Effect of Magnetized water on the growth of the common carp *Cyprinus carpio* (L., 1758)

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Abstract

Common carp, *Cyprinus carpio* (L., 1758), fry were used with 0.19 g average weight to estimate the effects of magnetized treated water on fish growth and survival , The experiment was carried out with two treatment and control, 500 fish fi h were randomly distributed at 100 fry fish per replicate per(T1)and(T2) and one replicate for control. Magnetized treated water was used for a period of 24 hours with a magnetized intensity of 1000 gauss in the first treatment, and 1500 gauss in the second treatment. The experiment continued from April to end of June2016. The temperature of the water during the experiment period was ranged 25.9- 27.8 ° C, and oxygen level ranged between (4.8 – 7.1) mg / L. magnetization system was operating 24 hours a day. YSI some environmental factors such as water salinity, pH and water temperature were measured using YSI. Fish were fed twice a day, with 10% of the total weight of fish, with a total protein content of 37%. The gain weight obtained after eight weeks was 1.27±0.049g in (T2), 1.13±0.021g in (T1), while the highest weight in the control treatment reached 0.92±0.007g. The mean of gain weight in the reared fish in (T1) for eight weeks feeding period was 1.10 ± 0.77 g. and in the treatment of 1000 gauss was 0.96 ± 0.67 g, while the mean of gain weight in the control treatment was 0.96 ± 0.53 g. common carp survival rate reared in magnetic water varied under the influence of different magnetic intensities within eight weeks. It was found that the highest survival rate was under the influence of the magnetic intensity of 1500 gauss which was 93%, and the percentage of surviving under magnetic intensity 1000 gauss was 82%, while in the control treatment, it was 45%.

Key words: magnetic field, fish growth, Common carp.

Introduction

Water is one of the most important inorganic compounds in the body. In order to possess these important physiological functions within the body, water must be characterized by some effective properties to become more flowing within the tissues of the body and reach the different organs (Michal, *et al.*, 2002). Therefore, many researches have been carried out researches to improve the water specifications (Hussen, 2002).

Denver (1996) explained that it is possible to produce many positive effects if the water is exposed to a magnetic field with a certain intensity, and then affect the properties when the physical and chemical properties of water change, after magnetic treatment, it becomes more vital and biologically active because it helps in the movement of the blood the tissues of the body (Habbas, 2004; 2005, Tkachenko, 1995).

The water retains its magnetic power for a period of time after its magnetism; magnetic intensity depends on the strength of the magnetic field, the duration of the tangency (water velocity), the retention time, and the temperature (Lin and Yotvat, 1990).

Forrnick and Winnicki (1998) noted that the magnetized field affects the larvae of fish, as it stimulates changes in the blood circulation of the eggs, pike fish larvae, common carp, *Cyprinus carpio*, which exposed to a magnetic field. Farther more of the magnetized field caused a change in the exchange of gas and an increase in the process of breathing depending on stages of embryonic development, especially at the period of organogenesis, and its effected the sense of direction in the movement of fish. Recent studies have shown the importance of olfactory devices in magnetized sense when fish migrate to possess magnetic receptor cells (Tesch *et al.*, 1991) Hemmers bach *et al.* (1997) confirmed that there is a positive effect of the magnetic field on the velocity and direction of fish depending on the strength of the magnetized field because of its direct effect on the mechanism of calcium and magnesium ion transport through the cell wall Ca-Mg ion transport.

The application of magnetic systems for fish breeding in ponds and other artificial ponds leads to magnetically treated water in fish ponds. Magnets are installed in the form of magnetic fountain spray inside the lake, or in the form of a reverse system, or by connecting magnetic devices to the main pipeline that provides the lake with water. The water, food and small fish are magnetically treated and this leads to bioactive water, which increase the oxygen content in the water by more than 5 mg/ L without the application of ventilation systems, which increase the activity of the fish reducing the water viscosity, and ultimately facilitating the fish swimming by reducing the fish

weight while swimming and spending less efforts for movement, (Magnetic Technologies LLC, 2004).Verkman (1999) found that the magnetic field affects channels of the water holes in the cell membrane and increases the permeability of the membrane.

The present study aimed at determine the effect of using magnetized water on fish growth, of Common carp, Cyprinus carpio

Materials and Methods

A total of 500 common carp fry, *Cyprinus carpio*, have been used their average weight0.19 g to estimate the effect of magnetically treated water on fish growth of Common carp

The experiment was carried out with two treatments and on as control, 500 fry fish were randomly distributed at 100 fish per replicate five glass aquarium were used with a aquarium of (60×40×40) cm, taken two replicates for each treatment. Magnetically treated water was used for 24 hours. The first treatment was 1000 gauss (T1) and the second was 1500 gauss (T2), while control treatment was considered as tap water. The magnetization system was operated 24 hours a day, with a partial change of water per week from all treatment. The fish weights were taken from all replicates weekly. Using YASI device, some environmental factors such as salinity, pH, and temperature were recorded for all treatments at the beginning and after the end of the experiment

The experiment continued from April to end of June 2016. Feeding was given twice a day, 10% of the total weight of fish and, a total proteins 37%. After the experiment was completed, survival rate and the averages of fish weight were calculated.

Table (1): shows the diet ingredients

ingredients	%
Fish meal	36.08
Soybean meal	26.62
wheat flour	18.56
Yellow Corn	18.56
Vitamins	5
Oil	1
Vitamins + Minerals	1.5

Biological indicators:

Growth indicators were calculated according to Jobling (1993)

Total weight increase (WG) g = Final weight (g)–initial weight (g)

Daily growth rate DGR g/ day = final weight rate - initial weight/duration (day) of experiment

Relative growth rate RGR = final weight rate - initial weight/primary weight (g) x 100.

Specific growth rate SGR% (g / day) = Ln. Final weight–Ln. Initial weight/ duration of experiment (day) × 100.

Table (2): shows the chemical analysis of diet.

Components (Chemical composition)%	
Moisture	0.26
Protein	37.00
Fat	8.84
Ash	11.00
Carbohydrate	42.64

Results

The water temperature during the experiment was period ranged between 25.9-27.8 ° C and the oxygen contents were between 4.8-7.1 mg /L .as give in table 3.

Table 3: values of some environmental factor for 1000 Gauss, 1500 Gauss, and control treatments during the experimental period

Environmental factors	Control Tap water	T1	T2
DO% mg/l(PPM)	4.87	7.30	7.10
pH	7.00	7.20	7.30
°C	27.83	25.95	26.43
MS/CMc	4.10	4.21	4.33
Ms/CM	4.32	4.29	4.45
TDS g/l	2.66	2.74	2.81
Sal/ppt	2.16	2.23	2.30

Table 4: Average fish weights (gm.) changes of common carp fry waits in different treatment of magnetic water.

	Periods							
Treatment	1st week	2nd Week	3rd Week	4th Week	5th Week	6th Week	7th Week	8th week
Control (tap water)	0.24 ±0.014	0.25 ±0.017	0.32 ±0.142	0.58 ±0.007	0.61 ±0.014	0.63 ±0.016	0.73 ±0.007	0.92 ±0.007
T1	0.25 ±0.021	0.33 ±0.007	0.38 ±0.021	0.67 ±0.042	0.69 ±0.014	0.79 ±0.035	0.84 ±0.007	1.13 ±0.021
T2	0.42 ±0.007	0.45 ±0.014	0.50 ±0.014	0.83 ±0.021	0.85 ±0.007	0.87 ±0.021	1.05 ±0.007	1.27 ±0.049

Results showed (table 4) that the highest weight obtained after eight weeks was1.27±0.049 g in water treated with 1500 gauss, while in 1000gauss treated water, was 1.13 ±0.021g and in the control treatment the weight was 0.92±0.007g.

Figure 1 show the weight of common carp fry per week under the magnetic treatment effect of 1000 gauss and 1500 gauss strength compared with the control treatment. The fish growth during the first week, second week, and third week were slowly and increased in the other week level of0.92 increase reached of 0.92±0.007 g, 1.13±0.021 g, and 1.27±0.049 g in the treatment of control, strength of 1000 gauss and strength of 1500 gauss respectively.at end of experiment.

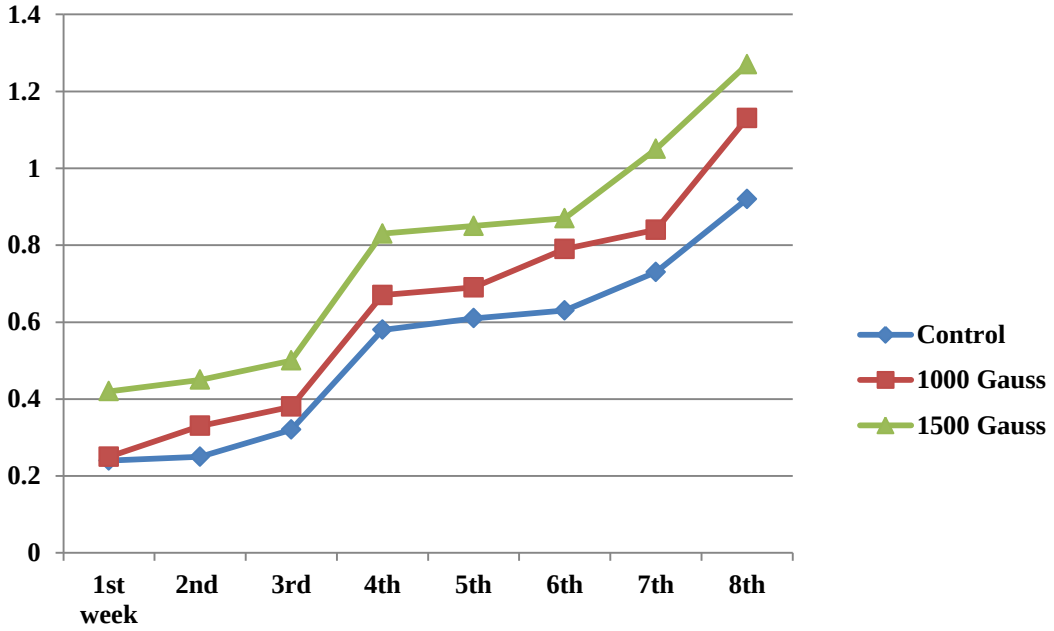

Figure 1: changes in weights of common carp fry in different treatmentduring the study period.

The final weight in the magnetized water 1500 gauss was 1.27 g ± 0.049, while the final weight was 1.13 g ± 0.021in the water treated with 1000 gauss and In the control treatment, the final weight was 0.92 g ± 0.007. The average of weight increase in fish fed in the treatment of 1500 gauss for 40 days feeding period was 1.10 ± 0.77 g. and in the treatment of 1000 gauss it was 0.96 ± 0.67 g, while in the control treatment was0.96±0.53 g.

Table 5: weight increase, daily growth rate and relative growth and specific growth, of common carp fry reared under the influence of different magnetic strengths.

Treatment	WG Gm	GR g/day	RGR%	SGR%g/day	Final Weight Rate
Control (tap water)	0.96±0.53	0.01875	441.176	4.221	0.92±0.007
T1	0.96±0.67	0.024	564.705	4.735	1.13±0.021
T2	1.10±0.77	0.0275	647.058	5.027	1.27±0.049

Figure(2) shows that the highest daily growth rate was 0.0275 g in the treatment of 1500 gauss, while in the treatment of 1000 gauss was 0.024 g, While the daily growth rate in the control treatment was 0.0187 g.

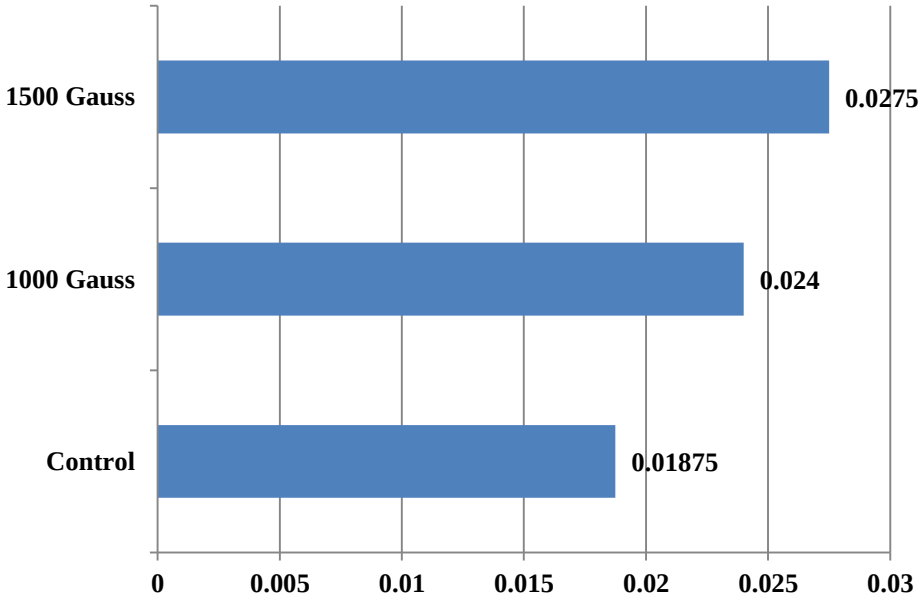

Figure 2: Daily growth rates of fry Common carp fry reared under different magnetized water.

Figure (3) shows the relative growth rate of Common carp fry in magnetized water under the influence of different strengths. The value of that treated with 1500 gauss was 647.05, while that treated with 1000 gauss, was 564.07 and was the relative growth value in the control treatment was 441.17%.

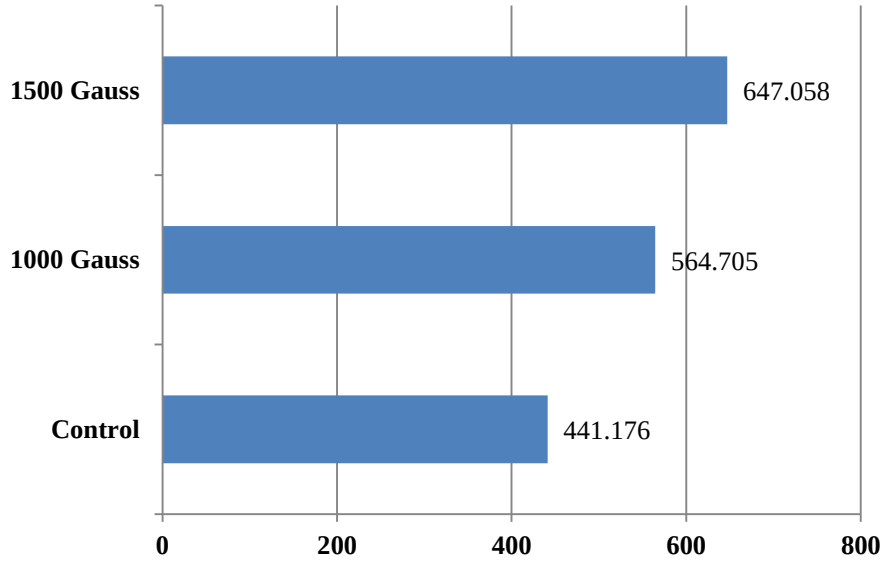

Figure 3: The relative growth % of Common carp fry in different magnetized water.

Figure (4) shows the survival rate of common carp fry in the magnetized water under the influence of different magnetic strengths within 8 weeks period. It was found that the highest survival rate occurred under the influence of strength 1500 gauss (93%) while the survival rate under strength 1000 gauss was(82%), the lowest was at control (45%.)

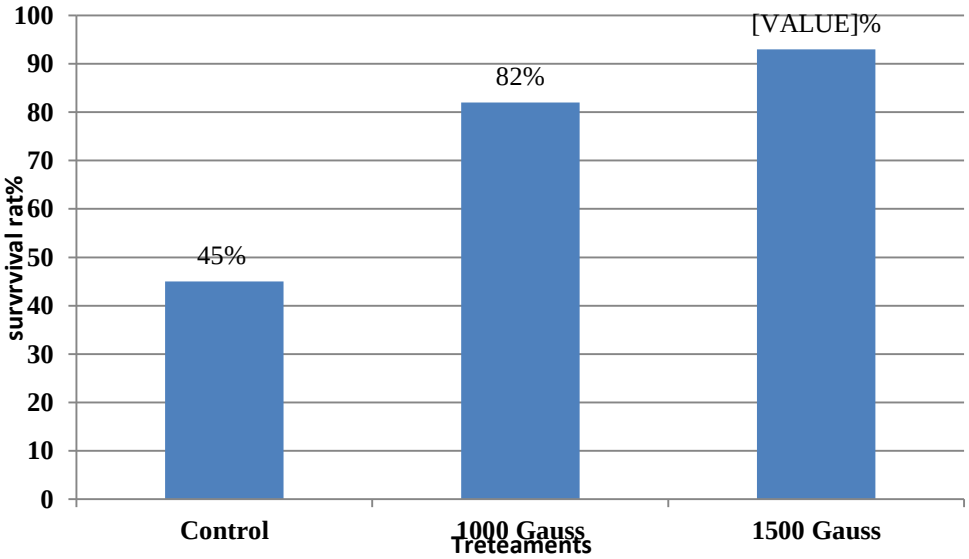

Figure (4) Survival rates % of common carp fry in diffrent magnetized water

Figure (5) show that the highest growth rate for Common carp fry was 5.027% g/day in the water treated with 1500 gauss, while it was 4.735 in the water treated with 1000 gauss and 4.221 in the control treatment.

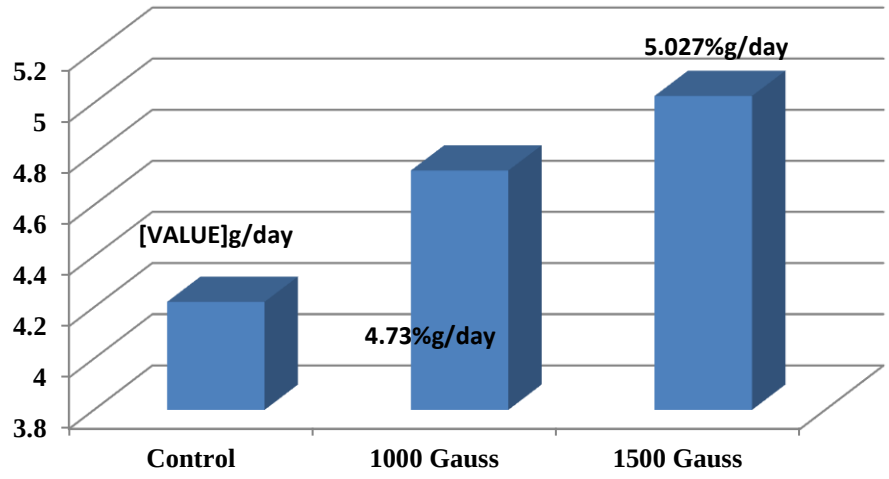

Figure 6: The specific growth of the common carp fry

Discussion

The results of this study shows that magnetized intensity had a clear effect on the weekly growth rates of fish fry due to that magnetic intensity changes the acidity of the blood, which in turn affected the feeding of fish (Lam, 2001). The highest growth was found in the (T2) during the experiment period, where fish were given a great impetus to growth.

The experimental of this study factors during the study period by increasing the intensive of magnetic strength T2. These changes in the physical and chemical properties of water in this treatment which may be are due to the magnetized intensity factor Al-khazan, and Saddiq (2010) pointed out that the use of magnetic intensity to treat the lake water had a vital role in post-chemical, physical and biological changes. The value of the pH was increased to the basal and the impurities were deposited to the bottom of the lake because of low surface tension and low bacterial count compared to pretreatment totals. Magnetic treatment of water makes it saturated with oxygen Al-khazan, and Saddiq (2010).

Differences in the final weight gain were due to differences in magnetic intensity. The specific growth rates in the current study were somewhat higher in the second treatment also because of higher intensity.

the highest weight survival rate of carp fry was in the second treatment,(1500 guss). this may be due to the magnetic intensity that changes the chemical and

physical properties and the positive effect on growth. The physical properties of water and the magnetic field had a clear effect on the
movement and activity of fish and their positive effect on growth. (Cutler and Cramb, 2002).
lower averages of relative and specific growth in the control treatment and of 1000 gauss, as the magnetic intensity may change the acidity of the blood, which in turn affects the rates of fish feeding. Nagy, and Szilagyi (1996) Proved that the magnetic treatment of water makes it oxygenated, showing biological ability to kill germs and increases the production of hydroxyl ions in his study.

The highest surviving rate of common carp fry was in the treatment of 1500 gauss and lowest in control treatment Results of the study also showed that there are low rates in the control treatment and this is because fish need high oxygen rates for survival and growth. Water, food, and micro-fish are treated magnetically for bio-active water, which increases the oxygen content in the water more than 5 mg/ L without using ventilation systems, and lead to increase the activity of fish and reduce the viscosity of water and thus facilitate fish swimming and reduce the effort in the movement, which weight energy due to the lack of effort during swimming (Magnetic Technologies LLC, 2004).

The study showed that there were significant differences between the treatments on the effect of using magnetized water in fish culture and different intensities in fish growth. The treatment treated 1500 gauss on the treatment of 1000 gauss and control treatment positively. The second treatment reached the highest values compared to the control treatment and the first treatment.

The various treatments of magnetized water have recorded differences when compared with the treatment of control that magnetized water promotes the formation of high blood cells by increasing the rate of intensity by stimulating the growth of lymphatic tissues responsible through the formation of white cells defensive, which play an effective role in the biting germs and foreign bodies And lead to an increase in immunity, where the treatment was the second highest values during the weeks. There were significant differences between the two treatments and between control and did not differ significantly between the comparison control treatment.

Conclusions

1. The magnetic water increase the growth of common carp fry and their survival rate.
2. Improved survival rates in magnetically treated treatments compared to control with high magnetized water intensity

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تأثير المياه الممغنطة على نمو يافعات اسماك الكارب الشائع *Cyprinus carpio* (L., 1758)

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الخلاصة

استخدم الماء الممغنط في تربية يافعات اسماك الكارب العادي *Cyprinus carpio* (L., 1758) بمعدل وزن 0.19 غم لمعرفة تأثير المياه الممغنطة في نمو الاسماك للفترة من4/27 ولغاية 28/ 2016/6.وزعت 500 سمكة عشوائيا لكل مكرر100 سمكة، وبمكررين لكل معاملة على احواض التجربة. استعمل الماء الممغنط على مدى 24 ساعة ,في المعاملة الاولى (T1) بشدة 1000 كاوس والثانية (T2) بشدة 1500 كاوس بينما اعتبرت معاملة السيطرة (ماء اسالة).وبمكرر واحد، تراوحت درجة حرارة الماء اثناء فترة التجربة بين (25.9-27.8)°م والاوكسجين بين (5-7) ملغم/لتر. ، سجلت بعض العوامل البيئية كالملوحة و الاس الهيدروجيني والحرارة لجميع المعاملات. بواسطة جهاز YASI، تم إعطاء العلف بنسبة 10% من الوزن الكلي للأسماك وبواقع مرتين باليوم بنسبة بروتين كلي بلغت 37%. بلغ اعلى معدل وزن 1.27±0.049 غم في المياه المعاملة بقوة 1500 كاوس (T2) في نهاية التجربة، في حين كانت في القوة 1000 كاوس (T1) 1.13±0.02غم بينما بلغت في معاملة السيطرة 0.92 غم. ان معدل الزيادة الوزنية الحاصلة في الاسماك المرباة في معاملة (T2) لفترة تغذية 40 يوم كان 1.10±0.77 غم، اما معاملة (T1) فكانت 0.96±0.67 غم, في حين كان معدل الزيادة الوزنية في معاملة السيطرة 0.96±0.53 غم. وان اعلى نسبة للمعيشة كانت تحت تأثير القوة 1500 كاوس حيث بلغت 93% بينما تحت القوة 1000 كاوس بلغت النسبة 82% وفي السيطرة سجلت 45%.

كلمات مفتاحية: مياه ممغنطة، تربية اسماك، الكارب الشائع، *Cyprinus carpio*