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Effect of Pelleted feeds (Floating and Sinking) on Growth and survival of Post Fry Sea Bream, *Acanthopagrusberda* (Forsskal, 1775)

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Abstract: The nutritional efficacy of sea-bream seed *Acanthopagrusberda* (Forsskal, 1775), was observed intensively cultivated for 5 weeks. Seed of experimental fish were collected from wild by the help of cast net. Collected seed were procured with oxygenated tanks carefully into the aqua-lab. Juveniles were kept in well aerated 60-L-1 glass water treatment tanks (10-1) with their two replicates and fed on different commercial diets i.e. T1-floating feed and T2-sinking feed. Feed were given twice daily after seven hours interval period, according to their total biomass (body weight, 2 %) and later on, the amount of feed was adjusted by their wet body weight in all tanks. After completion of acclimatization period, fries were distributed among treatments having mean initial length and weight (4.5±0.5 cm, 5.84±0.3g) respectively. At the end of experiment, all juveniles were collected and measured total length (cm) and weight (g). Results shows that, the highest weight gain (g) was found in T1, floating feed (17.8±0.2g) as compared to T2, sinking feed (12.6±0.17g), while the ratio of food conversion and growth, also K were absolutely different (P<0.05) among treatments. Survival remained 100% in both treatments. However, physicochemical parameters of water found in an optimum range throughout the experimental period i.e. (temperature; 27 to 28 ◦C), (Dissolve oxygen; 6.8 to 7.3±32 mgL-1), pH (7.3 to 7.5), ammonia (0.067±0.004 mgL-1), NO2-N below (0.006 mgL-1) and salinity (17‰ to 20‰). It is suggested that, 40% protein comprising floating feed is best for obtaining optimum growth in post fry black-fin seabream, *Acanthopagrusberda* in captivity.

Keywords: Post fry, *Acanthopagrusberda,* Feed, Floating and Sinking Feed, Growth Performance, Survival.

1. INTRODUCTION

Aquaculture is an economical business which can improve social sustainability and economic growth and also decrease the poverty and malnutrition (Toufique and Belton, 2014; Toufique and Gregory, 2018; Karim *et al.*, 2011; Brummett *et al.*, 2011; Saguin, 2014; Serrana, *et al.*, 2013). Worldwide, demand of aquaculture is increasing significantly since last two decades due to feeding demand and estimated that, 50 million metric tons of seafood demand is fulfill by aquaculture and further demand will increase in upcoming years (Tacon and Forster, 2001; FAO, 2006). Overexploitation of natural resources, amendments of environmental factors and decline of commercial fish trade in international markets has long-lasting influence of fisheries.

Specifically, the production of aquaculture in Asian countries is 87% of total production and the aquaculture status in Pakistan especially mari-culture ratio is very low (El-Dahhar, *et al.*, 2013; Ngandzali *et al.*, 2011; Sa *et al.*, 2006). In order to maintain fish ponds, must be gain knowledge about specie-specific nutrition and environment. Nutrition of fish is the most important factor but one of the expensive items in intensive aquaculture system. However, cost effective feed is highly adaptable in aquaculture (Abbas *et al.*, 2011, 2015; Rosenlund *et al.*, 2001).

Sea bream *Acanthopagrusberda* is famous for their taste and nutrition, having high commercial value and market price(Anonymous, 2012; Abbas *et al.*, 2011; 2015; Rahim *et al.*, 2015). Sparids are hermaphrodite and mostly consume benthic fauna and considerable amount of benthic flora (Platell, *et al.*, 2007; Vahabnezhad, *et al.*, 2016). Previously, many researchers have been working on nutrition and feeding aspects of sea bream (El-Dahhar, *et al.*, 2013; Aydin *et al.*, 2011; Ozorio *et al.*, 2006; Johansen *et al.*, 2001). Despite high commercial value of sea bream species, in Pakistan limited research on biology, nutrition and culture techniques for particularly, black fin seabream, *A. berda*compared with other species (*A. latus*) (Sarwat, 2014; Rahim *et al.*, 2015; Rigos *et al.*, 2011). Therefore, it was necessary to test the effect on growth performance in sea bream by using different cost-effective diets. In Mari-culture, nutrition and feeding strategies is significant for body growth and economical point of view and this is the main objective of our study.

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Table 1. Feed Ingredients ($g^{-100\text{-}g}$) and Chemical Composition (%) of artificial feed used in Different Treatment Tanks of Post Fry Seabream, *A. berda*.

	Diets ($g^{-100\text{-}g}$)	
Ingredients	**Floating**	**Sinking**
Wheat flour	5.00	5.00
Rice bran	8.55	8.55
Soybean meal	12.50	12.50
Corn	6.55	6.55
Tapioca flour	7.55	7.55
Soybean oil cake	4.50	4.50
Fish oil	4.50	4.50
Fish meal	36.50	36.50
Vitamin premix	14.40	14.40
Chemical analysis†††		
Crude Protein††††	38.5±0.01	39.2±0.02
Fat	10.5±0.02	7.9±0.02
Moisture	8.7±0.02	9.5±0.02
Crude Fiber	7.5±0.04	8.6±0.04
Ash	9.3±0.03	8.3±0.04
NFE	33.5±3.60	35.7±2.89

†††Percent (%) dry matter(mean± S.E., n = 2).
†††† (N×6.25).

2. MATERIAL AND METHOD

The experiment was performed at aquaculture laboratory, CEMB, University of Karachi. Designated four glass tanks with their two replicates for 40 days. Post Fry Sea bream, *Acanthopagrusberda* (average initial length 4.5±0.5 cm) captured from wild and acclimatized for one week. Ten fries were kept in each tank and two kinds of commercial feeds such as, floating feed in (T1) and sinking feed in (T2) were provided two times per day (seven-hour interval) according to their total body weight at 2%. During fish stocking the average body weight of fries in each tank was 5.8±0.36 g.

The daily physicochemical parameters of all water tanks were observed in the morning and found in an optimum range throughout the experimental period. The temperature was range between (27 to 28 ◦C), Dissolve oxygen (6.8 to 7.3 32 mgL-1), pH (7.3 to 7.5), ammonia (0.067±0.004 mgL-1), NO2-N below (0.006 mgL-1) and salinity (17‰ to 20‰) were sustained on daily basis. Transparency of water were maintained by adding 50% of water after siphoning.

After 10 days of interval, all fries were collected form each tank by the help of scoop net and measured total length in centimeters and wet body weight in grams by the help of digital weight balance machine and released back immediately.

Ingredients and proximate composition of fish feed by using the standard methods of AOAC (2000) are specified in **(Table 1).**In the end of experimental trial, 2 fishes in each tank were randomly collected and preserve for further assessment of meat quality. The major component found in meat (lipid, crude protein, carbohydrate, moisture and ash) were assess by (AOAC, 2000) procedure. Results articulated as total percentage of dry body weight. ANOVA (Analysis of variance between two variables) studied via new various test-range (Duncan) for assessing significant ($P<0.05$) differences among all groups.

The growth parameters were examined by the help of formulas:

1) (WG, g) = mean FW – mean PW
2) (DWG, g) = fresh WG of fish/ days
3) Food conversion = wet WG/ feed intake × 100
4) (SGR, %) = Log FW – Log PW × 100 /days
5) Survival rate (SR, %) = Fn of fish/Pn of fish × 100
6) K = FW/ FL 3 × 100.

Where, FW=final weight, PW, primary weight, WG=weight gain, DWG= daily weight gain, Fn= final number, Pn=primary number, and FL= final length.

3. RESULTS

The primary mean body weight (g) of black fin seabream fries, *Acanthopagrusberda* was 5.8±0.3g and the final mean body weight was significantly higher in (T1; floating feed) was 23.6±0.2g as compared to (T2; sinking feed) was 18.4±0.17g. Fishes were increased about (17.8±0.2 g) in T1 tank than T2 (12.6±0.1 g) during the 40 days trial period **(Table 2).** The growth of fishes was slightly increased within 20 days in T1 and highly significant (P<0.05) in 30 days and onwards when compared to their wet body weight (g) than T2 **(Fig 2).** The body growth of fries, *A. berda* were slow at the start of the experimental trial but enhanced in the later stages. This singularity had been previously reported by Yousif *et al*., (2005) and Ahmed *et al*., (2012).

Table 2 Growth parameters of post fry black fin sea bream, *A. berda* fed with different commercial feeds in brackish-water glass tank for 40 days.

Growth parameters	T1(Floating feed)	T2(Sinking feed)
Initial Length (cm)	4.47±0.2[a]	4.52±0.1[a]
Final length (cm)	16.4±0.01[a]	11.2±0.2[b]
Initial weight (g)	5.84±0.1[a]	5.8±0.2[a]
Final weight (g)	23.6±0.2[a]	18.4±0.17[b]
Weight gain (g)	17.8±0.2[a]	12.6±0.1[b]
WG (%) IW	108.91±0.00[a]	68.96±0.01[b]
Specific growth rate (%)	3.49±0.01[a]	2.89±0.01[b]
Feed conversion ratio	1.24±0.01[a]	3.7±0.02[b]
Condition factor	3.7±0.02[a]	3.22±0.03[b]
Survival ratio (%)	100±0.00[a]	100±0.00[a]

ANOVA *(P<0.05)* Duncan new multiple test range (Mean ±SE). Different superscripts showed significant differences among groups.

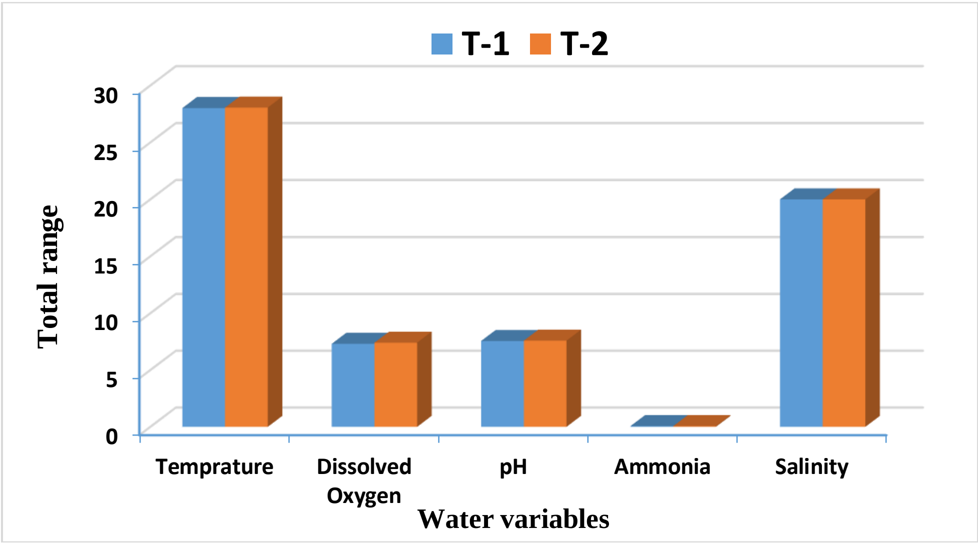

Fig. 1 Physio-chemical parameters of water in different tanks were recorded throughout the experimental period (40d)

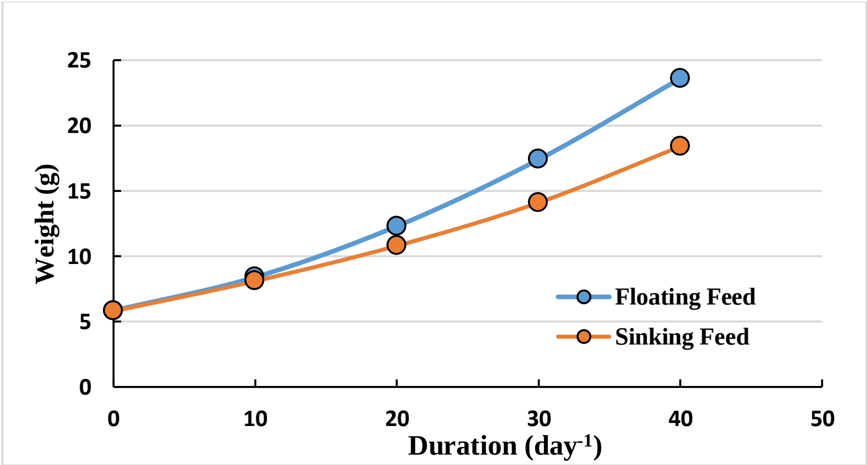

Fig. 2. Weight gain of Post Fry Seabream, *A.berda*reared in two different Treatments with different diets.

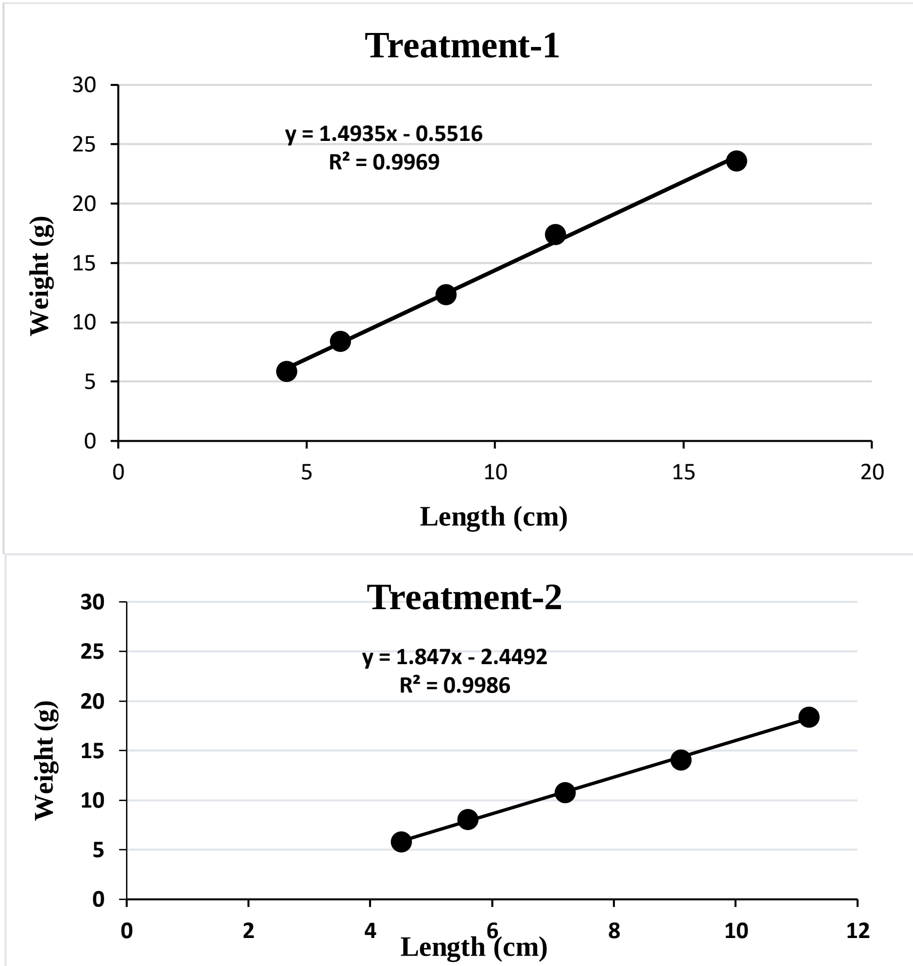

Fig.3 Allometric growth of *A. berda* in T1 (floating feed) & T2(sinking feed).

The optimum SGR was found in T1 (3.49±0.01) as compared to T2 (2.89±0.0) which were found significantly (P<0.05) different. Whereas, ratio of food conversion was also different among groups and optimum FCR was found in T1 (1.24±0.01) rather than T2 (3.7±0.02). The K was observed as significantly (P<0.05) different among both treatments (Table 2). Results showed optimum growth in T1 tank. Regression analysis (R2 = 0.996) showed non-significant difference (P<0.05) among both treatments (1 & 2). All fishes were allometrically grown **(Fig3).**

Water variables i.e. (temperature, 28.02 ± 0.13 °C), (DO, 7.31 ± 0.32 mgL-1), pH (7.59 ± 0.14), ammonia (0.067 ± 0.004 mgL-1) were found within the tolerable level, as no disease and mortality were recorded during whole experimental period with 100% survival rate in all tanks **(Fig1)** because of controlled environment.

The protein range between (53.16 -53.26), moisture (71.16 - 71.26), lipids (2.49 - 2.53), ash (4.17 to 4.19) in fish meat were non-significant (P>0.05). This study proves that, both feeds (Sinking and Floating feed) were suitable for rearing black fin seabream fries, *A. berda* in captivity. Although, floating feed was consume more throughout the whole experimental period, improved the body weight by (17.8±0.2 g) rather than sinking pelleted diet (12.6±0.12 g).

4. DISCUSSION

In present study, we examine different commercial feeds i.e. floating and sinking form on the body growth and utilization of nutrients in post fry sea bream (*Acanthopagrusberda*). Throughout the experiment, the optimum growth in terms of wet body weight (g) were found in T1=23.6±0.2 g, fed on floating diet and sinking feed, T2=18.4±0.17 g, which is significantly different because of high protein contents and fish behavior. Similarly, Limbu (2015) reported higher growth in relation to weight gain (49.20 ± 0.77 g) and (47.22 ± 1.70 g) in African cat fish, *C. gariepinus*, by feeding floating and sinking diets, respectively.

The results on floating feed are significant as compared to sinking feed and the value of weight gain (WG) on floating feed was (17.8±0.2 g) greater than sinking feed (12.6±0.1g). Equivalent findings were described by Sadek and co-authors, (2004) on *Sparus aurata* by using extruded floating feed, found higher growth than other commercial feeds during their 8 months of trial period. Rahim *et al*., (2015) reported that, 42% protein and 20% lipid concentration diet for total 60 days were enhanced the WG of juveniles (*A. berda*) from (10.2 gm) to (56.3 gm) of body weight. Similar outcomes were gathered by (Zakeri *et al*., 2010) on *Acanthopagrus latus*, (Lopez *et al*., 2006), on *Atractoscionnobilis*, (Silva *et al*., 2006) on *Pagellusbogaraveo* and (Rigos and co-authors, 2011; El-Husseiny and co-authors, 2013; Mongile and co-authors, 2014) on *Sparus aurata*. Although, Rahim *et al*., (2016) specified that optimum growth in terms of WG (959.6 g and 984.1 g) of juvenile black fin seabream, *A. berda* were found by feeding 40% and 50% protein containing diet for 90 days.

Many researchers experienced on diverse species of gilthead bream in earthen pond with the utilization of commercial and natural feedings and found optimum results on fish growth (Jasmine and co-authors, 2011; Terziyski and co-authors, 2007; Ahmad and co-authors, 2005; Khan and co-authors, 2002; Sadek and co-authors, 2004).

In our study, fish growth ratio was considerably higher about (3.49±0.0%) in T1 tank (floating feed) than sinking feed (2.89±0.01%). Comparably, Sadek *et al*., (2004) found significantly higher SGR (0.99%) on extruded floating pellets than others extruded semi-sinking pellets (0.95%) and compressed sinking pellets (0.79%). Contrary, Limbu (2015) specified surpassing growth ratio in African catfish on sinking diet (2.2%). However, Rahim *et al*., (2016) found higher SGR (2.6%) in juvenile, *A. berda* by using protein comprising feed for 90 days in an intensive environment. Similar finding was reported by (Abbas and Siddiqui, 2013) in *Lutjanusargentimaculatus*, (Silva and co-authors, 2006) in *Pagellusbogaraveo*, (Coutinho and co-authors, 2012) in *Diploduspuntazzo* and (Zhang, 2010) in *Sparus microcephalus*.

According to our results, sea bream fries showed significantly ($P<0.05$) different results in terms of K (3.7±0.02, 3.2±0.03) and FCR (1.24±0.01, 3.7±0.02) in both treatments (T1, floating feed) and (T2, sinking feed), respectively. Contrary, Limbu, (2015) found similar feed conversion efficiency and condition factor in *C. gariepinus*, when they fed on sinking and floating diets. Comparable results were experienced in *Lutjanussp* (Abbas and Siddiqui, 2013) and *Sparus aurata* (Sadek and co-authors, 2004). Moreover, Rahim and co-authors, (2015) found higher FCR (0.053 ±0.02) in *A. berda*by using 20% lipid and 42% protein containing commercial feed for 60 days in a controlled environment.

In this study we had observed 100% survival rate among both treatments by feeding 40% protein containing commercial feed in two different forms. Same results were found by Rahim *et al*., (2015) and (2016) with 100% survival ratio in juvenile, *A.berda*, Alava and Lim (1988) reported 92 to 98% survival in *Chanoschanos* fry, Mwangamilo and Jiddawi 2003 in milk fish, Daudpota and co-authors, (2016) in Nile tilapia. Many researchers reported that, high protein containing diet (50% or above) gave higher survival ratio and growth in fishes under controlled environment such as Parazo (1990) in *S. guttatus*, Yousif *et al*., 2005 in *Siganuscanaliculatus*.

Although, survival of fishes is directly associate with appropriate water variables in intensive system. Such as, Boyd, (1981) recommended salinity for *A. berda* was 17 to 20‰. Similarly, this level is considered as best for sea bass and seabreams in brackish water environment (Ercan *et al.*, 2015). However, 20 to 25‰were reported by Sadek *et al*., (2004) for *Sparus aurata* in brackish water ponds. In our study we were sustained post fries, *A. berda* in 20‰saline water with optimum 28.02±0.13°C water temperature. This range of temperature (27 to 28 ◦C) were suitable for warm water fishes reported by Mizanur *et al*., (2014); Mahboob and Al-Ghanim, (2014).

It is concluded that, both forms of feed either sinking and floating are suitable for optimum growth of seabream fries, *A.berda*, but 40% protein containing commercial floating feed gave better growth results by increasing body weight (5.84±0.1 to 23.6±0.2 g) than sinking feed (5.8±0.2 to 18.4±0.17 g) in intensive environment.

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