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A Nursery Feed for Indian Major Carps (*Labeo rohita*) and its Evaluation in Farmer's Field

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ABSTRACT

Realizing the importance of carp feed for its nursery phase, the Fish Nutrition and Physiology Division of ICAR- Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar has been working since last three years and has developed a nursery feed for carp which ensured better survival, growth and palatability. The feed was prepared from maize, soybean meal, rice bran, groundnut oil cake, fish meal, oil, minerals and vitamin mixture by extrusion technology and then crumbled into suitable size for feeding the carp fry. The prepared feed was evaluated through demonstration experiments in different locations of Odisha in Government fish farm and farmer's ponds following standard protocols. The evaluation was done in terms of growth, feed efficiency and survivability with existing feed commonly used by the farmers of the region. Result of this experiment showed that, the fish fed with developed nursery feed had 1.5 to 2 times higher growth performance, 25% higher survivability and better feed efficiency compared to the feed which is used by most of the farmers of this region.

Keywords*:* Carps, Extrusion, FCR, Growth performance, Nursery feed

INTRODUCTION

Nursery phase is one of most critical phase in the production of stockable seed materials in carp culture. Generally, it is observed that the recovery of spawn to fry and fry to fingerling is around 25-30% and 40-50%, respectively in farmers' practice. Nutrition plays a vital role in growth and survival of the carp in nursery rearing. Non-availability of quality feed is one of the major reasons for the poor survival and growth making the nursery rearing of carp less remunerative. Realizing the importance of carp feed for its nursery phase, the Fish Nutrition and Physiology Division of ICAR-CIFA, Bhubaneswar has been working since last three years and has developed a nursery feed (Carp starter) for carp which ensures better survival and growth.

Extrusion technology is gaining importance for production of fish feed for Indian Major Carp. Extrusion process improves nutrient digestibility, palatability, pellet durability, water stability and pellet storage life (Barrows and Hardy, 2000). It also increases *in vivo* digestibility of dry matter (DM) and energy of feed in rainbow trout *Oncorhynchus mykiss* (Cheng and Hardy, 2003). Good quality feed containing til oil cake could be produced through extrusion technology by maintaining extrusion temp of 130°C and moisture of 20% (Das *et al.,* 2018). The nursery feed for carp (Carp starter) was produced from maize, soybean meal, rice bran, groundnut oil cake, fish meal, oil, minerals and vitamin mixture by extrusion and then crumbled into suitable size for feeding the fry. This feed is nutritious and highly palatable. It has been tested at indoor facilities and demonstrated multi-locationally in Government fish farm and farmer's pond. In this experiment, Carp starter produced through extrusion technology was evaluated in terms of growth, feed efficiency and survivability with existing feed commonly used by the farmers of the region.

MATERIALS AND METHODS

A fish feed for carp fry was formulated using high quality locally available feed ingredients *i.e.* maize, soyabean meal, groundnut oil cake (GNOC), fish meal and de-oiled rice bran (DORB) with supplementation of minerals and vitamin mixture. The ingredients were pulverised, mixed, extruded and then dried. The extruded and dried feed was then ground into suitable size, packaged and stored for feeding the fish (Fig. 1). The

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Fig. 1. Carp Starter after preparation for carp fry

feeds were produced in the feed mill facilities of ICAR-CIFA, Bhubaneswar, India with extrusion temperatures of 130°C and moisture of 20% maintaining constant pressure (10 kg/cm^2). After production of extruded feed, it was packaged for easy transportation to the experimental site. The feed was then analysed for chemical characteristics to ascertain the quality of the feed (Table 1). Developed nursery feed was then compared with a feed (control feed) which is normally used by most of the farmers of this region. A control feed was also prepared after mixing GNOC and rice bran in 1: 1 ratio and then grinded properly into powder form as it is the standard practices of feeding carp fry in many places of India including Odisha.

The chemical parameters *i.e.* DM, crude protein (CP), ether extract (EE), crude fibre (CF), nitrogen free extract (NFE) and total ash were analysed for quality evaluation (AOAC, 2012). DM was estimated by oven drying the samples at 105°C till a constant weight and CP content was calculated by estimating nitrogen content by micro-Kjeldahl method and multiplying with a factor 6.25. EE was determined by solvent extraction with petroleum ether, boiling point 40–60°C, for 10–12 h. Total ash content was determined by incinerating the sample at 650 °C for 6 h and CF was determined by acid digestion (1.25%) followed by alkali digestion (1.25%).

Demonstration experiment was simultaneously conducted in five location of Odisha *i.e.* state fishery farm, Keonjhar; College of Fisheries, Rangailunda (OUAT), Berhampur; KVK, OUAT, Ranital, Bhadrak; ICAR-CIFA, Bhubaneswar and Sahu Fish Farm, Subarnapur, Gop, Puri.

Pond preparation was done in all the five places for demonstration experiment. Before stocking the fish, all the ponds were dried and bleaching powder (30% active chlorine) was applied at 300 kg ha^{-1} to eradicate the unwanted predatory and weed fishes. Lime was applied at 1000 kg ha^{-1}. After 7 days of lime application, the water was filled up to 1.0 m depth and ponds were fertilized with raw cow dung, urea and bleaching powder at 3.0 ton ha^{-1}, 40.0 kg ha^{-1} and 60.0 kg ha^{-1}, respectively (ICAR 2009).

Table 1. Chemical characteristics of nursery feed (Carp Starter)

Parameters	% on DM basis
Moisture	7.5
Crude Protein (CP)	35.58
Crude Fibre (CF)	4.62
Total Ash	10.74
Ether Extract (EE)	6.10
Nitrogen Free Extract (NFE)	42.96
Energy (kcal/g)	3.61

Rohu fry (average weight 0.5 gm) were either procured from CIFA Farm, Bhubaneswar, India or purchased from the local market for stocking in the respective pond sites. Carp fry were stocked randomly into triplicate ponds (each 130×60 ft) for both control and treatment following a completely randomized design and were stocked @ 1 lakh/ acre. The fish of control ponds were fed with GNOC and rice bran (1:1 ratio) as it is the standard practices of rearing fry in many places of India including Odisha. The fish of treatment ponds were fed with carp starter to compare the performance with fish of control ponds. Both

Fig. 2. Rohu fry after feeding with Carp Starter for one month

treatment and control fish were fed at the rate of 10% of body weight (BW) for 2 weeks followed by 5 % of BW for another 2 weeks. Sampling of fish was done in fortnightly interval to regulate the feeding requirement and to estimate the average BW and biomass of fish in each pond (Fig. 2). The experiment was continued for one month.

The data of the experiment were statistically analyzed by using computer software (GraphPad PRISM 2007).

RESULTS AND DISCUSSION

The chemical characteristics of nursery feed (Carp Starter) used in the experiment is presented in Table 1. The feed contained 35.58% protein, 6.10% fat and 4.62 % CF and size of feed particles varied from 0.4 to 0.5 mm. The chemical characteristics showed that, it is a very good feed for carp fry.

The growth performance of *L. rohita* fry fed with different test diets in different locations of Odisha like Keonjhar, Bhadrak, Bhubaneswar, Berhampore and Gop

Table 2. Growth performance of L. rohita fry fed with different diets in Odisha

Locality	Parameters	Control	Carp Starter	P value	SEM
Keonjhar	Initial weight (g)	0.30	0.30	-	-
	Final weight (g)	3.36 ^{a}	4.72 ^{b}	0.0001	0.3069
	Weight gain (g)	3.06 ^{a}	4.42 ^{b}	0.0001	0.3069
	SGR (% day^{-1})	8.77 ^{a}	12.27 ^{b}	<0.0001	0.7877
	FCR (Apparent)	2.46 ^{a}	1.26 ^{b}	0.0002	0.2717
	Survival (%)	63 ^{a}	87 ^{b}	0.0114	5.888
Bhadrak	Initial weight (g/fish)	0.75	0.75	-	-
	Final weight (g/fish)	2.53 ^{a}	6.00 ^{b}	0.0042	0.8188
	Weight gain (g/fish)	1.78 ^{a}	5.25 ^{b}	0.0042	0.8188
	Survival (%)	53.0 ^{a}	82.0 ^{b}	0.0056	6.913
	FCR (Apparent)	2.10 ^{a}	1.69 ^{b}	0.0371	0.1094
Bhubaneswar	Initial weight (g/fish)	0.93	0.93	-	-
	Final weight (g/fish)	5.07 ^{a}	6.12 ^{b}	0.0135	0.2598
	Weight gain (g/fish)	4.14 ^{a}	5.19 ^{b}	0.0135	0.2598
	SGR (% day $^{-1}$)	4.8 ^{a}	5.3 ^{b}	0.0376	0.1335
	Survival (%)	80 ^{a}	95 ^{b}	0.0086	2.422
	FCR (Apparent)	1.57 ^{a}	1.24 ^{b}	0.0014	0.076
Berhampore	Initial weight (g/fish)	0.7	0.7	-	-
	Final weight (g/fish)	1.45 ^{a}	3.68 ^{b}	0.0001	0.5008
	Weight gain (g/fish)	0.75 ^{a}	2.98 ^{b}	0.0001	0.5008
	SGR (% day -1)	2.43	5.53	0.0376	0.1335
	Survival (%)	75 ^{a}	94 ^{b}	0.0004	4.394
	FCR (Apparent)	3.43 ^{a}	1.5 ^{b}	0.0001	0.4349
Gop	Initial weight (g/fish)	0.5	0.5	-	-
	Final weight (g/fish)	3.37 ^{a}	5.60 ^{b}	0.0001	0.5016
	Weight gain (g/fish)	2.87 ^{a}	5.10 ^{b}	0.0001	0.5016
	SGR (% day^{-1})	6.36	8.05	0.0376	0.1335
	Survival (%)	71 ^{a}	95 ^{b}	0.0001	5.241
	FCR (Apparent)	2.45 ^{a}	1.5 ^{b}	0.0004	0.2045

Means with different superscripts in a row differ significantly (P<0.01).

is presented in table 2. The initial average weight of fry was 0.63 g (varied from 0.3 g to 0.93 g) in both control and treatment groups and attained 3.15 g (varied from 1.45 g to 5.07 g) in control group and 5.22 g (varied from 3.68 g to 6.12 g) in treatment groups after 30 days of feeding trial. The weight gain in all the feeding experiments were significantly higher in treatment groups compared to control groups. The specific growth ratio (SGR) were also significantly higher in treatment group compared to control group of fish and is indicated in table. Similarly, feed conversion ratio (FCR) of fish fed on carp starter was significantly superior ($P<0.05$) compared to fish fed on control feed. The growth performance of fish during the experiment showed that the growth rate of fish in Keonjhar, Bhadrak, Bhubaneswar, Berhampore and Gop was higher than control group of fish fed with ground nut oilcake and rice bran. There was an average increase of 1.5 to 2 times of weight gain fed with carp starter compared to control feed.

Nursery feed (carp starter) was developed by extrusion process in the feed mill of ICAR-CIFA, higher feed utilization by extrusion process may be responsible for improved growth and survival of carp fry (Das *et al.,* 2018). Extrusion is the process in which the feed material is pushed through the barrel by means of screws of different configurations and pressed through the die at the end of barrel. The basic concept of extrusion process is high temperature, short time, whereby the high temperature is a direct result of friction or pre-conditioning and steam injection or a combination of both (Levic, 2010). Extrusion technology has been used in the feed industry for almost one century (Hardy and Barrows, 2000) and it has become popular for aqua feed production (FMT, 2005) as extruded pelleted feed reduces the feed wastage and improve the over all growth performane of fish.

The survival percentage of fish fed on carp starter was higher compared to fish fed on control feed. The survival percentage in control group of fish was 68 percentage (53 -80 percent) where as survivability in treatment group of fish was 90.6 percent (82 - 95 percent). Survivability of carp fry is an important parameters as generally, it is observed in the farmers practice that recovery of spawn to fry and fry to fingerling is around 25-30% and 40-50%, respectively. Nutrition plays a vital role on growth and survival in nursery rearing of the carp. Non-availability of quality feed is one of the reasons for the poor survival and growth making the nursery rearing of carp less remunerative. Though planktons are available in natural rearing process, it is not sufficient to meet nutritional requirement of all nursery carps. In our experiment, survivability of fish in different experimental stations varied from 82 to 95 percent with an average of 90.6 percent. Availability of nutrition rich carp starter along with natural planktons are prime factors for improving survival of carp fry.

Carp starter as used in this experiment contained many feed ingredients like maize, soyabean meal, groundnut oil cake (GNOC), fish meal and de-oiled rice bran (DORB). Supplementation of many feed ingredients in the production of fish feed improve the keeping quality of feed compared to two or three feed ingredients as has been observed by Das *et al.* (2016). There may be balancing of amino acids like methionine, lysine and arginine in carp starter produced from soyabean meal, ground nut cake and fish meal compared to feed of control group. This might be due to better utilization of protein in Carp starter compared to control feed. It has been reported that the feed prepared by using more than one protein sources always resulted in better growth of fish due to proper balancing of amino acids (Djissou *et al.,* 2016; Gaylord *et al.,* 2017). This showed that, carp starter had better growth performance as compared to control feed. The palatability of feed was higher in carp starter compared to control feed as observed during feeding time. Use of fish meal/fish oil in carp starter might have increased palatability of feed as observed by many workers. This indicated that, carp starter is a very high quality feed and may be provided to carp fry for higher growth performance and survivability.

CONCLUSION

Result of this experiment showed that, the fish fed with developed nursery feed had 1.5 to 2 times higher growth performance, 25% higher survivability and better feed efficiency compared to the feed which is used by most of the farmers of this region. Thus, the carp starter developed at Fish Nutrition and Physiology Division of ICAR- Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar could be used at farm level as an efficient nursery feed for carp which would ensure better survival and growth.

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REFERENCES

AOAC. 2012. *Official Methods of Analysis. A*ssociation of Official Analytical Chemists International(19th ed.), Gaithersburg, MD, USA*: Association of Official Analytical Chemists.*

Barrows, F.T. and Hardy, R.W. 2000. Feed Manufacturing Technology. In: Stickney RR, editor. Encyclopedia of aquaculture. New York: Wiley, p. 354-9.

BIS. 2018. *The National Standard Body of India for Fish Feed.* Bureau of Indian Standards.

Cheng, Z. J. and Hardy, R. W. 2003. Effects of extrusion processing of feed ingredients on apparent digestibility coefficients of nutrients for rainbow trout (*Oncorhynchus mykiss*). *Aquacult. Nutr*. 9: 77-83.

Das, K.C., Toppo, S., Mohanty, T., Pradhan, C., Mohanta, K.N. and Giri, S.S. 2016. Cost effective floating feeds for Indian Major Carps (IMC) by replacement of soyabean meal with alternative feed ingredients. *Indian J. Anim. Res*. 50: 526-528.

Das, K.C., Mohanta, K.N., Nayak, S.K., Mohanty T., Toppo, S. and Swain, P. 2018. Effect of Extrusion Temperature on Quality of Carp Floating Feed Prepared from Local Feed Resources. *Anim.Nutr. Feed Technol.* 18: 117-123.

Djissou, A.S.M., Vodounnou, J.V., Tossavi, C.E., Toguyeni, A., Fiogbe, E.D. 2016. Complete replacement of fish meal by unconventional proteins sources in diet of *Oreochromis niloticus* (L.,1758) fingerlings: growth performance, feed utilization and body composition. *Int. J. Fish Aquacult. Std*. 4: 242-247.

AFIA. 2005. *Feed Manufacturing Technology V*. American Feed Industry Association, Inc., 15001 Wilson Blvd., Suite 1100, Arlington, VA 22209.

Gaylord, T.G*.,* Sealey, W.M*.,* Barrows, F.T*.,* Myrick, C.A. and Fornshell, G. *2017.* Evaluation of ingredient combinations from differing origins (fishmeal, terrestrial animal and plants) and two different formulated nutrient targets on rainbow trout growth and production efficiency. *Aquacult. Nutr.* 23: 1319-1328.

Hardy, R.W. and Barrows, F.T. 2000. Diet formulation and manufacturing In: Halver JE, Hardy RW (Eds.), *Fish Nutrition*, 3rd edition. Academic Press Inc, New York, N.Y, pp. 506-600.

ICAR. 2009. Grow out carp culture. *In: Aquaculture Technologies for Farmers (*Jena, JK*,* Das PC*,* Das BK*,* Mohapatra BC*,* Sarangi N*,* Modayil MJ*.,* Vass KK*.,* Ravichandra P*,* Ponniah AG*,* Syda Rao S*,* Eknath AE *&* Ayyappan S *eds), pp.* 17-22*. Indian Council of Agricultural Research,* New Delhi, India*.*

Levic J. 2010. *Thematic proceedings of 2nd workshop on "Extrusion Technology in feed and food processing", I*nternational Feed Industry Federation, Edited by Institut for Food Technology Bulevar cara Lazara 1, 21000 Novi Sad.

Muyang Group 2009. R&D Center, No.1, Muyang Road, Hanjiang Industrial Park Yangzhou Jiangsu 225127 China.

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