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A study on growth performance and survivability of *Ompok pabda* (Hamilton 1822) fingerlings in earthen pond fed with different feed ingredients

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Abstract
An experiment of one and half month was conducted to perceive the growth performance and survivability of *Ompok pabda* (Hamilton, 1822) fingerlings in earthen pond fed with different feed ingredients. These were four distinct types of feed ingredients with different percent of protein content in rice bran (RB) 14%, mustard oil cake (MOC) 30%, Floating feed (FF) 32% and fish meal (FM) 45% respectively. These all feed stuffs are formulated as EF-I (RB+MOC), EF-II (RB+FF) and EF-III (RB+FM) Three experimental ponds with uniform sizes of rectangular earthen ponds (20 × 10 × 1.5) meters with triplicate replication was conducted. *Ompok pabda* experiment was started with few old days' fingerling having an average weight and length of (1.609 gm) and (6.85cm) respectively. 70 fishes were initially stocked. The highest gain in weight P3C (9.20gm), P1C (6.70gm) & P2C (5.40gm), Length P1C (9.8cm), (P3C 8.8cm) & (P2 8.6cm), Average Daily Weight Gain P3C(0.175), P1C (0.692) & P2C (0.062), Specific Growth Rate P3C (2.102), P1C (1.731) & P21 (1.114), and Survivability of fishes P1C (97%), P3B (82%) & P3A (97%) And lowest Food Conversion Rate after experiment was P3B (0.488), P1C (0.692) & P2C (1.378) respectively. Beside this, the water quality parameters showed most of the fluctuations in phosphate level in water as compared to pH, Ammonia, Temperature, Dissolve oxygen and others. The result implies that fish has better growth performance and survivability with EF-III firstly and secondly in EF-I as compare to EF-II respectively.

Keywords: *Ompok pabda*, Experimental feed (EF), Pond numbers, Survivability

1. Introduction
Aquaculture is a productively growing sector in our country and Indian aquaculture has a vast potential to culture more fisheries in future. India is a country which is drastically improving their fisheries [growth] year by year. Whole world predicted demand for fish and fishery product is 183 million tonnes by end of 2016 and it is expected that 73% will come from aquaculture (FAO, 2004) [7]. The national fish requirement will be 12 mt in 2020 expected· *Ompok pabda* is freshwater catfish belonging to family Siluridae and of the order Siluriformes (Hamilton, 1822) [4]. *Ompok pabda* body is elongated and laterally compressed with dorsal-ventrally flattened head. Snout rounded and two pair of barbells present. Superior mouth with lower jaw, O. pabda caudal fin is forked with rounded lobes and pectoral fin with smooth spines (Talwar and Jhingran 1991) [7]. *Ompok pabda* is a patamodromous catfish and feeding habit is carnivorous.Non-air-breathing catfishes can be well suited to normal pond environment. *O. pabda* culture is going on strongly in Northeast states (Assam and Tripura) West Bengal and Bihar also. It attains a length of 17cm and geographically distribution of pabda in many neighbor countries like Bangladesh, Pakistan, Afghanistan, and Myanmar (Chakarbati *et al* 2007; Talwar and Jhingran, 2000) [3, 7]. *Ompok pabda* has high demand due to its high lipoprotein, fewer bones, taste and its nutrition value. But it is not receiving a good response in aquaculture sector because of not proper productive knowledge about feeding, breeding and culture techniques. Internationally IUCN (International Union for Conservation of Nature) [3] declared pabda in red list near threatened species in the whole world. So, there is need to full the demand by improve our skills in fisheries sector by which we can introduce a more productive growth of *Ompok pabda* in aquaculture. Among various indigenous fishes of India *Ompok pabda* (Hamilton, 1822) [4], commonly called as pabda but in M.P Gangwari pabda.

In Madhya 70% of total on dry weight basis and are needed for replacement of worm-out tissue as also several proteinaceous products like intestinal epithelial cells, enzymes and hormones which are required for proper body functions. Protein also required for synthesis of new tissues and hence growth. There are various kind of protein source like casein, fish meal, groundnut oil cake and soybean etc. The gross protein requirement decreases with increase in age and size of fish. Lipids are important source of energy, essential fatty acid and phospholipids, and provide a vehicle for absorption of fat-soluble sterols and vitamins. Carbohydrates, protein and lipids all are act as a good source of energy. Fish do not have specific dietary requirement, but carbohydrates are always included in fish diets as they are inexpensive energy source and act as pellet binder. Vitamins and minerals are required in trace amounts; are essential for fish growth and to fight against disease. Many are water soluble vitamins also act as co-enzymes. Vitamins are manly occurred in natural food. Minerals are required for osmotic balance of various metabolic processes and for structural function in fish. Fish requires 11 water soluble vitamins like A, D, E and K. There are 20 recognized inorganic mineral demands, which perform essential functions in the body (Ayyappan *et al*., 2006) [5].

Materials and methods

Experiment procedure and sampling

Fingerlings of *Ompok pabda* were collected from earthen nursery pond of CIFE center by using mesh size drag net. Netting was done 5-6 times for proper harvesting fingerling from nursery pond. Further, the collected fingerlings were transferred into incubation tank of catfish hatchery for acclimatization up to 24 hrs. Furthermore, after 24 hrs fingerlings were transferred into experiment earthen ponds after taking length weight measurement of stock.

Site of experiment

In older pond there is necessary to do some mandatory initial pre stocking management of the pond for proper maintenance. Before seed collection we already selected three earthen ponds at field area of Central Institute of Fisheries Education center Powarkheda, Hoshangabad (M.P). Following pre-stocking management steps have been done before the stocking of fishes. Earthen ponds of (20 × 10 × 1.5) meters were used for rearing of fingerlings. Ponds were further divided into three parts of (7× 10× 1.5) meters with the help of small mesh size mosquito net and bamboo poles.

Pond Preparation

Drying of pond

The experimental pond was initially dried by using motor pump for removal of weed fish and aquatic weed. The pond was kept for a week for hardening of the pond bottom.

Liming of pond

Liming was done at the rate of 300 kg/Ha for correction of pH as the normal pH of Powarkheda was slightly alkaline before stocking of fishes. The optimum pH for fish culture is between7.5 to 8.5 (figure no.1 and 2).

Water Filling

Water was filled up to the depth of 1.5 meter and the source of water was from bore well (figure no.3).

Manuring and fertilization

Initial pond fertilization with Lime, Raw cow dung, Urea and Single Superphosphate (SSP) at the rate of 300kg/Ha, 2000kg/Ha, 25kg/Ha and 30kg/Ha respectively was done prior to seed stocking (Figure no.4,5 and 6). Manuring was done for primary production of planktons as natural food for the fish.

Stocking

Stocking was done with 70 fingerlings in each partition (@10000/hectare) in the morning hours (Table no.1 and 2). The initial length and weight of the fishes were recorded. We harvested almost 800 fingerlings from earthen nursery pond and noticed near about 99% the whole fingerlings were same as in length and weight (Table no.1 and 2). However, for proper readings we measured randomly weight & length of 70 fishes. During experiment length and weight measurements of fishes had been taken with the use of measurement scale and field electronic weight meter respectively.

Table 1: Measured length & weight data present in

Sr. no.	Weight (gm)	Length (cm)	Sr. no.	Weight (gm)	Length (cm)	Sr. no.	Weight (gm)	Length (cm)	Sr. no.	Weight (gm)	Length (cm)
1	1.44	6.9	10	1.23	6.2	19	1.58	6.8	28	2.38	7.9
2	1.42	6.8	11	1.66	7.0	20	1.63	6.9	29	1.14	6.0
3	1.68	7.0	12	2.10	7.6	21	1.63	6.9	30	1.33	6.3
4	1.49	6.7	13	1.75	7.1	22	1.40	6.4	31	1.66	6.9
5	1.32	6.3	14	1.11	6.7	23	1.71	7.0	32	1.52	6.7
6	1.52	6.7	15	1.50	7.0	24	1.73	6.8	33	1.38	6.4
7	1.29	6.6	16	0.96	5.5	25	1.40	6.4	34	0.99	5.8
8	1.20	6.3	17	1.61	6.8	26	1.97	7.5	35	1.85	7.2
9	2.39	7.9	18	1.95	7.4	27	1.90	7.1	36	1.42	6.5

Table 2:

Sr. no.	Weight (gm)	Length (cm)	Sr. no.	Weight (gm)	Length (cm)	Sr. no.	Weight (gm)	Length (cm)	Sr. no.	Weight (gm)	Length (cm)
37	1.74	6.9	46	1.97	7.2	55	2.80	7.5	64	1.68	6.3
38	1.77	6.8	47	2.03	7.3	56	1.70	6.7	65	1.65	6.9
39	1.97	7.2	48	2.61	8.0	57	2.00	7.5	66	1.82	6.8
40	1.63	6.7	49	2.08	7.1	58	2.35	7.5	67	1.67	6.6
41	1.50	6.3	50	1.65	6.8	59	2.04	7.5	68	1.52	6.4
42	1.40	6.5	51	1.66	7.4	60	1.50	6.3	69	1.72	6.9
43	1.13	5.6	52	2.78	8.4	61	1.88	6.9	70	1.40	6.1

44	1.55	6.5	53	2.48	8.0	62	1.56	6.5			
45	2.23	7.3	54	2.60	7.6	63	2.08	7.4			

Feed ingredient

The different feed ingredients used in our experimental feed are Rice Bran (RB), Mustard Oil Cake (MOC), Fish meal (FM) and Floating feed (FF). These feed ingredients are grinded fine and experimental feed RB+MOC (1:1) (EF-1), RB+FF (1:1) (EF-II) and RB+FM (1:1) (EF-III) were prepared (Table no.3).

Data analysis for FCR, SGR and PER- the following formulae was employed

$$\text{Feed conversion ratio} = \frac{\text{Amount of dry feed consumed}}{\text{Live weight gain}}$$

$$\text{Specific growth rate} = \frac{\text{Log final body weight-log initial body weight} \times 100}{\text{Number of days}}$$

$$\text{Protein efficiency ratio} = \frac{\text{Gain in body weight}}{\text{Protein intake}}$$

Fig 1: of Liming

Fig 2: of Liming

Fig 3: of Filling of Water

Fig 4: of Organic & in-organic

Fig 5: of Manuring

Fig 6: of Manuring Preparation

Table 3: Carcass composition of feed ingredient in percent dry matter (DM)

Feed	Moisture%	CP %	Crude fat %	Fiber %(DM)
Floating feed	10	32	4	5
Fish meal	9	45	10	2
MOC	9	30	7	12
Rice bran	8	14	12	8

Feeding Rate and Frequency

Feeding rate defines the amount of feed made available to the cultured organism. Determination of the feeding rate or ration size is one of the difficult tasks in aquaculture operation. An optimum ration size is one which given the best growth and FCR. Under feeding, or a lower ration result in poor growth and production. Overfeeding result in wastage of feed and water quality deterioration. Ration size therefore need to be modified according to the size and age of the cultured organism.

Feeding rate during experiment was once a time in a day through tray feeding method according to body weight of fishes.

Water quality parameters

Water quality parameter has significant role in Aquaculture. Fish are equilibrium with potential organisms and their environment. Changes in this equilibrium, such as deterioration in water quality can result in fish becoming stressed and vulnerable to diseases. Therefore, it is important to know water quality parameters and their management is necessary for better growth and survival. There is various kinds of physical and chemical water quality parameters like DO (Dissolved Oxygen), Temperature, pH, Salinity, Turbidity, Ammonia, Nitrate, Nitrite, Total Alkalinity, Total Hardness, Orthophosphate, Carbon Dioxide etc APHA (1998) [6].

Results

Weight & Length Relationship Analysis

The initial weight of *Ompok pabda* fingerling stocked under different sections in experimental ponds were i.e. P_1 (a) 1.609mg, (b) 1.609mg & (c) 1.609mg, P_2 (a) 1.609mg, (b) 1.609mg & (c) 1.609mg And P_3 (a) 1.609mg, (b) 1.609mg & (c) 1.609mg respectively (Table no.4). While the average final weight after 45 days were founded to be P_1 (a) 3.949mg, (b) 3.441mg & (c) 5.320mg, P_2 (a) 3.461mg, (b) 3.455mg, & (c) 3.470mg, And P_3 (a) 5.600mg, (b) 6.875mg & (c) 6.533mg in respective experimental ponds (Table no.4). The maximum weight gain trend of fishes in experimental ponds was P_1 (a) 5.32mg, (b) 5.30mg & (c) 6.70mg, P_2 (a) 4.10, (b) 4.00, (c) 5.40 and P_3 (a) 7.20, b) 8.70, (c) 9.20 respectively. And highest weight gain occurred in P_3 (c) 9.20gm, P_1 (c) 6.70gm and in P_2 (c) 5.40gm than other sections of experimental ponds respectively (Table no.4).

The initial average length in experimental ponds was 6.8 cm and final average length of fishes was 8.8 cm after 45 days of experiment. The minimum initial length of fishes was 7.0 cm and final average maximum length was 10.80 cm obtained after 45 days experiment. Percentage of length increment was P_1 (a) 33.8, (b) 27.2, (c) 46.2, P_2 (a) 30.7, (b) 43.3, (c) 24.1 and in P_3 (a) 40.3, (b) 34.3, (c) 39.6% respectively. The highest length increment occurred in P_1 (c) 46.2 and minimum in P_2 (c) 24.1% respectively (Table no.4).

Table 4: Weight and length relationship table

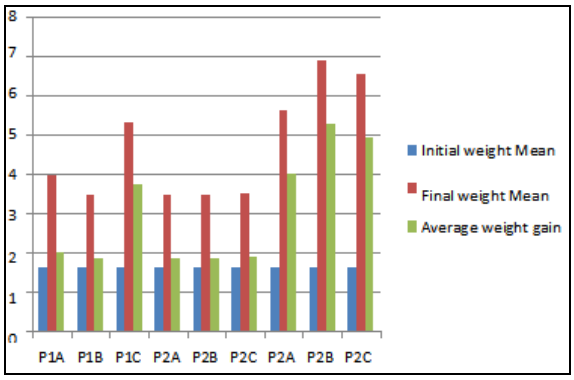
Parameters	Ponds								
	1(a)	1(b)	1(c)	2(a)	2(b)	2(c)	3(a)	3(b)	3(c)
Initial length(cm)	6.8	6.6	6.7	6.5	6.0	6.2	6.2	6.4	6.3
Final length	9.1	8.4	9.8	8.5	8.6	7.7	8.7	8.6	8.8
% increment length	33.8	27.2	46.2	30.7	43.3	24.1	40.3	34.3	39.6
Initial weight (gm)	1.609	1.609	1.609	1.609	1.609	1.609	1.609	1.609	1.609
Final weight	3.949	3.441	5.320	3.461	3.455	3.470	5.600	6.875	6.533
% increment weight	154	115	223	108	117	115	248	329	306
Initial Min. Length	8.0	7.2	8.2	8.0	7.4	8.0	8.5	7.0	8.0
Final Max. Length	10.6	10.10	10.80	9.3	9.5	10.1	10.9	11.2	11.0
Initial Min. weight	3.00	1.99	3.69	2.98	2.70	2.30	3.50	4.40	4.30
Final Max. Weight	5.32	5.30	6.70	4.10	4.00	5.40	7.20	8.70	9.20

Average Daily Weight Gain

The Highest ADG increment was recorded with EF3 of each pond (P1-0.124) (P2-0.062) (P3-0.164) and average is 0.116g/day. ADG with the EF2 (P1-0.061), (P2-0.061), (P3-0.175) and average is 0.099g/day (Table no.5). And the lowest ADG was recorded with EF1 of each pond (P1-0.079), (P2-0.061), (P3-0.133) and average is 0.091g/day (Table no.5), (Graph no.1).

Table 5: of Average Daily Weight Gain

Pond	Initial Wt Mean	Final Wt Mean	Avg. Wt Gain	Avg. Daily Weight Gain (G/Day)
P1A	1.609	3.949	2.390	0.079
P1B	1.609	3.441	1.832	0.061
P1C	1.609	5.32	3.721	0.124
P2A	1.609	3.46	1.852	0.061
P2B	1.609	3.46	1.846	0.061
P2C	1.609	3.48	1.866	0.062
P3A	1.609	5.60	3.991	0.133
P3B	1.609	6.88	5.266	0.175
P3C	1.609	6.53	4.924	0.164



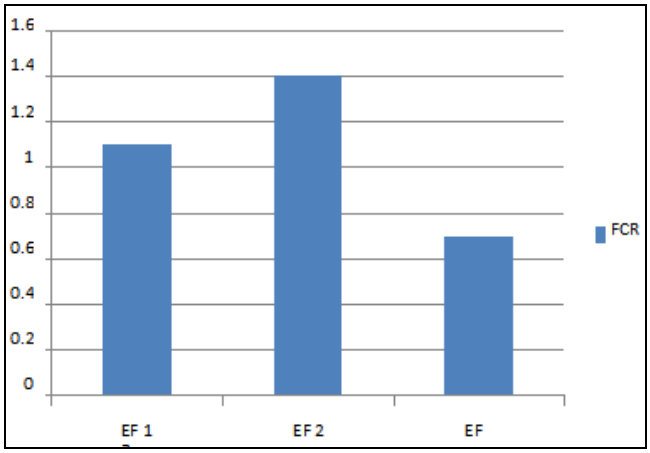
Graph 1: of length and weight relationship (Y axis representing Weight and X axis ponds)

FCR and SGR Analysis

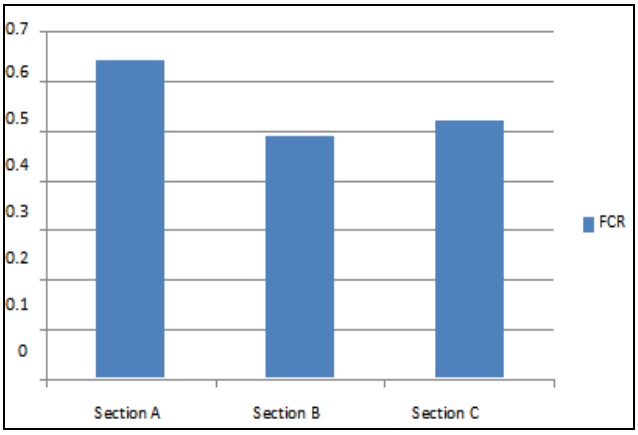
In 45 days experiment FCR in P1A is 1.098, B 1.400 & C 0.692, P2A 1.387, B 1.392, C 1.378 And in P3A 0.644, B 0.488, C 0.522 respectively. The highest Food conversion ratio occurred in P3 1.452 and Minimum in P2 0.764 respectively (Table no.6), (Graph no.2, 3 & 4). The specific growth rate of is P1A 1.300, B 1.300 & C 1.731, P2A 1.109, B 1.106, C 1.114 And in P3A 1.805, B 2.102, C 2.028 respectively (Table no.6). The Maximum specific growth rate occurred in P3A 1.805, B 2.102 and C 2.028 and Minimum in P2A 1.109, B 1.106, and C 1.114 respectively (Table no.6).

Table 6: of FCR and SGR analysis

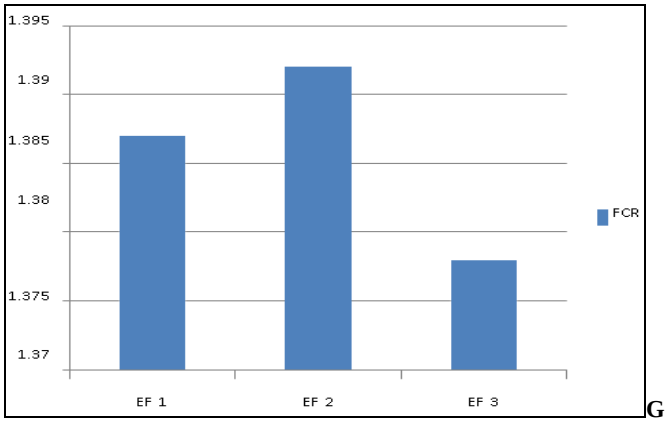
Pond	Initial Wt Mean	Total Initial Wt	Feed Intake	Log Final Wt	Log Initial Wt	Log Fw Log Iw	Fcr	Sgr
P1A	1.609	112.63	180	0.596	0.206	0.390	1.098	1.300
P1B	1.609	112.63	180	0.536	0.206	0.330	1.40	1.100
P1C	1.609	112.63	180	0.725	0.206	0.519	0.692	1.731
P2A	1.609	112.63	180	0.539	0.206	0.332	1.387	1.109
P2B	1.609	112.63	180	0.538	0.206	0.331	1.392	1.106
P2C	1.609	112.63	180	0.540	0.206	0.334	1.378	1.114
P3A	1.609	112.63	180	0.748	0.206	0.541	0.644	1.805
P3B	1.609	112.63	180	0.837	0.206	0.630	0.488	2.102
P3C	1.609	112.63	180	0.815	0.206	0.608	0.522	2.028



Graph 2: for FCR of Pond 1 (Y axis representing FCR rate and X axis Experimental Feeds)



Graph 4: FCR of pond 3 (Y axis representing FCR rate and X axis Experimental Feeds)



Graph 3: FCR of Pond 2 (Y axis representing FCR rate and X axis Experimental Feeds)

Water quality Parameters Analysis

Water quality parameters were also monitored to check the effect of various feed on water quality. Parameters like Temperature, transparency, pH, DO, CO_2, Total Alkalinity, Total Hardness, Ammonia, Nitrate and Phosphate were monitored in interval of 15 days. During the experimental period the average concentration of chemical properties of water like pH, DO, Total Alkalinity and total hardness was found to be 8.17 , 8.6 mg/lit, 209.33 mg/lit and 145.22 mg/lit respectively (Table no.7). The average concentration of Ammonia in pond 1, pond 2 and pond 3 is 0.034, 0.016 and 0.02 mg/lit respectively (Table no.7). The average concentration of Nitrate in pond 1, pond 2 and pond 3 was 0.93, 1.026 and 0.933 mg/lit respectively (Table no.7). The average concentration of phosphate in pond 1, pond 2 and pond 3 was 0.22, 0.32 and 0.306 respectively. The physical parameters like temperature and transparency was also monitored. The temperature of water during the entire experiment ranged from 23 to 26 °C. Transparency decreased during the period and ranged from 37-45 cm (Table no.7).

Table 7: for water quality parameters

Pond	Periods/ days	Temp (°C)	pH	DO (mg/lit)	CO2 (mg/lit)	Alkalinity (mg/lit)	Hardness (mg/lit)	Ammonia (mg/lit)	Nitrate (mg/lit)	Phosphate (mg/lit)
P 1	0-15	25.4	7.5	6.4	Nil	188	150	0.13	0.9	0.40
	16-30	24.6	8.0	8.4	Nil	204	130	0.01	1.0	0.04
	31- 45	25	8.5	10	Nil	236	137	0.02	0.9	0.24
P 2	0-15	24	8.3	8.0	Nil	190	172	0.02	1.00	0.50
	16-30	24.5	8.1	9.2	Nil	210	136	0.01	1.02	0.36
	31- 45	24	8.0	10	Nil	230	142	0.02	1.06	0.10
P 3	0-15	24	8.5	9.2	2	180	174	0.04	0.90	0.53
	16-30	23.5	8.4	8.0	Nil	206	126	0.01	0.90	0.21
	31- 45	23	8.3	8.4	Nil	240	140	0.01	1.00	0.18

Discussion

The average final weight after 45 days in P1 (a) 3.949mg, (b) 3.441mg & (c) 5.320mg, P2 (a) 3.461mg, (b) 3.455mg, & (c) 3.470mg and P3 (a) 5.600mg, (b) 6.875mg & (b) 6.533mg respectively. The average final weights of *pabda* were 32±3.83, 27±3.88 and 23±3.0g, in treatment 1, treatment 2 and treatment 3, respectively. The poor harvesting weight was observed in treatment 3 whereas, comparatively higher harvesting mean weight was observed in treatment 1. The weight of *pabda* showed significant difference (P<0.05) among the treatments. In case of *gulsha*, the harvesting mean weight was higher than pabda in all the treatments. However, it was 48±4.22, 42±2.99 and 38±3.81 in treatments 1, 2 and 3 respectively (Kohinoor A.H.M.; Begum M. *et al*, 2003) [1]. The initial average length in our experimental ponds was 6.8 cm and final average length of fishes was 8.8 cm after 45 days of experiment. The initial average length of *pabda* 0.8-0.2cm respectively in all experiments (D. Sarma, J. Dass, *et al*, 2012) [2].

The highest ADG increment was recorded during 45 days experiment with EF3 of each pond (P1-0.124) (P2-0.062) (P3-0.164) and average is 0.116g/day. ADG with the EF2 (P1-0.061), (P2-0.061), (P3-0.175) and average is 0.099g/day. And the lowest ADG was recorded with EF1 of each pond (P1-0.079), (P2-0.061), (P3-0.133) and average is 0.091g/day. The specific growth rate of is P1A 1.300, B 1.300 & C 1.731, P2A 1.109, B 1.106, C 1.114 and in P3A 1.805, B 2.102, C 2.028 respectively. The maximum specific growth rate occurred in P3A 1.805, B 2.102 and C 2.028 and minimum in P2A 1.109, B 1.106, and C 1.114 respectively. On the other hand, specific growth rate (SGR) of *catla*, *rohu*, *mrigal*, *pabda* and *gulsha* varied from 2.41 to 2.28, 2.31 to 2.17, 2.25 to 2.18, 1.07 to 0.87 and 1.38 to 1.22, respectively. Among the treatments, the highest SGR values were observed in treatment 1. The specific growth rate of *catla*, *rohu*, *mrigal*, *pabda* and *gulsha* in treatment 1 were 2.41, 2.31, 2.25, 1.07 and 1.38, respectively (Kohinoor A.H.M.; Begum M. *et al*, 2003) [1].

During 45 days experiment we observed water quality parameters in all experimental ponds is: pH, DO, Total Alkalinity and total hardness was found to be 8.17 , 8.6 mg/lit, 209.33 mg/lit and 145.22 mg/lit respectively. The average concentration of Ammonia in pond 1, pond 2 and pond 3 was 0.034, 0.016 and 0.02 mg/lit respectively. The average concentration of Nitrate in pond 1, pond 2 and pond 3 was 0.93, 1.026 and 0.933 mg/lit respectively. The average concentration of phosphate in pond 1, pond 2 and pond 3 was 0.22, 0.32 and 0.306 respectively. The physical parameters like temperature and transparency was also monitored. The temperature of water during the entire experiment ranges from 23 to 26 °C. Transparency decreased during the period and ranges from 37-45 cm. But in (D. Sarma, J. Das., *et al*, 2012) [2] experiment they observed temperature 30-31, pH 7.9-8.1, D.O 9-11, Free CO2 2-5mg/l, Alkalinity 90-100mg/l and hardness was 57-61 respectively.

Conclusion

This research work can be one of the baseline data for conducting further research on the locally available feed ingredients and specially catfishes like *Ompok pabda*. In the entire research we have noticed that pabda has good survival and after breeding for rearing purpose. It is important that we keep it in monitoring tanks to check the feeding rate and mortality rates. We have also confirmed that *Ompok pabda* fingerlings started to take locally available ingredients like RB, MOC and also high protein containing floating feed and fish meal. But as similar to other previous research pabda can feed on high protein feed ingredients for better growth in terms of FCR, SGR and ADG.

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