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Effect of Different Concentration of Salinity on the Survival and Feeding of fingerling, Silver Carp (*Hypophthalmichthys molitrix*) (Valenciennes, 1844)

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Abstract - In the present study, different concentration of salinity (4, 6, 8, 12 and 14 ppt) was studied for 21 days during December 2015, and compared with 1.4 ppt to investigate its effects on growth, nutrition and survival percentage rate of Silver carp *(Hypophthalmichthys molitrix)*. The average of water temperature was 18.17 °C±1.3, dissolved oxygen was 7.9±0.60 (mg/l), hydrogen ion (8.13±0.327). The study showed that the mortality percentage for fish exposed to 14 ppt of salinity was 100 % after 24 hours, while the others was exposed to different concentration of salinity (4, 6, 8 and 12 ppt) were 0, 0, 0 and 25 % respectively after 21 days comparing with control (1.4 ppt) was 0 %. Inversely relationship was seen between food intake percentage and various concentration of salinity, the highest percentage of food intake 6.11 % in treatment of control (1.4 ppt) and the lowest 1.99 % in concentration 12 ppt. Statistic analysis was demonstrated that there significant differences ($P<0.05$) in rate of food intake ratio between treatments 1.4, 4, 6, 8 and 12 ppt.

Keywords: Silver carp, salinity, mortality percentage and food intake.

Introduction

Carps are belonging to the Cyprinidae family, which is the largest of freshwater fish in the world (Nelson, 1994). Carps has widespread in many centuries of the genus *Hypophthalmichthys* (Cindy *et al.*, 2005), originally described as *Leuciscus molitrix* Valenciennes 1844, (Eschmeyer, 2003). Silver carp is the native to large lakes and rivers of China, Northern Vietnam (Xie and Chen, 2001; Froese and Pauly, 2004). Silver carp are restricted in many states because of their tolerance in many habitat types and their ability to decrease phytoplankton (US EPA, 2006). Silver carp have been introduced to many countries, the exotic may became established in the large river system of Southern Iraq (Code, 2010). The Silver carp is a powerful filter-feeder with a wide food spectrum that grows (Lu and Xie, 2001). This species has a common food around the world and grows quite large up to one meter and can grow to weight more than 30 kilograms (ISSG, 2005; USGS, 2005). *Hypophthalmichthys molitrix* can tolerate salinities in the wide range of 6 -12 parts per thousand (ppt) and temperature in the range 0 - 40 °C (Coad, 2010). Adaptation of fish bony and a wide tolerate salt complex process that involves physiological responses in requirement of the external environment has changed through members of osmotic changes (Farabi *et al.*, 2009).

Many studies were showed increased of energy requirements and low feed rate in fishes with higher salinity levels and therefore a lower growth rate were a result of the low nutrition and exchange of energy (De Boeck *et al.*, 2000; Saleh, 2006; Luz *et al.*, 2008). Arjona *et al.* (2009) have pointed a decrease in food intake and growth in the *Solea senegalesis* fish at the salinity of 39 g/liter. The present was study aimed to investigate the impact of acclimatization of salinity on the growth, feed and survival of Silver carp fingerlings.

Materials and Methods

Silver carp *Hypophthalmichthys molitrix* fingerlings were brought from Marine Science Centerponds during December 2015, with an initial weight average of 1.961 ± 0.249 (gm) and, acclimatization and starved for one day prior to experiment. Five different concentrations of salinity *viz.*, 4, 6, 8, 12 and 14 ppt were prepared in addition to control (1.4 ppt).

Twelve glasses aquaria of 15 liter capacity, each one contains eight fishes with two duplicate aquaria for each treatment and equipped with pumps aeration for the purpose of providing dissolved oxygen for the fish. Collected fish were feed for 21 days during experiment with manufactured standard diet (Table 1).

Chemical composition was estimated (Table 2) depending on the methods proposed by A.O.A.C. (1981). The remanding food was pulled of two hours of feeding, dried and weighed to estimate the food initial (Maclead, 1977). This process was repeated each time for 21 days of exposure. Same ecological factor like the temperature (T), and hydrogen ion (pH) which was measured by using an equipment of HANNA Type model HI-9146 of German origin. The dissolved oxygen (DO) was measured by using an equipment of HACH type, model 156 of German origin.

Statistical program (SPSS) (ver. 17, 2011) (Statistical Package for Social Science) was used to conduct the statistical analysis for the results of the study using ANOVA test below t level of (0.05) and a test of least significant difference (LSD).

Table 1. Percentage of the components of the standard diet.

Components	Percentage (%)
Fish meal	31.93
Yellow corn	22.29
Soybeans	21.39
White flour	17
Sunflower oil	1
Metals	1
Vitamins	5

Table 2. The chemical composition of the diet used in the Fish feeding Silver carp.

Chemical composition	Percentage (%)
Protein	35.27
Carbohydrates	49.64
Fat	6.9
Ash	7.9
Moisture	0.29

To achieve the objective of the study a number of growth indicators is used depending on Jobling (1993).

Results

Ecological Factors:

The Table (3) shows the environmental factors that have been conducted during the duration of the experiment, as was the rate of water temperature 18.17 °C±1.3 and the rate of dissolved oxygen was 7.9 ± 0.60 (mg/l) while the rate Ion hydrogen (pH) was 8.13 ± 0.327.

Table 3. Environmental factors (average ± standard deviation).

Ecological Factors	Values
Water Temperature (°C)	18.17 ± 1.3
Dissolved Oxygen (mg/l)	7.9 ± 0.60
Hydrogen Ion (pH)	8.13 ± 0.327

The Effect of Different Salinity Concentrations on the Rates

The Figure (1) represents the survival percentage for Silver carps (*H. molitrix*), after exposed for 21 days for different concentrations of salinity. It was seen mortality was 100 % to fish exposed to 14 ppt after 24 hours and 25 % exposed to 12 ppt of salinity for 21 days of exposure while other treatments had no change.

Percentage for food intake at different salinity concentrations

Inversely relationship was seen between food intake percentage and salinity (Fig. 2). The highest percentage of food intake 6.11 % was seen in control treatment while the lowest 1.99 % with treatment exposed to 12 ppt of salinity, while the ratio of food intake 5.714, 5.6 and 4.85 % in treatments of 4 ppt, 6 ppt and 8 ppt respectively in the same order. The results showed significant differences ($P<0.05$) in the ratio of food intake between the control (1.4), 4, 6, 8 and 12 (ppt).

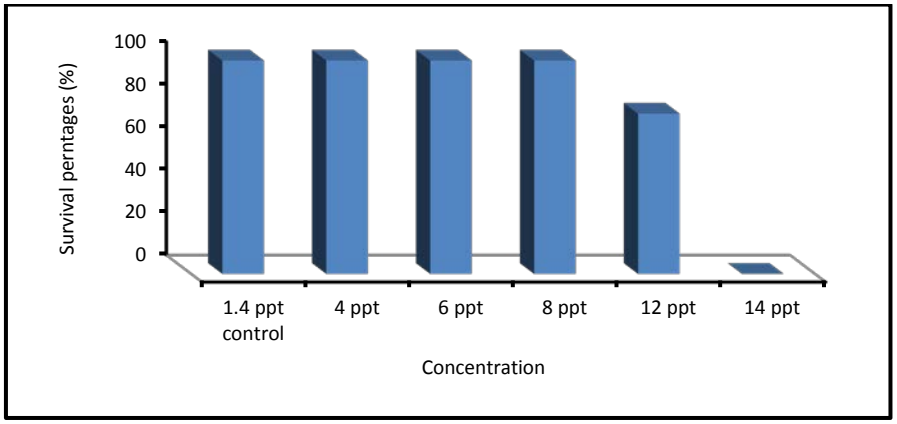

Figure 1. Percentage (%) of survival in different concentrations during 21 days.

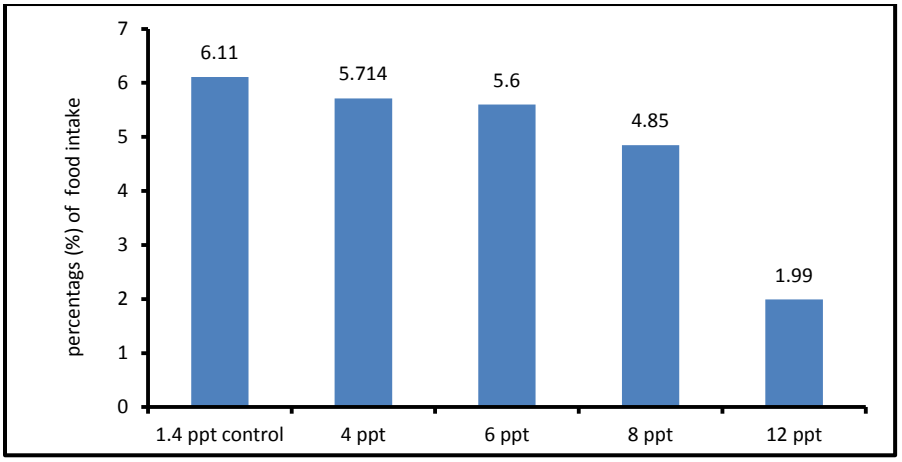

Figure 2. Percentage (%) of food intake in different concentrations during 21 days

The Table (4) shows initial, final weight rate and weight growth rate. It also shows the specific comparative in daily growth rates with different concentration of salinity (4, 6, 8 and 12 ppt) comparing with control. The lowest rate of the final weight 1.8 g/min treatment 12 ppt and reached the highest 2.421 g in treatment control. Significant differences ($P<0.05$) between the treatment exposed to 12 ppt and others (4, 6 and 8 ppt). The lowest rate of total weight growth was - 0.25 for the treatment of 12 ppt and the highest 0.709 in the control treatment and the lowest values -0.001 g/day, -12.19 % and -0.268 % in the treatment of 12 ppt and the highest 0.033 g/day and 41.41 %, 0.716 % in the control treatment of the rates daily growth and relative, specific of growth in the same order. The result of statistical analysis showed significant differences ($P<0.05$) in the values of the treatments rates, as mentioned above.

Table 4. Measurements for fingerling Silver Carp in different salinity concentrations (average ± standard deviation).

Conc. ppt.	Average Initial Weight (g)	Average Final Weight (g)	The total rate of weight (WG) g	The daily growth rate GR (g/day)	Relative growth rate (RGR) (%)	Specific growth rate (g/day) (%)
Control 1.4	1.712 ± 0.84	2.421 ± 1.68	0.709	0.033	41.41	0.716
4	1.542 ± 0.44	1.955 ± 0.524	0.413	0.019	26.7	0.490
6	1.867 ± 0.815	2.196 ± 1.39	0.329	0.015	17.62	0.335
8	1.993 ± 0.571	2.07 ± 0.740	0.079	0.003	3.86	0.078
12	2.05 ± 0.471	1.8 ± 0.341	-0.25	-0.001	-12.19	-0.268

Discussion

Abiotic factors have a direct role in the success of aquaculture operations (Akin-Oriola, 2003). Fish juveniles are very sensitive to environmental changes (Ghazi, 2009). However, salinity was considered as one of the most important ecological factors heavily fluctuates in our inland water environment (Hussein and Kamel, 2012). It was the effect of salinity on growth, food conversion rate and food intake (Al-Hamdani *et al.*, 2010). High concentrations of Salinity (14 ppt) led to killed all fish juveniles exposed after 24 hours due to low ability to tolerate high concentrations of salinity (Al-Faiz *et al.*, 2009), in addition to high osmotic concentration of blood plasma, which led to mortality occurrence (Arjona *et al.*, 2009).

The present study showed a significant difference in average of final weight among treatments, so the rate of food intake decreased with increased salinity because of effort in the process of osmotic regulation which causes disorder in the digestion process and loss of appetite (Ahmed *et al.*,2005), in addition increase in salinity levels lead to increase in metabolic rate as a result of the growth need to energy needed to osmotic regulate to maintain internal stability which reflects growth rate (Lazi-Carrion *et al.*, 2005). Sultan (2007) has been referred to a negative effect of salinity on food intake rate that reported in his study of effect salinity acclimatization in some physiological and nutritional for seabream silver fish.

The present study was showed that the best daily growth rate was found with lower concentrations of salinity (Saleh *et al.*, 2008). Also significant differences in the relative growth rate were found among treatment of 12 ppt and other, which has an impact on food intake rates (Faris, 2015).

It was noted that impact of high salinity in the growth rate was indirect due to the increased rate of energy osmotic and ionic regulation so that little energy which remained for growth (Boeuf and Payan, 2001). This study agreed with several studies by Imsland (2008) and Dimaggio (2010).

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تأثير التراكيز الملحية المختلفة على بقاء وتغذية صغار أسماك الكارب الفضي *Hypophthalmichthys molitrix* (Valenciennes 1844)

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المستخلص - أُجريت دراسة لمعرفة تأثير التراكيز الملحية المختلفة على نمو وتغذية ونسبة بقاء صغار اسماك الكارب الفضي (*Hypophthalmichthys molitrix*) ولمدة 21 يوم خلال كانون الأول 2015 في التراكيز 4 و 6 و8 و12 و14 غرام/لتر فضلاً عن معاملة السيطرة 1.4 غم/لتر، وكانت معدلات درجة حرارة الماء والأوكسجين الذائب والأس الهيدروجيني (18.17 ± 1. 3 °م، 7.9 ± 0.65 ملغم/لتر، 8.13 ± 0.327) على التوالي. أظهرت الدراسة هلاك الأسماك في المعاملة 14 غم/لتر وبنسبة 100 % بعد 24 ساعة من نقلها وكانت نسبة البقاء في المعاملات 4 و 6 و 8 غم/لتر ومعاملة السيطرة 100 % بينما كانت نسبة الهلاك في المعاملة 12غم/لتر 25 %. بينت الدراسة أعلى نسبة لتناول الغذاء 6.11 % في معاملة السيطرة وادناها 1.99 % في المعاملة 12 غم/لتر. أظهرت نتائج التحليل الاحصائي فروقاً معنوية ($P<0.05$) في معدلات تناول الغذاء بين معاملات السيطرة (1.4) و 4 و 6 غم/لتر والمعاملتين 8 و 12 غم/لتر.