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# Effect of pH on hatching and survival of Larvae of common carp *Cyprinus carpio* (Linnaeus, 1758)

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**Abstract**

Artificial hatching of common carp eggs was fulfilled in Marine Sciences Center hatchery. Fertilized eggs was taken from hatchery and was distributed in seven concentrations of pH (4.5, 5.5, 6.5, 7, 8.5, 9, 9.5). The results show that segmentation of eggs begin in each concentration especially in the critical concentrations (4.5, 5.5, 9 and 9.5). Then the eyes were formed and other organs respectively. After 48 hours hatching occurs by 85% in all concentrations. Hatched larvae were distributed on the same concentrations, survival rates of larvae in concentrations ( 4.5, 5.5, 6.5, 7, 8.5, 9 , 9.5) were 50% , 54% , 60% , 95% , 90% , 20% , 0 respectively after 24 hours from hatching.

## 1- Introduction

pH of the water is one of the most important environmental factors affecting fish farming. Excessive acidification as well as alkalization are detrimental to fish development. According to EIFAC criteria (1971) water pH safe for fish ranges from 6.5 to 8.5. The effect of acidity on fish was confirmed at first once by Dahl (1926). In carp ponds temporary alkalisation may occur during hot summer, usually due to algal blooms, reaching sometime pH over 10.0 (Alabaster and Lloyd 1980).

Chemical parameters of water in lakes and rivers regard that have effect on organisms by any food of level in ecological systems (Wright *et al*. 1975). Researchers often interested in the impact of low and high concentration of pH on the survival of fish, especially salmon when there is a significant loss of stock due to a low concentration of pH in the rivers, west

Norway (Munize *et al*.,1975). Leivestad and Munize (1976) explained that the mortality of fish is due to differences in ion balance, and this happened due to the low concentration of pH in the water. The acidity (low value of pH) can affect on reproduction, the composition of communities, growth and food choice (Almer, 1972; Andersson, 1972; Beamish, 1974; Carrick, 1979). Also Milbrink and Johansson (1975) noted that the development stages of eggs and larvae in the fish are most sensitive at low levels of pH. The embryo stage was found to be particularly sensitive in fish (Brown and Sadler, 1989). Low pH leads to denaturation of the hatching enzyme and subsequently to deformation of the embryos and high embryonic mortality as well as hatching delay in various fish species (Kwain and Rose, 1985; Ingersoll *et al.*, 1990). The aim of this work is to study the effects of different pH values on embryonic development and survival rates of common carp larvae.

**2-Materials and Methods**

Three adult females and two males of common carp *Cyprinus carpio* were selected from aquaculture experimental station at the Marine Science Center *(www.msc-basra.com)*. Adults were transferred to the fish hatchery, then were weighed. The quantity of pituitary gland hormone was estimated, which was injected in the adults fish depended on weight of adults. The standard quantity of pituitary gland hormone, which inject in common carp for artificial spawning (3-4 mg / kg weight of fish). The quantity of hormone divided into two injections. The first was 0.1 from total quantity of hormone, and the second after 12 hours, the females was injected with residual (0.9) from total quantity of hormone. At the next day the eggs were taken from females and put in plastic bowls and fertilized by sperm of male by dry method. Then the fertilized eggs was washed by fertilization solution for one hour. Then it was towed by tannic acid. Seven different concentrations of pH were supplied (4.5, 5.5, 6.5, 7, 8.5, 9, 9.5) and distributed these concentrations in the flasks capacity 750 ml. This system ready for hatching by three replicates for each concentration. Eggs was flipped by air which provide by three pumps instead of current of water (Fig. 1). The fertilized egg were distributed to 100 eggs for each replicate. The water temperature was fixed to 24 c˚. The same concentration of pH were prepared in plastic basins ( 3 liters) to receive the hatched larvae. The statistical analysis SPSS was used for data analysis, and test LSD (Least Significant Deference) to test the significant difference between the treatments ($P<0.05$).

**Fig. 1. Photograph for system of the artificial hatching.**

## 3- Results

### Effect of pH on embryonic development and larval hatching

Cell division of eggs began in all concentrations after two hours of putting the fertilized egg in different pH concentrations was examined. After 24 hours the embryo was formed until it reached to the stage of eye formation and is clarity of heart beats and the appearance of tail movement. Any stoppage did not appear in embryonic development at whichever stage in any concentration of pH. The hatching occurs after 48 hours. The hatching rate of larvae was 85% in all concentrations .

### Effect of pH on the survival rate of larvae

After the distribution of hatched larvae on concentrations of pH which it used in the experiment to observe the effect of these different concentrations on the survival of larvae during the next 24 hours. The survival rates of larvae survival in pH concentrations of 4.5, 5.5, 6.5, 7, 8.5, 9 and 9.5 were 50% ,54 % , 60% , 95% , 90% , 20% and 0% respectively (Fig. 2). From statistical analysis appeared that there is significant differences in survival rates ($p<0.05$) among most concentrations beyond pH 7 and 8.5 no any significant differences was shown ($p>0.05$).

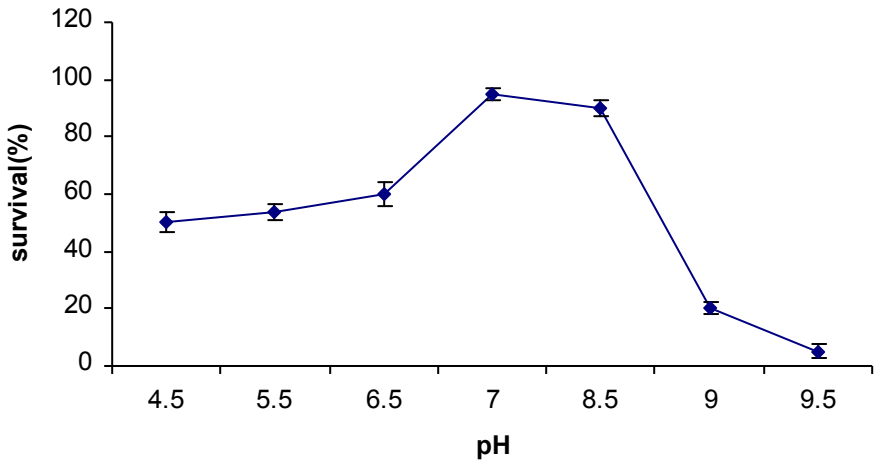


**Fig. 2. Survival rates of common carp larvae after 24 hours from hatching in Different pH concentrations.**

**4- Discussion**

The pH regards one of the environmental factors that have effect on some stages of the life of fish, especially in the larval stage. This study proved that the eggs of common carp *Cyprinus carpio* exposed to different concentrations of pH hatched at suitable time and with high percentage (85%). When the hatched larvae were transferred to the same concentrations of pH, showed deferent survival rates. A higher specific mortality rate often occurs immediately following the period of strictly endogenous yolk feeding, and during the period of first exogenous feeding (Sifa and Mathias, 1987). As any environmental change can lead to high mortality and it is consistent with what the Claiborne and Heisler (1986) said that any change in the pH of the fish environment of fish have an impact on the pH of blood plasma and this has a negative effect can lead to mortality in fish larvae. This happened when larvae of common carp exposed to different concentrations of pH. Also the results explained that the low and high concentration of pH leads to mortalities of many fishes larvae. While it was noted by Brownell (2003) when he put the fish larvae in different concentrations of during 24 hours and observed ability to first feeding. Where the larvae are sensitive during the first four hours to nutrition in the concentrations of the high pH. Our study showed high mortality in larvae which exposed to high pH (9 , 9.5). Reduced oxygen consumption in fish exposed to

alkaline water was observed by Murthy *et al*. (1981), it resulted from difficulties in oxygen uptake by gills and disturbances in oxygen transport by blood. Similar changes were observed by Jezierska (1988) in fish exposed to alkaline environment. Damage or covering with mucus of gill epithelium and chloride cells may also result in impaired ion exchange. Muniz *et al.* (1975) reported that disturbances in ionic regulation, especially loss of sodium, were a direct cause of fish mortality. Also from results noted high mortality in larvae when displayed to low pH. Fish larvae sensitivity begin in all levels of the low pH where it harmful to them, especially in the lower levels from 6.0. And the cause of mortalities that obtain to fishes at low levels of pH is the imbalance between the place where the fishes live and the content of body fluids (Wilson *et al*. 1999).

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# تأثير الأس الهيدروجيني على تَفْقيس واعاشــة يرقاتِ اسماك الكارب الشائع *Cyprinus carpio* (Linnaeus, 1758)

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**الخلاصة**

أجريت عملية تلقيح اصطناعي لبيضِ اسماك الكارب الشائعَ في مفقسِ مركز علوم البحار. أُخِذتْ كمية من البيض المُخَصَّبِ مِنْ المفقسِ ووُزّعتْ في سبعة مِنْ تراكيز الأس الهيدروجيني (4.5, 5.5, 6.5, 7, 8.5, 9, 9.5). وَضعتْ هذه التراكيز في قناني زجاجية سعتِها 750 مل بثلاثة مكررات. بَدأَ انقسام خلايا البيضِ في كُلّ تركيز خصوصاً في التراكيز الحرجةِ (4.5، 5.5، 9 و9.5)، ثمّ تكونت العيون والأعضاء الأخرى على التوالي. فقّستْ اليرقاتِ بنسبة 85 % بعد 48 ساعةِ. وُزّعتْ اليرقات الفاقسة على نفس تراكيز الـ pH ثم حسبت نِسَب بقاءِ اليرقاتِ في التراكيز (4.5، 5.5، 6.5، 7، 8.5، 9 ، 9.5) كَانتْ 50 % ، 54% ، 60% ، 95% ، 90% ، 20% ، 0 على التوالي بعد 24 ساعةِ مِنْ التَفْقيس.