

Effects of Artificial Diet and Vitamins on Growth and Survival of Snakehead (*Channa striatus* Fowler)

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ABSTRACT

The experiment was conducted to study survival rate and growth of snakehead fry fed on artificial diet (0211-85 SNF) of 42% protein compared to fish flesh (with and without vitamins premix) generally used in fish farms. Snakehead larva of about 10 days old were stocked in aerated tanks at the stocking rate of 285 fry per tank. The fry were fed ground fish flesh (62.2% protein), ground fish flesh + vitamins premix, ground fish flesh + vitamins premix for 7 days followed by artificial diet (0211-85 SNF) and artificial diet (0211-85 SNF) alone for 45 days. It appeared that both artificial diet and fish flesh followed by artificial diet gave higher survival rates (54.73 and 60.69% respectively) after the first two weeks of feeding but the survival rates decreased rapidly afterward. Fish fry fed on fish flesh + vitamins premix gave the best survival rate (37.54%) at the end of the experiment whereas fish flesh alone showed extremely low survival rate (3.51%). Growth of the fry fed 4 types of feed showed nonsignificant difference after 15 days of rearing but after 30 and 45 days the group of fry fed on fish flesh + vitamins premix yielded the best growth and differed significantly from other groups of fry. The conclusion was drawn, however, that neither the artificial feed (0211-85 SNF) nor fish flesh is suitable for snakehead fry as their first feed. Palatability and digestibility of the artificial diet should be improved in order to get better survival rate.

INTRODUCTION

Culture of snakehead in Thailand has been widely practised for some 20 years in all regions, predominantly in the central part of the country. Estimate made in 1982 by the Department of Fisheries, Ministry of Agriculture and Cooperatives, indicated annual culture production of 5656.74 tons which were valued at 191,887,610 baht (Department of Fisheries, 1984). Although it has been widely cultured and produced the highest value of production, fish farmers are still dependent on the natural fry. The collected fry are stocked in nylon net cages floated in ponds. They are fed ground trash fish plus a small amount of rice bran. Since

they are stocked in high stocking density and fed low quality feed, survival rate is generally low and obtained fingerlings are of low quality. Thus, artificial diet is looked for in order to solve not only the problems mentioned above but also those of feed unavailability in some part of the country as well as the homogeneity of feed quality.

The purpose of the work described here was to compare the effect of artificial diet and that of fish flesh which was widely used by farmers on growth and survival of snakehead fry. In order to ensure the effects of vitamins deficiency, fish flesh + vitamins premix was also included in the experiments.

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MATERIALS AND METHODS

Larva of snakehead fish obtained from breeding pond were stocked in five-hundred-litre tanks with 60 cm. water level. They were fed live food, *Moina sp.* for 8 days and then transferred to eight tanks at a stocking rate of 285 fry per tank. Each treatment was assigned to each experimental unit according to Randomized Complete Block Design with 2 replications: unexposed (R_1) and exposed (R_2) to sunlight due to the area available in the hatchery. Air was supplied continuously to every tank. At the beginning of the experiment feed was gradually changed from live food to experimental feed within 3 days. The initial weight and total length of fry were 0.021 gm and 1.02 cm. respectively. The experiment was assigned for 4 treatments as follows:

Treatment 1—Ground fish flesh plus 5% dicalcium phosphate was fed to the fish twice daily. Feed was placed in a small tray hanging in water at the depth of about 20 cm.

Treatment 2—Ground fish flesh plus 5% dicalcium phosphate and 1% vitamins premix (Table 1) was fed to the fry as was described in treatment 1.

Treatment 3—Fry were fed ground fish flesh as described in treatment 2 for 7 days and fed crumble artificial feed (0211-85 SNF) of 42% protein (Table 1, 2, 3) for the rest of the experimental period. Changing of feed was gradually made within 3 days. The artificial feed was fed 3 times daily.

Treatment 4—Artificial feed used in treatment 3 was fed to the fry with the same ration.

For every treatment fry were fed voluntarily. Excess feed was removed daily in the evening. Seventy percent of water was changed every morning before feeding time. Water quality was measured weekly before changing

Table 1 Vitamins premix used in the experiment. (in 1 ton of feed)

Vitamin B ₁	20	grams
Vitamin B ₂	20	grams
Vitamin K ₃	10	grams
Pyridoxal pyrophosphate	20	grams
Niacin	100	grams
Folic acid	5	grams
Vitamin E	50	grams
Vitamin C	100	grams
Biotin	5	grams
Cyanocobalamine	0.002	grams
Panthenic acid	50	grams
Vitamin A D ₃	1,500,000	I.U.

Table 2 Composition of ingredients used in the artificial feed (0211-85 SNF)

Fish meal	70	kgs
Saybean meal	7	kgs
Skimmed milk	5	kgs
Meat and bone meal	5	kgs
Binder	5	kgs
Seed oil	8	kgs
Antibiotic	1	kgs
Total	101	kgs

of water. The fry were treated with Piperazine (0.4% in feed) to kill internal parasites on the 31st day of experiment.

Every 15 days the fry from each tank were counted for survival rate and 25 fry randomly taken from each tank were measured for weight and total length.

Table 3 Nutrient contents of artificial feed (0211-85 SNF) and ground fish flesh + vitamins premix and optimum value for snakehead fry

Diets	Nutrient Content (% dry weight)				
	Moisture	Protein	Fat	Calcium	Phosphorus
Artificial feed (0211-85 SNF)	7.6	42.0	11.6	4.99	2.4
Fish flesh + vit. premix	5.4	62.2	5.83	3.56	2.8
Optimum value for snakehead fry		42 ^{1/}	6 ^{2/}		

1 Boonyaratpalin, 1980.

2 Boonyaratpalin, 1983.

RESULTS

Survival rates, body weight and length of fry after 15 days of rearing (Table 4, 5 and 6) were not significantly different for all treatments. However, fish solely fed artificial feed and fish fed fish flesh for 7 days followed by artificial feed seemed to have higher survival rates (60.69% and 54.73% respectively) due to better dispersion of feed. Mean survival rates and body weight of fry between the two replicates were significantly different. The fry in the tanks which were exposed to sunlight showed better growth and survival rates. Difference of water temperature between replicates ($R_1 = 26.32^\circ\text{C}$; $R_2 = 27.82^\circ\text{C}$) might be the cause of the differences mentioned above.

After 30 days of rearing the fry fed fish flesh + vitamins premix yielded the highest survival rate (40.35%) although it was not significantly different from that of the other treatments. The fry solely fed artificial feed and those fed fish flesh for 7 days before transfer to artificial feed yielded very similar survival rate; 20.87% and 25.78% respectively and these survival values showed no statistical difference from the very low survival rate (8.06%) of the fish fed fish flesh. Besides low survival rate, fry in the latter group showed signs of vitamins

deficiency namely, poor appetite, pale body and slow growth (National Research Council, 1977). Average weight and length of the fry fed solely on fish flesh + vitamins premix for 30 days were significantly higher than the other 3 fish groups whose average weights showed non-significant difference whereas significant difference was shown statistically among their average length.

Survival rate of the fry fed fish flesh + vitamins premix over 45 days (37.54%) was significantly higher than the fish group fed fish flesh for 7 days (14.91%) and those fed artificial feed (10.17%). Fish flesh without vitamins premix yielded extremely low survival rate (3.51%). Average weight and length of the fry fed fish flesh + vitamins premix were high and showed significant difference when compared to the other groups of fry.

DISCUSSION

In this experiment fish flesh + vitamins premix appeared to be the best feed for snakehead fry, although survival rate was not appreciable. Great mortality occurred during the first 15 days of the experiment. This was due to the paste form of feed which can not be reached thoroughly. However, survival rate of this group of fry

Table 4 Survival rate (%) of snakehead fry fed fish flesh, fish flesh + vitamins premix, fish flesh + vitamins premix for 7 days followed by artificial feed and artificial feed alone for 15, 30 and 45 days.

Diets	15 days	30 days	45 days
Fish flesh	45.78 ^a	8.06 ^a	3.51 ^a
Fish flesh + vit. premix	47.01 ^a	40.35 ^a	37.54 ^b
Fish flesh + vit. premix (7 days) followed by artificial feed (0211-85 SNF)	54.73 ^a	25.78 ^a	14.91 ^c
Artificial feed (0211-85 SNF)	60.69 ^a	20.87 ^a	10.17 ^c

Note : Means with the same superscript are not significantly different

Table 5 Body weight (gm.) of snakehead fry fed fish flesh, fish flesh + vitamins premix, fish flesh + vitamins premix for 7 days followed by artificial feed and artificial feed alone for 15, 30 and 45 days.

Diets	15 days	30 days	45 days
Fish flesh	0.048 ^a	0.139 ^a	0.522 ^a
Fish flesh + vit. premix	0.055 ^a	0.593 ^b	1.249 ^b
Fish flesh + vit. premix (7 days) followed by artificial feed (0211-85 SNF)	0.056 ^a	0.220 ^a	0.414 ^a
Artificial feed (0211-85 SNF)	0.045 ^a	0.139 ^a	0.396 ^a

Note : Means with the same superscript are not significantly different

Table 6 Body length (cm.) of snakehead fry fed fish flesh, fish flesh + vitamins premix, fish flesh + vitamins premix for 7 days followed by artificial feed and artificial feed alone for 15, 30 and 45 days.

Diets	15 days	30 days	45 days
Fish flesh	1.72 ^a	2.17 ^a	3.33 ^a
Fish flesh + vit. premix	1.79 ^a	3.80 ^b	5.16 ^b
Fish flesh + vit. premix (7 days) followed by artificial feed (0211-85 SNF)	1.74 ^a	2.77 ^c	3.46 ^a
Artificial feed (0211-85 SNF)	1.61 ^a	2.33 ^a	3.32 ^a

Note : Means with the same superscript are not significantly different

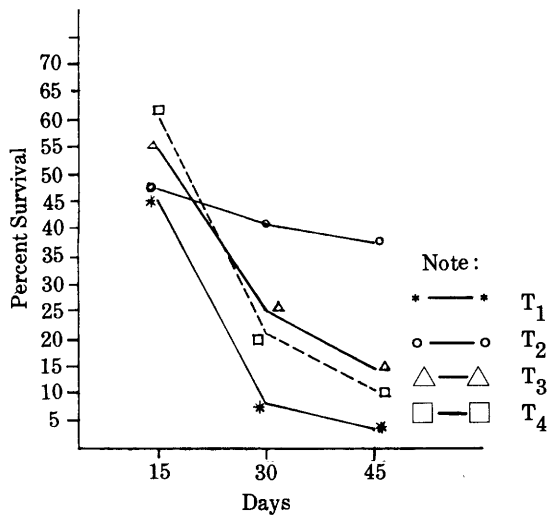


Figure 1 Survival rate (%) of snakehead fry fed fish flesh (T₁), fish flesh + vitamins premix (T₂), fish flesh + vitamins premix (7 days) followed by artificial feed (T₃) and artificial feed alone (T₄) for 15, 30 and 45 days.

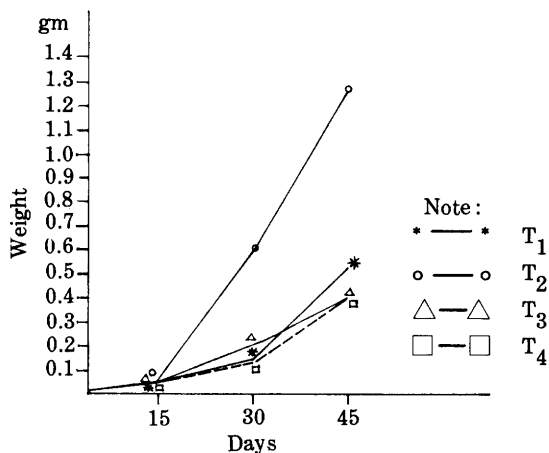


Figure 2 Body weight (gm.) of snakehead fry fed fish flesh (T₁), fish flesh + vitamins premix (T₂), fish flesh + vitamins premix (7 days) followed by artificial feed (T₃) and artificial feed alone (T₄) for 15, 30 and 45 days.

decreased very slowly during the last 30 days of the experiment. Higher contents of protein (62.20%), needed vitamins and preferable flavor and odor in fish flesh might be the reason for

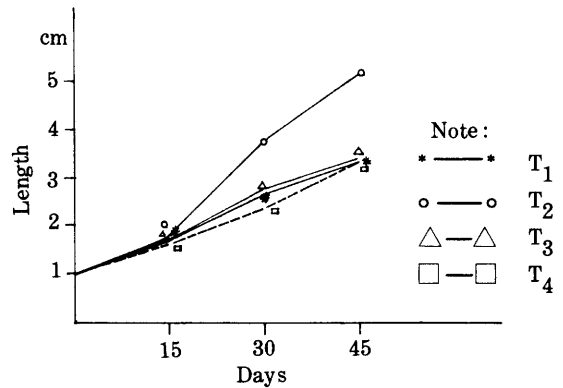


Figure 3 Body length (cm.) of snakehead fry fed fish flesh (T₁), fish flesh + vitamins premix (T₂), fish flesh + vitamins premix (7 days) followed by artificial feed (T₃) and artificial feed alone (T₄) for 15, 30 and 45 days.

those higher survival and growth rates after 45 days. Artificial feed yielded high survival rate in the first period but decreased rapidly afterward. Although its protein content was in the optimum range for snakehead fry (Boonyaratpalin, 1980), but it might be unpalatable for the fry. The use of excessive heat during processing of artificial feed could also lower nutritional value of the feed (National Research Council, 1977).

Feeding fish fry with fish flesh for 7 days before transfer to artificial feed did not improve growth and survival rate of the fry. The conclusion was drawn that neither fish flesh nor artificial feed was suitable for snakehead fry as their first supplemental feed. However, form of feed was also important during the first period of rearing.

The effect of vitamins deficiency on survival rate and growth was clearly shown after 15 days of rearing (Figure 1, 2, 3) for the group of fry fed fish flesh without vitamins premix. However, the so call "adaptation weight", weight of the fry first fed artificial feed, should be considered in order to improve survival rate and growth of snakehead fry as was reported

in 4 cyprinids by Dabrowski (1984).

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