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Effect of brood source on the growth of rohu (*Labeo rohita* Ham.) fingerlings reared in glass tanks with formulated diets

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Abstract

A 60 day long feeding trial was conducted in an indoor static water system with rohu fingerings (*Labeo rohita* Ham.) originating from wild brood, private and public hatcheries (*denoted as A, B and C respectively).* They were fed on formulated diet having 34% crude protein level using indigenous ingredients. The effect of brood source on growth as well as their responses to formulated diet were observed . On the basis of the observed growth rate, food conversion ratio, protein efficiency ratio, apparent net protein utilization and apparent protein digestibility, fingerling source A showed significantly ($p<0.05$) higher growth, while the sources B and C produced no significantly different ($p>0.05$) in terms of these parameters. The results of the present study demonstrated that the fingerlings of wild source was of best quality in terms of growth and food utilization in comparison to those had the sources from hatcheries.

Key words : *L. rohita,* Fingerlings, Formulated diets

Introduction

The spawn fry or fingerlings of rohu fish (*Labeo rohita* Ham.) one of the most popular cultivable fast growing, non predacious species, are to be collected either from wild source or through making the reproduce in captivity as they do not breed naturally in ponds. The difficulties inherent in the former method are associated with the success of natural spawning but due to various man made and environmental changes the availability of fish seeds in the wild is being affected resulting in a phenomenal growth in number of hatcheries both in public and private sectors. But the hatchery population may be subjected to inbreeding, so the chances of bottleneck effects will be vary common in the hatchery population because of the small size of the brood. The two processes

in combination can very quickly damage a population by loosing genetic variability, lowering production performance and increasing production cost.

Recently other trends have been observed within the hatcheries belonging to the private sectors. Persons having no or little technological knowledge want early and good returns of their investment which leads them towards the mal-practice of inducing immature undersized broods by means of introducing overdoses of pituitary and human chorionic gonadotropin (HCG) hormones. Thus the fingerlings produced are believed to be of inferior quality.

Therefore, the main aim of this study was to assess if there is any effect on the nutritional uptake of fingerlings from different brood sources like wild, public and private hatcheries.

Materials and methods

Experimental fish and acclimation

The experiment was conducted for 60 days from 15 August to 15 October '95 in the laboratory of the Fisheries Technology, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh with rohu (*Labeo rohita*) fingerlings of three different brood sources. Wild fingerlings had source from the old Brahmaputra river were collected from Shutiakhali village of Mymensingh district (denoted as **A**). In this case, local fishermen collected the wild spawn of *L. rohita* from the river Brahmaputra and reared them in local pond at Sutiakhali. When these fish fingerlings became about 3 months old (about 35 to 38g size) they were collected for the experiment. The possible size of wild brood fish of these spawn/fingerlings was not known.

For other group of fish from private hatchery, fingerlings were collected from Puliamari Aquaculture Farm, situated at Shambhuganj of Mymensingh district (denoted as **B**). The broods used in this case were collected from the brood stock of the farm which had their source through artificial reproduction and the spawns were also artificially propagated from under-size brood (1.5 to 2.0 kg) of the farm. In this case, age of the experimental fish was estimated about three months. However, the under-sized brood fish had good health.

The third group of the experimental fish fingerlings had the source from the Fisheries Research Institute (FRI) hatchery of the same district (denoted as **C**). In this case the weight of the healthy brood ranged between 3.0 to 4.0 kg. In this case the broods were used from the brood stock pond of Fisheries Research Institute. The probable origin of this brood fish was from the river Halda of Chittagong. The fingerlings used from this source were also about three months old and had an average size between 35 and 38g. After prophylactic treatment with table salt and 0.5mg/l methylene blue the fingerlings were subjected to acclimation for two weeks in three separate 80 cm diameter plastic pools with 100 Litre water (stocking rate @ 1 fish/l) having continuous aeration. During this

period, they were given semi-purified pelleted diet containing 30% crude protein as maintenance ration.

Formulation and preparation of diets

Fish meal, mustard oil cake, duck weed and rice bran were used as feed ingredients. After proximate analysis (by the method as was followed by AOAC 1980) of each of the ingredients a diet was prepared by adjusting these ingredients in such a way to obtain 34% dietary crude protein level (Table 1). Wheat flour was used as binder as well as source of carbohydrate while "Embavit fish" premix" (Rhone Poulenc, Dhaka) was used for vitamin and minerals supplement. 0.5% chromic oxide was used also in the diet for the digestibility study.

Table 1. Proximate composition of dietary ingredients and experimental diet (% dry wt. basis)

	Components			
Ingredients	Crude protein	Crude lipid	Ash	NFE*
Fish meal	55.30	18.32	26.53	0.25
Duck weed	21.23	3.94	23.22	51.61
Mustard oil-cake	40.12	11.27	9.98	38.63
Wheat flour	12.60	3.50	1.40	82.50
Rice bran	14.17	12.30	17.97	55.56
Experimental diet	33.92	7.83	18.70	39.55

NFE = Nitrogen free extract as calculated as : 100 - %(moisture + Crude protein + Crude lipid + Ash)

Experimental procedure

The experiment was conducted with 9 glass aquaria (45 x 25 X 30cm each) containing 30 litres of water with adaquate supply of aeration to maintain saturated level of oxygen in each aquarium. A triplicate group of 12 uniform sized fish from each of the three treatment groups A, B and C were randomly selected for the feeding trials. The mean initial weight of all fish in the triplicates was 36.80 $\pm$ 0.54g. The experimental feeding regime was started after 24 hours of transferring the fish to the glass aquaria and was as follows: the fish were fed at satiation level daily for 60 days at regular intervals and amount of feed was recorded for subsequent calculation for various growth parameters.

Water from each aquarium was partially changed with clean stored aerated water every morning before feeding. Routine monitoring of dissolved oxygen

(DO), pH and temperature was done by using DO meter (Check mate, Mettler-Toledo Ltd, U.K.) every 10th day before sampling. For digestibility study, any uneaten food or faeces were removed from each aquarium 30 minutes after last feeding by a siphoning technique followed by collection of faeces on the subsequent morning.

Post experimental analysis

All dietary ingredients, diet, faeces and initial and final fish samples were analysed for the determination of moisture, ash, lipid, protein etc. according to the method followed by Association of Official Analytical Chemists (AOAC, 1980). Data collected during the feeding trial and subsequent proximate analysis were used for the determination of various growth parameters. Simple Analysis of variance (ANOVA) was employed to observe the effect of brood source on the growth of fish fingerlings followed by Duncan's New Multiple Range test to identity the level of significance (5%) among the treatment means.

Results and discussion

Proximate composition of experimental diets

The proximate composition of experimental diet is shown in Table 2. Singh *et al.* (1978) found better conversion efficiency of rohu fed on a diet containing 29.5% crude protein level, while Jayaram (1978) observed best growth with a diet having 35% protein level. Therefore selection of 34% dietary protein in this study was based on previous studies for a good growth response in subsequent feeding trials.

Table 2. Formulation of the experimental diet

Ingredients	% dry weight (in gram)
Fish meal	35.0
Duck weed	22.0
Mustard oil-cake	17.5
Wheat flour	5.0
Rice bran	18.0
*Embavit premix	2.0
Chromic oxide	0.5
Total	100.0

Embavit premix = Vitamin & mineral premix, Rhone poulenc, Dhaka, Bangladesh

Water quality

Physico-chemical parameters of the water used in aquaria were routinely monitored and the ranges were: Temperature 25.8 - 28^{O}C; pH 6.6 - 7.3 and dissolved oxygen 4.4 - 6.5 mg/l. The amount of ammonia was not measured because the water of each aquarium was replaced partially everyday.

Acceptability of the diet

Response of the fish groups to the formulated diet was judged by a subjective behavioural assessment. The fish became adjusted to the experimental diet within the first two or three days and no marked differences between the acceptability of the diet of the fish groups were observed. No mortality was observed in any of the treatment groups during the experimental period.

Growth and food utilization

The effect of fingerlings sources on their growth and food utilization are summarized in Table 3. The highest growth was obtained with fish group A (wild source) followed by C (public hatchery) and B (private hatchery) respectively. However, statistically no significant ($p>0.05$) differences were observed between the fish groups B and C. The highest growth of fish originating from a wild brood has also been reported for silver carp (Vdovichek and Selivanova 1984) and seabass juvenile (Melloti *et al.* 1993). In the present study the specific growth rate (SGR) ranged from 1.13 to 1.33, with source A producing significantly ($P<0.01$) the highest SGR.

The FCR in the present study varied from 1.79 to 2.16 (Table 3) with significantly ($p<0.05$) lower FCR values for fish source A . A significantly ($p<0.05$) higher FCR value for fish source B in this study indicates that the fingerlings originating from the private hatcheries are not efficient converters of supplementary fish to flesh which results in increased production cost. This indication is also supported by the fact that the protein efficiency ratio (PER) of the present study followed this same trend as with FCR ranging from 1.36 to 1.63 (Table 3) with significantly ($p<0.05$) the highest PER produced by fish source A followed by C and B respectively. This may be due to the fact that the fish originating from the wild brood can utilize the dietary nutrients better, maximizing the use of each meal as unlike in the hatcheries a regular food supply is not guaranteed in the wild.

Significant differences ($p<0.01$) between the apparent net protein utilization (ANPU) values of fish sources A and B and that of A and C were observed while the values for B and C showed no significant ($p>0.05$) difference. This can be explained from the fact that the amount of dietary protein for fish is determined not only by the requirements for its maintenance and growth, but also by its utilization capacity for this purpose. From the above statement it is

clear that the protein utilization capacity of fish of wild origin is high. Because the relationship between anabolic capacity as rate of protein synthesis and growth potential in a number of species is dependent on the genetic strain which tells that protein synthesis displayed by individuals of rapidly growing strains can be greater than recorded for individuals from slow growing strain (Jobling, 1994).

Table 3. Summary of growth parameters of rohu fish (*L.rohita*) collected from different brood sources fed on formulated diet for 60 days

Treatment groups	Growth parameters								
	Initial wt (g)	Final wt (g)	Weight gain (g)	Weight gain(%)	SGR (%day)	FCR	PER	ANPU %	AOD %
A (Wild brood)	37.07^{a} (±0.10)	82.19^{a} (±1.46)	45.12^{a}	121.27^{a}	1.33^{a} (±0.06)	1.79^{a} ±0.09)	1.63^{a} (±0.08)	27.98^{a} (±0.16)	84.54^{a} (±0.05)
B Private hatchery	37.01^{a} (±0.08)	72.93^{b} (±0.46)	35.92^{b}	97.05^{b}	1.13^{b} (±0.02)	2.16^{b} (±0.03)	1.36^{b} (±0.01)	23.72^{b} (±0.31)	82.04^{b} (±0.84)
C Public hatchery	36.38^{a} (±0.04)	73.54^{b} (±0.65)	37.16^{b}	102.14^{b}	1.17^{b} (±0.02)	1.99^{C} (±0.02)	1.47^{C} (±0.01)	24.29^{b} (±0.21)	82.40^{b} (±0.19)

Figures in the same column having the same superscripts are not significantly different (P>0.05) from each other

Fish group A showed significantly ($p<0.05$) the highest apparent protein digestibility (APD) value while no significant ($p>0.05$) difference was observed between the APD values of B and C. APD values in this study was slightly lower than that of Jayaram and Shetty (1980) who reported a protein digestibility of 91.89% in rohu fish. Fish meal used in this study was prepared by grinding marine fishes of mixed origin in which the non-protein nitrogen content could be fairly high. This might have contributed to the lower protein digestibility of fish meal based diet in the present study. The findings of the present study clearly reveals that fingerlings originated from wild brood (A) are able to digest supplementary protein to the maximum thereby producing the highest yield.

Initially no significant ($p>0.05$) differences among the proximate composition of the fingerling sources were observed (Table 4). Source A significantly ($p<0.05$) produced the highest protein (17.59) and lowest moisture content (75.63%) whilst source C produced significantly ($p<0.05$) the lowest protein (16.82%) and the highest moisture content (76.13%). However, final lipid content of the treatment groups showed no significant ($p>0.05$) difference due to the differences in their brood origin (Table 4).

Table 4. Initial and final carcass composition of experimental fishes (% fresh matter basis)

Parameters	Initial			Final		
	A	B	C	A	B	C
Moisture	80.16	80.23	80.28	75.63	76.13	76.01
Crude protein	12.80	12.70	12.63	17.59	16.82	16.97
Crude lipid	2.98	2.95	2.99	3.14	3.30	3.22
Ash	3.45	3.44	3.48	3.56	3.63	3.59
NFE*	0.61	0.68	0.62	0.08	0.12	0.21

* *NFE = 100 - %(Moisture + Crude protein + Crude lipid + Ash)*

The results of the present study indicate that fingerlings of the wild origin are of superior quality in terms of of growth and food utilization in comparison to those originating from hatcheries. This may be due to the fact that the hatchery operators do not maintain large populations of quality brood stock to keep the population abated from inbreeding and genetic drift. To determine this further investigation on genetic and histopathological condition of fingerlings of different brood origin should be carried out.

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