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Supplementing Artificial Diets for Catfish (*Clarias macrocephalus*) Fry with *Tubifex*

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ABSTRAK

Fri ikan keli (Clarias macrocephalus) *yang berumur tiga minggu diberi makanan uji pada paras protein 30% dan 35% serbuk ikan dominan serta 35% dan 40% kacang soya dominan selama 8 minggu. Sembilan rawatan telah diuji di mana empat rawatan diberi makanan uji sahaja, satu diberi* Tubifex *sahaja (kawalan) dan selebih empat lagi diberi Tubifex diikuti dengan makanan uji. Fri yang diberi makanan tambahan* Tubifex *makan lebih aktif dan menujukkan kadar pertumbuhan dan kecekapan pemakanan yang baik dibandingkan dengan makanan uji sahaja. Di antara rawatan yang menerima makanan* Tubifex, *makanan 30% dan 35% serbuk ikan dominan menunjukkan pertumbuhan dan penggunaan makanan yang paling bererti.*

ABSTRACT

Three-week-old catfish (Clarias macrocephalus) *fry were fed exprimental diets at protein levels of 30% and 35% fish meal dominant and 35% and 40% soybean dominant types for 8 weeks. Nine treatments were tested with four treatment consisting wholly of experimental diets, one of* Tubifex (*control) and the remaining four diets supplemented with live* Tubifex. *Fish reared on experimental diets supplemented with live* Tubifex *fed more actively and showed better growth and feed efficiency than those reared without supplemented diets. Those on the 30% and 35% fish meal dominant feed showed significantly better growth and feed conversion than those fed 35% 40% soybean dominant diet.*

Keywords: Artificial diets, Catfish fry, Tubifex

INTRODUCTION

Intensive culture of catfish (*Clarias macrocephalus*) in Malaysia in recent years is the result of higher demand and good market prices offered for this fish (FAMA, 1990). However, limited fry production due to poor survival has made it necessary to improve hatchery techniques and upgrade nutritional qualities of diets for fry and fingerlings.

The nutritional requirements of several species of catfish such as *Clarias gariepinus* (Henken *et al.* 1986) and *Clarias batracus* (Chuapoehuk, 1987) have been determined in previos studies. This information has been used to formulate low cost feeds utilizing local ingredients. However, among the problems encountered when these ingredients (especially those of plant origin) were used, were inconsistensies in quality and digestibility of the diet; and the unattractive feeds, although the nutritional requirements were satisfied. Thus various ingredients such as lumbricid worms (Tacon *et al.* 1983) krill, silkworm pupae powder, etc. (Akiyama *et al.* 1984) have been incorporated into fish feeds to act as feed attractants or feeding stimulants. This work investigates the feasibility of using *Tubifex* worms as a feed attractant and appetite stimulant for catfish (*Clarias macrocephalus*) fry.

MATERIALS AND METHODS

Four experimental diets containing 30%, 35% and 40% protein levels of varying proportions of animal and plant protein were prepared by mixing the feed ingredients and pelletised with an extruder. The percentage composition and nutrient levels of the diets are presented in Table 1. The diet preparations were on based earlier feeding studies (Hashim and Ali, 1989) Diets 1 and 2 contained 30% and 35% protein respectively, at a ratio of 2:1 animal to plant protein i.e. fish meal to soybean meal. Diets 3 and 4 contained 35% and 40% protein respectively, at a ratio of 2:1 plant to animal protein (soybean to fish meal). Diet 5, (control), consisted wholly

TABLE 1
Formulation and proximate composition of the experimental diets (% by dry weight) for *Clarias macrocephalus* fry

Component	Diet				
	1	2	3	4	*Tubifex*
Ingredient					
Fish Meal	40.49	47.23	23.62	26.98	
Soybean Meal	17.39	20.28	48.20	55.07	
Broken Rice	8.93	10.40	5.22	5.94	
Wheat Flour	28.49	18.09	14.16	3.91	
Crude Palm Oil	4.5	3.8	8.6	7.9	
Vitamin Mix[1]	0.10	0.10	0.10	0.10	
Mineral Mix[1]	0.10	0.10	0.10	0.10	
Proximate analysis					
Moisture	7.0	9.1	8.3	8.3	-
Crude Protein	29.4	36.2	35.4	39.8	69.8
Crude lipid	11.5	12.1	11.9	11.0	3.8
Ash	13.1	14.0	11.8	12.8	8.3
N. F. E.[2]	39.0	28.6	32.6	28.1	18.1
Gross energy[3] (kcal/g)	432.8	435.7	445.2	443.8	506.4

[1]Recommended by the National Research Council (1983).
[2]N.F.E. = Nitrogen Free Extract (100 - [moisture + crude protein + crude lipid + ash])
[3]Based on 5.7 kcal/g protein; 9.5 kcal/g lipid and 4.0 kcal/g carbohydrate

of live *Tubifex*. The *Tubifex* was treated with 20 ppm formalin for 10 to 15 minutes and washed thoroughly with tap water prior to feeding to avoid the introduction of pathogens and parasites normally associated with live natural food (Uys and Hecht, 1985).

Catfish fry were obtained by induced spawning using human chorionic gonadotropin (Mollah and Tan, 1983) at the laboratory in the School of Biological Sciences. Forty-five 40-liter aquariums were then randomly stocked with 20 fry (average weight 0.1g) at 5 replicates per treatment. The water exchange was maintained at a rate of 0.5 1/min and all tanks were aerated. Throughout the feeding trial the temperature, pH and dissolved oxygen were maintained at between 27.9 - 31.7°C, 7.16 - 7.74 and 5.1 - 6.8 mg/l, respectively. The fry in treatmentas A - D were fed only the experimental diets 1 - 4 respectively, whereas those in Treatment E with *Tubifex* only. In treatments F - I, the fry were fed *Tubifex* in the morning at a feeding level of 2% body weight before experimental diets. In all the nine treatments, the fry were fed to satiation three times daily according to the prescribed diets.

At the end of 8-week feeding trial, the fish were weighed and the relative growth rate, feed conversion ratio, protein efficiency ratio and survival rate were determined. The differences in the parameters for each treatment means were tested by Analysis of Variance (Anova) followed by the Duncan's Multiple Range Test (Steel and Torrie, 1960).

RESULTS AND DICUSSION

Fry fed with *Tubifex* alone (Treatment E) and those supplemented with *Tubifex* in the morning followed by the experimental diets (Treatments F - 1) fed more actively from the beginning of the feeding trial compared with fry maintained entirely on the respective experimental diets (Treatments A to D). The optimal growth of *Clarias macrocephalus* fry obtained at 30% - 40% protein is consistent with previous studies (Hashim and Ali 1989, Chuapoehuk, 1987). A significantly higher growth rate and improved feed conversion were observed among fry fed on diets supplemented with *Tubifex*, indicating that the poorer growth performance of the fry fed solely with the experimental diets (Diets 1 - 4

could be improved by supplemental feeding with *Tubifex*. The poorer growth rate and feed conversion of these fry could be attributed to the poor digestibility and assimilation of the diet (Wilson *et al.* 1981) or its unattractiveness. Several studies have been conducted to improve the acceptability and feed consumption of experimental diets. Recently, Lovshin and Rushing (1989) used feed attractants, also known as gustatory additives, in pelleted diets which showed improved diet acceptance for largemouth bass fingerlings. Oligochaetes such as earthworms have also been know to contain food attractants for catfish, *Ameiurus nebulosus* (Olmsted, 1981). Sugars such as glucose and sucrose in cat (Rabin *et al.* 1976) and chum salmon fry (Akiyama *et al.* 1982) feeds have been reported to act as appetite stimulants. However, the improvement in feeding activity for the experimental diets after a morning feed of *Tubifex* observed in this experiment, suggests that the *Tubifex* not only contains food attractants but it also stimulates the fry appetite for the test diets.

The data obtained from this feeding trial is summarised in Table 2. Mortalities throughout the feeding trial for all treatments were negligible except for the fry maintained entirely on *Tubifex* (Treatment E). It is likely that the nutrients present in the live *Tubifex* were insufficient to sustain the fry over the feeding trial period. No significant difference in growth and feed conversion ratio was obtained when the fry were fed the experimental diet alone. This indicates that either fish meal or soybean meal can be used as the dominant protein source when experimental diets are used alone. Our study shows that, supplementing the experimental diets with a small amount of *Tubifex* (at 2% body weight) resulted in fry having a significantly higher relative growth compared to those maintained on *Tubifex* alone or on experimental diets alone. Fry maintained on the supplement 35% fish meal dominant diet (Treatment G) showed the highest improved relative growth rate (780.8%) but this was not significantly different from that of Treatment F (683.6%) where the diet was supplemented by 30% fish meal. This observation suggests that when *Tubifex* is used to supplement fish meal dominant diets, a 30% instead of 35% protien feed is sufficient for optimal growth. Tacon *et al.* (1983) reported that partial replacement of a commercial rainbow trout diet with frozen lumbricid worms resulted in growth and feed efficiency that were similar to those associated with the commercial feed. No difference was observed in this study probably because freezing reduces the nutritive quality of some natural feeds and hence are unsuitable for the fish (Grabner *et al.* 1981). However, the significant improvement in growth and feed efficiency observed in the supplementary feeding regime could be attributed to the fact that live

TABLE 2
Effects of the dietary treatments on relative growth rate (RGR), feed conversion ratio (FCR), protien efficiency ratio (PER) and survival rates on catfish (*Clarias macrocephalus*) fry.

Treatment	Diet (% protein)	RGR (%)	FCR	PER	SR (%)
A	1 (30%)	141.6a	2.43a	1.50a	98.8a
B	2 (35%)	120.4a	2.37a	1.35a	99.0a
C	3 (35%)	110.1a	2.99a	1.07b	90.0a
D	4 (40%)	189.6a	3.06a	0.88b	97.9a
E	Tubifex	284.4b	2.24a,b	0.90b	60.0b
*F	1(30%) + Tubifex	683.6c	1.31c	1.51a	97.6a
*G	2(35%) + Tubifex	780.8c	1.24c	1.63a	97.2a
*H	3(35%) + Tubifex	314.8b	1.75b	1.71a	97.4a
I*	4(40%) + Tubifex	460.0d	1.66b	1.31a,b	97.0a

Means in columns with the same superscripts are not significantly different ($P < 0.05$)
* Supplementation with Tubifex at 2% body weight.
RGR = Final wt. - Initial wt./Initial wt. X 100
FCR = Total dry feed fed (g) + Total Tubifex (dry matter)/Total wet weight gain (g)
PER = Wet weight gain (g)/Amount of protein fed (g)

unprocessed *Tubifex* retained its nutritive qualities, its feed stimulants and was an attractant. However, Akiyama *et al.* (1984) observed that the incorporation of various processed ingredients such as krill meal, earthworm powder, glucose, etc, to replace 5% of fish meal in experimental diets was able to improve the growth and feed efficiency of chum salmon fry.

CONCLUSION

This study indicates that supplementation of artificial diets with live *Tubifex* at 2% body weight can effectively promote growth and feed conversion efficiency of the *Clarias macrocephalus* fry. This type of feeding regime is a practical and economic propositon since it requires only treatment of the *Tubifex* with formalin prior to feeding at no extra cost; and the abundance of this natural feed in this region ensures a suitable source for supplemental diet for *Clarias macrocephalus* fry production.

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