniversary of the Department of Zoology, National University of Singapore, Chou, L.M. and K.L.P. Ng (Eds.). Department of Zoology, National University of Dingapore, Singapore, pp: 127-152.

Qin, J. And A.W. Fast, 1997. Food selection and growth of young Snakehead *Channa striatus*. J. Appl. Ichthyol., 13: 21-25.

Qin, J.G. and A.W. Fast, 1998. Effects of temperature, size and density on culture performance of snakehead, *Channa striatus* (Bloch), fed formulated feed. Aquacult. Res., 29: 299-303.

Qin, J.G., A.W. Fast, D. DeAnda and R.P. Weidenbach, 1997. Growth and survival of larval snakehead *Channa striatus*, fed different diets. Aquaculture, 148: 105-113.

Rahim, M.H.A., A. Rozila and A.M. Mat Jais, 2009. The physical-chemical and morphological study of haruan *Channa striatus* in Peninsular Malaysia. Res. Biol. Sci., 4: 994-1009.

Ronyai, A. and A. Ruttkay, 1990. Growth and food utilization of wels fry (Silurus glanis) fed with *Tubifex*. Aquacult. Hung. (Szarvas), 6: 193-202.

Sarowar, M.N., M.Z.H. Jewel, M.A. Sayeed and M.F.A. Mollah, 2010. Impact of different diets on growth and survival of *Channa striatus* fry. Int. J. Biol. Res., 1: 8-12.

Shiau, S.Y., 1997. Utilization of carbohydrate in warmwater fish-with particular reference to tilapia, *Oreochromis niloticus*×*O. aureus*. Aquaculture, 151: 79-96.

Shim, K.F., 1988. By-Product Utilization in Live Food Culture for Tropical Aquarium Fish. In: Fish Nutrition Research in Asia, De Silva, S.S. (Eds.). Heinemann Asia, Singapore, pp: 42-47.

Steffens, W., 1960. Ernahrung und wathstum des jungen zanders (Lucioperca: Lucioperca) in teichen. Z. Fur Fischerei, 9: 161-272.

Sugden, L.G., 1973. Feeding ecology of pintail, gadwall, American wigeon and lesser scaup ducklings. Can. Wildl. Serv. Rep., 24: 44-44.

Victor, R. and B.O. Akpocha, 1992. The biology of snakehead, *Channa obscura* (Gunther), in a Nigerian pond under monoculture. Aquaculture, 101: 17-24.

Wee, K.L., 1982. The Biology and Culture of Snakeheads. In: Recent Advances in Aquaculture, Muir, J.F. and R.J. Robberts (Eds.). Westview Press, Boulder, CO, USA., pp: 181-213.

Yaakob, W.A.A. and A.B. Ali, 1992. Simple method for backyard production of snakehead (*Channa striata* Bloch) fry. Naga, 15: 22-23.