Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(5): 1859-1863

Received: 28-07-2017
Accepted: 29-08-2017

Shwetanshumala
Department of Aquaculture College of fisheries, B. S. K. K. V. Dapoli, Ratnagiri, Maharashtra India

Vimal Sharma
Head Department of Biotechnology Former Dean College of Fisheries MPUAT Udaipur Rajasthan India

Hukam Singh Dhaker
Senior scientific officer (Head), Marine Biological Research Station, Zadgaon, Ratnagiri Maharashtra India

Correspondence
Shwetanshumala
Department of Aquaculture College of fisheries, B. S. K.K.V. Dapoli, Ratnagiri, Maharashtra India

Effects of restricted feeding ration on growth and body composition of juvenile *Pangasianodon hypophthalmus*

Shwetanshumala, Vimal Sharma and Hukam Singh Dhaker

Abstract
Feeding trial was conducted to investigate the growth response and body composition of juvenile *P. hypothalamus* with initial body weight 1.2 ± 0.019 g. Diet (35% protein,3% lipid) were fed at the rate 4, 6, 8, 10 and 12 percent bodyweight^{-1} for a period of 60 days. At the end of feeding period fishes showed significant difference in length gain, weight gain, specific growth rate, feed conversion efficiency, protein efficiency ratio, lipid efficiency ratio and voluntary feed intake. The relationship between the specific growth rate in wet weight (SGR_w,) and ration level (RL) showed an asymptotic curve which is described as $SGRw = 0.6380 + 0.4344RL - 0.0712RL^2$; $R^2 = 0.9272$ while $FCE = 0.8431 - 0.09785RL - 0.01933RL^2$; $R^2 = 0.9272$. Feed conversion efficiency decreased significantly with increase in ration levels.

Keywords: Restricted feed, feeding rate, growth on *P. hypothalamus* juvenile, body composition

Introduction
Pangasianodon hypophthalmus is the fast growing catfish belong to the Pangasiide family and it is native of Mekong of the river in Vietnam. This species are spread in Asian countries such as China, Bangaladesh, Myanmar, Malaysia, Taiwan, Philippines, India and Nepal. In India, Andhra Pradesh is the leading state with 25,000 ha under *P. hypophthalmus* culture in freshwater sector. Fish growth largely depends on the amount of food given, method of feeding, its frequency and the characteristics of the diet. Regulating these parameters, can improve the use of nutrients and result in increased growth of fish with better yield [23]. The ration level, is a major factor influencing fish growth rate [28]. Thus for successful commercial fish culture, the knowledge of the optimal ration level of fish is essential. Optimizing the feeding strategy help in maximizing the fish growth and feed conversion ratio along with reduction in size of hetrogeneity and the cost of production [20]. True satiation feeding can be difficult to achieve with the culture system because satiation feeding is hard to achieve which is affected by many factors. Both over and under feeding affect the outcome in terms of growth. Thus development thus the of proper feed management and husbandry is an important upwards for cost reduction in fish farming.

Materials and Methods
Juveniles of *P. hypophthalmus* were obtained from 'Neahati' fish market Kolkata and transported in aerated polyethene and kept to acclimatize to wet laboratory condition for eight weeks in a 500 L^{-1} capacity plastic pool. They were kept under natural photoperiod and fed with laboratory prepared diet for eight weeks before the commencement of the experiment. The water source was freshwater open well. The Water temperature ranged from 23 ^{0}C to 25 ^{0}C. Practical diets were prepared containing 35% crude protein and 3% lipid of diet of a based on [6, 12]. respectively in Table 1.0.

Table 1: Composition of the basal diet for *pangasianodon hypophthalmus.*

Ingredient (%)	Experimental diets
Fish meal	25
Gluten	27.5
Rice bran	45.7
Wheat Flore	1
Cod-liver oil	0.2
Vitamin-mineral mix[a]	0.6
	Proximate analysis
Dry matter (%)	95.35±0.26
Crude protein (%)	35.00±0.25
Lipid (%)	3.04±0.19
Fiber (%)	4.09±0.24
Ash (%)	8.78±0.29
NFE[b] (%)	49.09
Gross energy[c] (kJ^{-1}/g)	1822.272

a. Vitamin-mineral mix (amount/100^{-1} gm) Ascorbic acid 150 mg, Biotin 0.25 mg, Calcium pantothenate 16.3 mg, Elimental boron 1mg, Elimental copper 3.39mg, Elimental manganese 2.03mg Elimental zinc 2.2mg, Ferrous sulphate 32.04mg Magnesium oxide 60 mg, Niacinamide 100 mg, Phosphorous 25.8 mg, Riboflavine 10mg, Sodium molybdate 0.25 mg, Thiamine 10mg, Tribasic calcium phosphate 129 mg, Vitamin A 10000 IU, B_{12} 15 µg, Vitamin B_6 3 mg, Vitamin D_3 1000 IU, Vitamin E 25 mg.
b. NFE = 100- (Crude protein + Crude lipid + Ash + Fiber).C. Calculated Gross energy, taking 23.9, 39.8 and 16.7 KJ/g for protein, lipid and NFE, respectively (Schulz *et al*, 2007).

Experimental procedure
Fishes in three replications were fed varying levels of feed T_1= 4%, T_2 = 6%, T_3 = 8%, T_4 = 10% and T_5 = 12% in separate plastic pools creating a range from underfed to overfed level. There were 28 randomly selected fishes in each group. The diet was fed in three doses at 9.00, 12.00 and 15.00 hrs. The leftover feed was removed 30 minutes after feeding and then oven dried at 70 ^{0}C. 25% of the water in the pools was exchanged with fresh water every day.

Proximate analysis of feed and juvenile of *P. hypophthalmus*
The fed diet was analyzed for proximate composition by using method using the given in [3]. Moisture was determined by gravimetric analysis following oven drying to constant weight at 70 ^{0}C. Total nitrogen was estimated using KEL PLUS-CLASSIC DX. Protein was calculated by multiplying nitrogen content by a constant 6.25. Crude lipid content was determined by using SOCS PLUS with petroleum either. Ash content was determined gravimetrically by burning in muffle furnace at 550 ^{0}C for 6 hours. Crude fiber content was determined by using FIBRA PLUS with 0.1% Sulphuric acid and sodium hydroxide wash further ashing the sample in muffle furnace at 550 ^{0}C for two hours. Gravimetric (oven drying 70 ^{0}C) method was used for moisture. The biological parameters were continued were Weight gain, Length gain, SGR, FCE, Voluntary feed intake, PER, Lipid efficiency ratio.Water parameters such as temperature, pH, dissolved oxygen, carbon dioxide, total alkalinity and total hardness was measured following the method [4, 5].

Statistical analysis
Experiments were designed as per completely randomized design with three replicates, standard error of the mean weight, length and survival percentage of juveniles of *P. hypophthalmus* for each replicate was calculated. Data obtained from the experiments for growth parameters, proximate compositions and biological composition were analyzed by one way ANOVA. Significant difference was indicated $P<0.05$ Student's Newman Keul multiple range test was used to determine the significant difference between the treatments [22, 30].

Results
Diet containing 35% protein and 3% lipid was fed to juvenile *P. hypophthalmus* at different ration level 4, 6, 8, 10 and 12% body weight for a period of 60 days. In these maximum and minimum length gain values were 39.6 ± 3.5% and 28.78 ± 3.5% respectively. The 12% (T_5) group showed significant difference from other treatments. The highest and lowest weight gain recorded, was 229.5 ± 3.45% and 112.18 ± 2.51% respectively. The weight gain of 8% (T_3), 10% (T_4) and 12% (T_5) were similar however, they differed from the 4% (T_1) and 6% (T_2). The maximum specific growth rate was observed in 12% (T_5) ration for 60 days. The 8%, 10%, and 12% was not found significant different from each other. The optimum ration was found be lower 10 to 12% as per the second order polynomial regression. The equation was $y = 0.6380 + 0.4344RL – 0.007129RL^2$; R^2=0.9272. The maximum feed conversion efficiency was observed in 6% (T_2) ration for 60 days. The 6%, 8%, 10% and 12% was found no significant different from each other. The equation was $y = 0.8431 - 0.09785RL – 0.01933RL^2$; R^2 = 0.6698. The maximum feed conversion efficiency was observed in 6% (T_2) ration for 60 days. The maximum value of Protein efficiency ratio (PER) in T_5 1.00 ± 0.03%, Lipid efficiency ratio (LER) in T_5 0.09 ± 0.003%, Voluntary feed intake in T_5 2.87 ± 0.08%, Survival in T_5 25 ± 0.57 with experimental treatment.

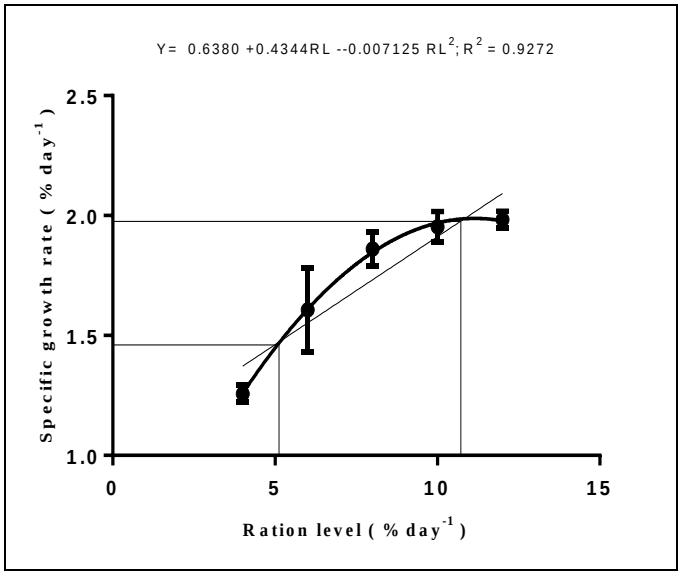

Fig 1: Curve showing relationship between SGR and RL

Table 2: Effect of ration level on survival and growth of *Pangasianodon hypophthalmus* juvenile to feeding at different ration level.

	Ration level (% body weight day^{-1})				
Parameter	**4**	**6**	**8**	**10**	**12**
Survival (%)	71.43	78.57	79.76	82.14	89.28
Initial length (cm)	5.04± 0.02	5.04± 0.02	5.04± 0.02	5.04± 0.02	5.04± 0.02
Final length (cm)	6.48± 0.04^{a}	6.58± 0.08^{ab}	6.72± 0.02^{bc}	6.76± 0.04^{cd}	6.89± 1.33^{d}
Length gain (%)	28.78± 0.60^{a}	30.63± 1.17^{a}	33.45± 0.97^{b}	34.28± 0.34^{bc}	36.87± 1.33^{c}
Initial weight (gm)	1.18± 0.003^{a}	1.19± 0.003^{a}	1.20± 0.003^{ab}	1.21± 0.003^{b}	1.24± 0.01^{c}
Final weight (gm)	2.5± 0.02^{a}	3.12± 0.19^{b}	3.64± 0.08^{c}	3.91± 0.08^{cd}	4.09± 0.08^{d}
Weight gain (%)	112.18± 2.508^{a}	163.28± 16.304^{b}	204.49± 7.505^{c}	222.79± 6.49^{c}	229.5± 3.45^{c}
SGR (%)	1.26± 0.02^{a}	1.61± 0.10^{b}	1.86± 0.04^{c}	1.95± 1.7^{c}	1.98± 1.7^{c}
FCE (%)	1.67± 0.04^{a}	1.68± 0.16^{ab}	1.60± 0.06^{b}	1.43± 0.04^{b}	1.24± 1.01^{b}
PER (%)	0.65± 0.09^{a}	0.76± 0.01 ^{a}	0.97± 0.16 ^{a}	0.95± 0.06 ^{a}	1± 0.03 ^{a}
LER (%)	0.06± 0.006 ^{a}	0.05± 0.02 ^{a}	0.07± 0.003 ^{a}	0.08± 0.006 ^{a}	0.09± 0.003 ^{a}
Voluntery feed intake	1.86± 0.25^{a}	2.18± 0.03^{ab}	2.41± 0.09^{abc}	2.70± 0.17^{bc}	2.87± 0.08^{c}

Values with different superscript (a,b.c,d and e) differ significant (ANOVA,P<0.05).

Table 3: Body composition of *P. hypophthalmus* fed with different ration level for 60 days.

Parameters	**Ration levels (% of body weight)**				
	T_1	**T_1**	**T_3**	**T_4**	**T_5**
Moisture (%)	69.17^{a} (±0.42)	71.72^{b} (±1.16)	73.26^{b} (±0.32)	73.91^{bc} (±0.32)	75.69^{c} (±0.43)
Protein (%)	7.14^{a} (±0.29)	7.58^{a} (±0.15)	8.12^{ab} (±0.15)	8.75^{b} (±0.25)	8.75^{b} (±0.25)
Lipid (%)	8.22^{a} (±0.11)	8.78^{a} (±0.45)	9.56^{b} (±0.11)	9.78^{b} (±0.11)	9.78^{b} (±0.11)
Ash (%)	0.37^{a} (±0.02)	0.43^{a} (±0.02)	0.48^{ab} (±0.02)	0.59^{b} (±0.05)	0.59^{b} (±0.05)

* Means followed by different superscript in rows indicates significant difference (P<0.05*)*.

Body composition

The maximum and minimum moisture was recorded in T_5 76.36 ± 0.61% and T_1 70.94 ± 0.71% respectively. The moisture content T_1 was significantly lower (P<0.05) than other treatments. Highest lowest protein was recorded in T_5 9.19 ± 0.25% and T_1 7.58 ± 0.15% respectively. The protein conversion ratio in T_4 and T_1 was significantly different (P<0.05) then the T_1, T_2 and T_3. The maximum and minimum lipid was recorded in T_5 (10.55 ± 0.22%) and T_1 (9.11 ± 0.40%) respectively. The lipid conversion ratio of T_1 was significantly different (P<0.05) fromT_4 and T_5. The highest and lowest ash was recorded in T_5 (0.71 ± 0.01%) and T_1 (0.39 ± 0.03%) respectively. All the treatment was differed significantly (P<0.05) from each other.

Water parameter

Values for various water parameters recorded during the 60 day experiment were water temperature (24.60 ± 0.63 ^{0}C), pH (7.5 ± 0.05), dissolved oxygen (5.04 ± 0.03 mg L^{-1}), carbon dioxide (6.60 ± 0.43 mg L^{-1}), alkalinity (100.11 ± 2.59 mg L^{-1}) and hardness (99.51 ± 2.47 mg L^{-1}) recorded during different during a ration level of *P. hypophthalmus* for a period of 60 days.

Discussion

Accurate feed management is essential in an aquaculture system as underfeeding leads to competition amongst fishes for the feed thereby lowering growth, conversely overfeeding leads to wastage of feed [26]. and alter feed conversion ratios [25, 17]. besides this water quality of the culture system is also altered due to rotting of left over feed [15, 8].

During the present study length gain, weight gain and SGR and FEC were not significantly different (P<0.05) between 4% (T_1), 6% (T_2), 8% (T_3), 10% (T_4) and 12% (T_5) ration level but significantly higher (P<0.05) then other treatments. The PER (1.00), LER (0.09), and VFI (2.87 g) were found maximum in 60 days ration level and found significantly higher (P<0.05) then other treatments. In the body composition, moisture (75.69%) protein (8.75%), lipid (9.78%), ash (0.59%) was found maximum in T_5.

According to our results, feeding fish at 12% is a waste as it is unable to grow more as compared to lower feeding ration. A food in the table values higher but growth is negligible [27]. moreover, leftover ration results in lower FCR which has a deteriorating effect on water quality [14]. Therefore, a clear understanding of the amount of food to be given is important for achieving maximum growth without any of the feed wastage as this will increase the cost of feeding. Feed intake increased with feed frequency while more increasing the feed frequency does not affect the feed intake values. Studied conducted on many fishes demonstrate feed consumption as well as growth improvement with feed frequency up to certain

limit [2]. Excess feed in fish cause the stress on the gut and certain gastro problem in digestion [13].

The final weight gain and SGR in different fish groups after the restricted feeding period were more at the lower ration levels indicating that growth of the fish was affected by fed ration. The SGR for fish fed ranged between 1.98 to 1.26 which is lower than that reported for *Spaues aurata* [9]. and *O. niloticus* [29].

The relationship between the SGR and ration levels of the *P. hypophthalmus* was that of an asymptotic curve and that the SGR of fish receiving feed at ration of 8%, 10% and 12% were not significantly different. It indicated that the highest increase in growth was seen at higher ration level is 8% as seen for in juvenile *P. hypophthalmus*. Effect of feeding on growth of nile tilapia [1]. affected on the final body weight, weight gain and specific growth rate. Which excess feed has no affect on growth but positive relation between growth and feeding frequency [19]. (Riche *et al* 2004).

In the different feeding ration, FCE less with more ration in *Pangasius bocoruti* [12]. in Nile Tilapia by [29], and juvenile cobia [24]. According to the study, the less FCE in juvenile of *P. hypophthalmus* was found at the 12% feeding ration. Experiment the showed that feed FCE at 4-6% feeding ration was less when decreased with increase in feeding, similar result were reported for *C. carpio* [7], *C. idella* [31] and *P. bocoruti* [12]. If the FCE and more ration (8%, 10% and 12%) were compared, then the fish 8% ration had more FCE than the 10% and 12% feeding ration. Result shows the maximum ration level for *P. hypophthalmus* was 10% which is similar to a study of *P. bocoruti* [12], 8% ration level is a sub-maximum by [29].

In optimum feeding recommends feeding at an intermediate level lower then maximum to obtain better growth and FCE [20]. Therefore, a more than 10% day^{-1} is given as the optimum ration level for the juvenile of *P. hypophthalmus* with a diet containing 35% crude protein and 3% crude lipid. It is also observed that a juvenile biomass increased depending upon the feeding ration.

Acknowledgement

The authors are grateful to the Department of Aquaculture college of fisheries Dr. B.S.K.K.V. Dapoli, Ratnagiri, which provided all the laboratory and working space for this research.

Conclusion

Present study was carried out in wet lab of Fisheries College, juvenile of *P. hypothalamus* were obtained from "Neathi" fish market Kolkata. Twenty eight fish were randomly selected and stocked in experimental pools, select the five ration levels in a range of under feeding and over feeding levels. Were used 4%, 6%, 8%, 10% and 12% of initial body weight per day. Based on the results of the present study the best feeding requirement for juvenile of *P. hypophthalmus*, works out to be 8% of body weight per day as optimal however this needs verification at commercial level.

References

1. Abbas G, Waryani B, Ghaffar A, Rahim A, Hafeezur RM, slum AM. Effect of ration size and feeding frequency on growth, feed utilization, body composition and some hematological characteristic of juvenile snapper, Lutjanus johnii. 2015; 47:719-730.
2. Ali TES, Liorens SM, Monino AV, Cerda MJ, Vidal AT. Effects of weekly feeding frequency and previous ration restriction on the compensatory growth and body composition of Nile tilapia fingerlings. 2016; 42:357-363.
3. AOAC. Official methods analysis of the Association of official Analytical Chemists, 12th edition, in Horwitz, (Ed), AOAC, Washington District of Columbia, 2006, 1094,
4. APHA. Standard methods for the examination of water and west water, 20th edition. American public Health Association, Washington District of Columbia. 2005, 2605.
5. Boyd CE. water quality in warm water fish ponds. Auburn university, Alabama, United States of America, 2001, 1-359.
6. Debnath D, Sahu NP, pal AK, Jain KK, Yengkokpam S, Mukherjee SC. Mineral status of Pangasius pangasius fingerlings in relation to supplemental phytase: absorption, whole-body and bone mineral content. Aquaculture Research. 2005; 36:326-335.
7. Desai AS, Singh RK. The effects of water temperature and ration size on growth and body composition of fry of common carp, Cyprinus carpio. Journal of Thermal Biology. 2009; 34:276-280.
8. Du ZY, Liu YJ, Tian LX, He JG, Cao JM, Liang GY. The influence of feeding rate on growth, feed efficiency and body composition of juvenile grass carp. Aquaculture International. 2006; 14:247-257.
9. Eroldogan OT, Kumla M, Kiris GA, Sezer B. Compensatory growth response of Sparus aurata following different starvation and refeeding protocols. Aquculture Nutrrition. 2006; 12:203-210.
10. Gatlin DM. Food intake in fish. In. Houlihan D, Boujard T, Jobling M (eds) COST action 827.Blackwell scince, Oxford. 2001, 1-259.
11. Hussein MS. Effect of various feeding frequencies on growth performance and previously starved fingerlings and juveniles of African catfish (Clarias gariepinus). Egyptian Journal of Aquatic Biology and Fisheries. 2012; 16(2):145-152.
12. Jiwyam W. Growth and compensatory growth of juvenile *Pangasius bocouriti* relative to ration. Aquaculture journal. 2010; 306:393-397.
13. Jobling M. Nutrient requirement of fish and shrimp, National research council (NCR). The National acadmic press, Washington D. C. 2012; 376+XVI.
14. Johnston G, Kaiser H, Hecht T, Ollermann L. Effect of ration size and feeding frequency on growth, size distribution and survival of juvenile clownfish, *Amphiphrion percula*. Journal of Applied Icthyology. 2003; 19:40-43.
15. Mahelakakis A, Tsolkas C, Yoshimatsu T. Optimization of feeding rate of hatchery produce juvenile gilthead sea bream Sparus aurata. Journal of World Aquaculture Society. 2002; 33:169-175.
16. Ndome CB, Ekwu AO, Ateb AA. Effect of feeding frequency on feed consumption, growth and feed conversion of Clarias gariepinus × Heterobranchus longifilis hybrid. American-Eurapian Journal of Scientific Research. 2011; 6(1):06-12.
17. Puvanendran V, Boyce DL, Brown JA. Food ration requirements of 0^+ yellowtail flounder Limanda ferruginea (Storer) juveniles. Aquaculture. 2003; 220:459-475.
18. Ribeiro FAS, Vasquez LA, Fernandes JBK, Sakomura NK. Feeding level and frequency for freshwater

angelfish. Revista Brasileira De Zootecnia. 2012; 41:6.
19. Riche MA, Heley DI, Oetker M, Garbrecht S. Effect of feeding frequency on gastric evacuation and the ration of appetite in tilapia (Oriochromis niloticus). Aquaculture. 2004; 234:657-673.
20. Schnaittacher G, King W, Berlinsky DL. The effects of feeding frequency on growth of juvenile Atlantic halibut, Hippoglossus hippoglossus L. Aquaculture International. 2005; 36:370-377.
21. Sevgili H, Hossu B, Emre Y, Kanyilmaz M. Compensatery growth after various levels of dietery protein restriction in rainbow trout, *Oncorhynchus mykiss*. Aquaculture. 2012; 344:126-134.
22. Snedecor GW, Cochra. Statistical methods, 6th ed.Oxford and IBH publishing co., New Delhi. 1967, 1-593.
23. Storebakken T, Hung SSO, Calvert CC, Plisetskaya EM. Nutrient partitioning in rainbow trout at different feeding rates. Aquaculture. 1991; 96:193-203.
24. Sun L, Chen H, Huang L, Wang Z, Yan Y. Growth and energy budget of juvenile cobia (Rachycentron canadum) relative to ration. Aquaculture. 2006; 257:214-220.
25. Talbot C, Korsoon O. Pattern of fed intake in four species of fish under commercial farming conditions implications for feeding management. Aquaculture Research. 1999; 30:509-518.
26. Thorpe JE, Cho CY. Minimizing waste through bioenergetically and behaviourally based feeding strategies. Water Sci Technol. 1995; 31:29-40.
27. Tsevis N, Spiros K, Klaoudateos S, Conides S. Food conversion budget in sea bass, Dicentrarchus labrax, fingerling under two different feeding frequency patterns. Aquaculture. 1992; 101:293-304.
28. Webb PW. Partitioning of energy into metabolism and growth. In, Gerking SD (ed) Ecology of freshwater fish production. Blackwell, Adelman. 1978, 184-214.
29. Xie S, Cui Y, Yang Y, Liu J. Energy budget of Nile tilapia (*Oreochromis niloticus*) in relation to ration size. Aquaculture. 1997; 154:57-68.
30. Zar JH. Biostatistical Analysis. Prentice-Hall, Inc, Englewood cliffs, N. J., U.S.A. 2006, 1-206.
31. Zhen-Yu D, Yong-jian L, Li-Xia T, Jian-Guo H, Jun-Ming C, Gui-Ying L. The influence of feeding rate on growth, feed efficiency and body composition of juvenile grass carp. Ctenopharyngdon idella. Aquaculture International. 2006; 14(3):247-257.