THE EFFECT OF THREE DIFFERENT DIETS ON GROWTH AND SURVIVAL OF PERSIAN STURGEON (*ACIPENSER PERSICUS*) LARVAE

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EFEKAT TRI RAZLIČITE HRANE NA RAST I PREŽIVLJAVANJE LARVI PERSIJSKE JESETRE (*ACIPENSER PERSICUS*)

Abstract

A feeding experiment was conducted to evaluate growth and survival of Persian sturgeon larvae fed with live food (*Nereis diversicolor* and *Daphnia* spp.) and artificial diet. Diets were included: Diet 1: Dafnia (*Dafnia magna*), Diet 2: *Nereis diversicolor* worm; Diet 3: Mix of Daphnia (*Daphnia spp.*) (50%) and *Nereis diversicolor* (50%), Diet 4: Mix of *Nereis diversicolor* (50%) and concentrate food (50%) and *Nereis diversicolor* (50%); Diet 5: Mix of *Daphnia spp.* (33.33%) and *Nereis diversicolor* (33.33%) and concentrate food (33.33%). Persian sturgeon larvae were distinctly transferred to 15 tanks and fed for 15 days. For each treatment, 60 larvae were stocked into tanks. The total length and body weight of the fish were determined once before initiation of the experiment and at the end of the experimental period to assess their growth performance. Water quality parameters were recorded two times a day**.** There was significant difference ($P<0.05$) in survival of Persian sturgeon larvae fed diets 2 and 3 and the other diets. Significant differences ($P>0.05$) were not found between diets 2 and 3 and also between diets 4 and 5.

The value for BWI, PBWI, GR, DGI, SGR was higher in larvae fed mix of *Nereis diversicolor* and *Daphnia spp.* (diet 3) ($p<0.05$) and there was significant difference between all of groups. Except diet 3 there was no significant difference in the CF of fish fed the survey diets.

Key word**:** *Growth, Survival, Acipenser persicus, Nereis diversicolor, Daphnia spp., Diets*

INTRODUCTION

Rearing of sturgeon larvae has received increasing attention in recent years (Buddington and Doroshov, 1984), due mostly to the fact that in several countries the wild stocks of these migratory fish are severely depleted or in danger of disappearance.. Earlier Information on nutrition and feeding is scarce for most sturgeon species, being limited and deal mainly with Atlantic sturgeon (*Acipenser axyrhynchus*) (Kelly and Arnold, 1999), lake sturgeon (*A. fluvescense*) (Dilauro et al, 1998), Adriatic sturgeon (*A. naccrii*) (Randall et al, 1992), and also for Persian sturgeon (Ebrahimi and Zare, 2006) most information is generated from nutrition studies conducted on white and Siberian sturgeon, but this information is still incomplete (Webster and Lim, 2002). Some larval feeding studies have comparing growth performance of larvae fed different live organisms with those fed dry or semi moist feeds (Lutes et al., 1990).

The use of live food in aquaculture in feeding commercially important fishes such as sturgeons and salmons has gained considerable importance as compared to formulated diets, whereby at present the main food in early stages of sturgeon larvae culture is comprised of live food such as *Artemia, Daphnia*, and Oligochaeta worms and the other foods such as *Nereis diversicolor* were not applied. The study of other live food including *Nereis* is an important objective of aquaculture.

Nereis diversicolor belongs to phylum Annelid and class polychaeta, which can be used as a live food in aquaculture, in the world.

The rag worm *Nereis diversicolor* (O.F. Muller, 1776) is typically an inhabitant of estuarine mud flats in Europe where it is one of the commonest of all shore polycaetes (Chambers and Milne, 1975; Heip and Herman, 1979 ; Mettam, 1979; Olive and Garwood, 1981; Fidalgo e Costa, 1994; Fidalgo e Costa and Cancela da Fonseca, 1995).

The quest for these species is increasing rapidly, mostly due to their important role as a nutrient stimulating gonad maturation and spawning in hatchery-reared species, e.g. *Solea senegalensis* (Dinis, 1986), *Penaeus kerathurus* (Luis, 1989) and *Penaeus vannani* (Lytle and Ogle, 1990).

MATERIAL AND METHOD

After hatching, 900 larvae of Persian sturgeon (*Acipenser persicus*) were transported to the laboratory (international sturgeon research institute) obtained in Shahid Beheshtie Sturgeon Hatchery Center, Rasht, Iran. They were placed into fifteen 60-L fiberglass tanks, (60 cm diameter ; water depth 25cm ; 3 tanks per diet ; 3 replicates per treatment) and were carried out the experiments for 15 days. For each treatment, 60 larvae were stocked into tanks. Water quality parameters were recorded two times a day (morning and afternoon). The water temperature, dissolved oxygen (DO), pH and flow rate were 22-23°C, 6-6.8 mg/L, 7-7.45 and 2 L/min. The 15-tanks system was supplied with change of water continuously. Larvae were sampled randomly before initiation of the experiment and at the end of the experimental period. The total length and body weight of the fish were determined once before initiation of the experiment and at the end of the experimental period to assess their growth performance. Data represent means and standard error from 3 replicates with initially 60 individuals stocked per tank. Diets were included: Diet 1: Dafnia (*Dafnia magna*), Diet 2: *Nereis diversicolor* worm ; Diet 3: Mix of Daphnia (*Daphnia spp.*) (50%) and *Nereis diversicolor* (50%), Diet 4: Mix of *Nereis diversicolor* (50%) and concentrate food (50%) and *Nereis diversicolor* (50%);

Diet 5: Mix of *Daphnia spp.* (33.33%) and *Nereis diversicolor* (33.33%) and concentrate food (33.33%).

In this study, Live *Daphnia* spp. as a control diet (diet 1) and cut *Nereis* worm was cut *Nereis diversicolor* worm cultured in laboratory. concentrate food was a sturgeon larval diet which has been used with success for sturgeon starter diet. Larvae were fed five times daily based on 30% larvae body weigh. After 15 d, 30 individuals from each tanks. Wet weight of larvae was measured by using a laboratory scale (0.01 mg). The Condition factor CF=W(g)/L(cm)^3)×100) and specific growth rate (SGR) was calculated using the following formula; SGR (%day^{-1})=100×(lnWt-lnWo)/t where Wt and Wo represent final and initial mean body weights and t is the growing period in days (Gisbert and williot, 1997). Total length (TL) was defined to be the distance from the tip of the snout to end of the upper lobe of the tail. Food conversion ratio (FCR) was consulated: FCR= Total feed intake (kg)/weight gain (kg). Dead larvae were counted daily, and the number of larvae survival at the end of the experiment was expressed as a percentage of the initial number. Percent mortality was determined by hand-counting all dead fish at the periods.

The effects of the different feeding sequences on growth and nutrient utilization parameters (SGR, CF) and mortality between experimental tanks on different periods were examined by a one-way analysis of variance (ANOVA) (Zar, 1974).

RESULTS

Differences between the means were compared by Duncan test at a 95% confidence interval at the end of the feeding trials using SPSS software.

Significant differences in final weights of larvae were found amongst the experimental tanks. There was significant difference ($P<0.05$) in survival of Persian sturgeon larvae fed diets 2 and 3 and the other diets. Significant differences ($P>0.05$) were not found between diets 2 and 3. Also significant differences ($P>0.05$) were not found between diets 4 and 5 (Fig 1).

A comparison of mean weights shows that fish fed mix of *Nereis diversicolor* and *Daphnia spp.* (diet 3) had a significantly ($P<0.05$) higher weight than the other diets and significant differences ($P>0.05$) were not found between diets 2 and 3 (table 1). In diet 3 treatment, the mean final weight of larvae was 282.21±4.16 mg, while in the trial fed mix of three diets (diet 5) this value was 210.83±1.56 mg (table 1). The value for BWI, PBWI, GR, DGI, SGR was also higher in larvae fed mix of *Nereis diversicolor* and *Daphnia spp.* (diet 3) ($p<0.05$) and there was significant difference between all of groups. Except diet 3 there was no significant difference in the CF of fish fed the survey diets (Fig3).

There was significant difference ($P<0.05$) in FCR of Persian sturgeon larvae fed diets 2 and 3 and the other diets. Significant differences ($P>0.05$) were not found between diets 2 and 3. Also significant differences ($P>0.05$) were not found between diets 1,4 and 5 (Table 1).

Table 1. Effects of different diets on growth and survival of Persian sturgeon larvae for a period of 15 days.

	Diet 1	*Diet 2*	*Diet 3*	*Diet 4*	*Diet 5*
Initial wt (mg)	95.66±0.97 a	95.66±0.97 a	95.66±0.97 a	95.66±0.97 a	95.66±0.97 a
Final wt (mg)	239.75±0.86 c	278.82±3.13 d	282.21±4.16 d	223.87±3.81 b	210.83±1.56 a
BWI	144.08±1.12 c	183.16±3.69 d	186.54±3.98 d	128.20±3.98 b	115.17±1.05 a
PBWI	150.63±1.89 c	191.51±4.97 d	194.99±4.04 d	134.04±4.53 b	120.38±0.62 a
GR	9.60±0.07 c	12.21±0.42 d	12.43±0.26 d	8.54±0.26 b	7.67±0.12 a
DGI	10.63±0.08 c	12.71±0.37 d	12.88±0.19 d	9.72±0.24 b	8.94±0.04 a
FCR	9.53±0.45 b	5.80±0.02 a	5.94±0.24 a	9.36±0.40 b	10.15±1.06 b

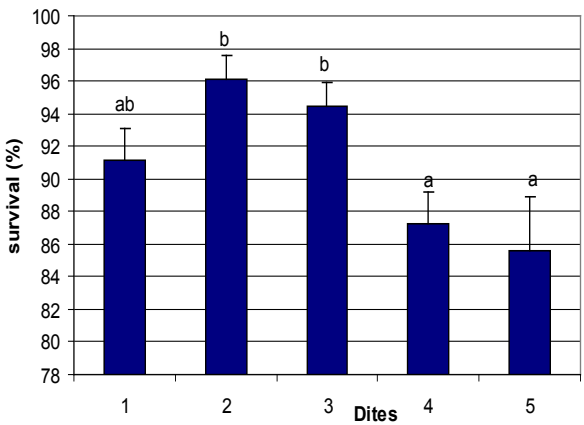

Figure 1. Effects of different diets on survival of Persian sturgeon larvae

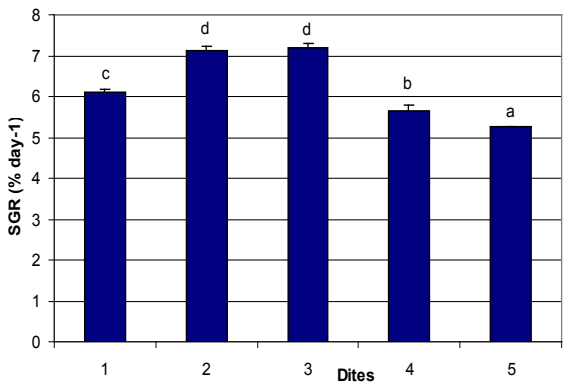

Figure 2. Effects of different diets on SGR of Persian sturgeon larvae

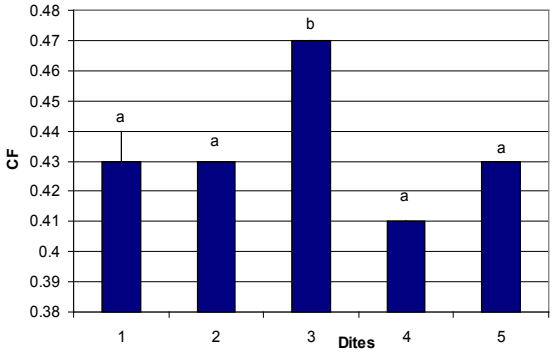

Figure 3. Effects of different diets on CF of Persian sturgeon larvae

DISCUSSION

Modern aquaculture is in need to improve the quality of the prepared fish feeds in particular for early life cycle stages, including start feeding. This problem is specially pertinent for sturgeons with due attention to an appropriate nutrient balance (Kasumyan et al., 1995).

Generally, our results indicate that Persian sturgeon larvae can be successfully weaned on prepared diets but loss in growth efficiency when compared to live food. Previous studies showed that the digestive system development of Persian sturgeon fingerling comes close to completion when reaching about 2.5 g (Soodakova, 1997).

Traditionally, hatchery-produced sturgeon larvae and fingerlings have been raised on live food organisms e.g. oligochaetes (*Enchytraeus* sp. and Tubifex sp.) and zooplanktonic organisms, such as *Daphnia* (*Daphnia* sp. and *Moina* sp.) or *Artemia salina* (Gisbert and Williot, 2002). Dabrowski et al. (1985) demonstrated that artificial larval diets could be used successfully for intensive commercial culture of several sturgeon species from the onset of exogenous feeding. These results are similar to those reported for *A. transmontanus* (Hung, 1991). An ideal larval sturgeon feed should be consisted of small (0.5- 1.4 mm diameter) soft pellets that sink rapidly to the bottom of a rearing tank and can be easily detected and ingested by larvae (Gisbert and Williot, 2002).

Laboratory experiments have demonstrated that food odour stimulates feeding responses in sturgeon larvae and juvenile (Kasumyan, 1999). As shown by Webster et al. (1991) who started feeding prepared diets after 17 days post-hatch in paddlefish and studies by Buddington and Doroshove (1984) comparing dry diets again *Tubifex*, we find in the literature similar results.

Mohler (2000) found that 26 days after feeding, the mean SGR in live *Artemia* feeds ranged between 4.9-11.1% per day. In our study, the mean SGR in live *Nereis* and Daphnia feeds was ranged between 5.26-7.21%.

Nathanailides et al. (2002) reported that on the third week after hatching, there were large and small size fish and that it was not possible to continue feeding all fish with the same size of dry feed diets. Furthermore, competition between the larger and smaller

fish for any food supplied was obvious and too great to be ignored. In this study, we found in the literature similar results.

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