Effect of Supplementary Diets on the Common Carp *Cyprinus carpio* L.

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Abstract

Experiment for sixty days was done to study the effect of different supplementary diets and starvation on the common carp *Cyprinus carpio* L. growth and health status. A total of 120 fishes weight (22.5 ± 0.6 g / fish) were distributed for four treatments . The first T1 contains 10% of black seed powder (cumin) *Nigella Sativa*, the second T2 of 1% of garlic powder *Allium sativum*, the third T3 has a mixture of 10% black seed with 1% garlic powder and the fourth T4 free from cumin and garlic powders. The treatments T2 and T4 were recorded significantly higher ($P \leq 0.5$) as the best grains and increase in fish daily weight, feeding efficiency and increase in white blood cells WBC numbers. Also, the same treatments T2 and T4 recorded significant decreases ($P \leq 0.5$) for fish hemoglobin concentration and red blood cells RBC numbers. Ffluctuation in results were observed for fish growth and its health during of the experiment, and the best results observed when adding 1% of garlic to the diet with one feeding every 24 hours as well as the treatment T4 (without cumin and garlic).

Key Words : Fish Supplementary Diets , Medicinal Plants , Growth ,and Health Status .

تاثير العلائق المدعمة على اسماك الكارب الشائع *Cyprinus carpio* L

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الخلاصة

اجريت تجربة لمدة ستون يوما لمعرفة تاثير العلائق المدعمة المختلفة مع التجويع على النمو والحالة الصحية لاسماك الكارب الشائع *Cyprinus carpio* L . وزعت 120 سمكة بمعدل وزن (22.5 ± 0.6 غم/سمكة) على اربع معاملات. احتوت المعاملة الاولى T1 نسبة 10% من مسحوق حبة البركة *Nigella sativa* L. ، والثانية T2 نسبة 1% مسحوق الثوم *Alium sativum* ، والثالثة T3 خليط من 10% مسحوق حبة البركة مع 1% مسحوق الثوم، والرابعة خالية من مسحوقي حبة البركة والثوم. سجلت المعاملة الثانية T2 ومعاملة T4 (السيطرة) ارتفاعا معنويا ($P \leq 0.5$) بالزيادة الوزنية اليومية وكفاءة العلف المستهلك وزيادة في عدد خلايا الدم البيض للاسماك . في حين سجلت المعاملتين نفسيهما T2 و T4 انخفاضا معنويا ($P \leq 0.5$) لتركيز الهيموغلوبين وخلايا الدم الحمر للاسماك نفسها . لوحظ تذبذب القيم بمعايير النمو والصورة الدمية للاسماك اثناء مدة التجربة، وسجلت افضل النتائج عند اضافة نسبة 1% من الثوم الى العليقة مع التغذية مرة واحدة كل 24 ساعة فضلا عن المعاملة T4 الخالية من مسحوقي حبة البركة والثوم وخليطهما.

الكلمات المفتاحية: علائق الاسماك المدعمة، النباتات الطبية، النمو و الحالة الصحية.

Introduction

Fish diet quality and its cost may increased the cost of fish farm production as well as the aquatic contamination which may occurred (Drew *et al*., 2008). Recently, several attempts have been taken for fish diets supported within unusual additions (medicinal plants). These researches focused on growth rates increments to reach fish marketing sizes and improve its health within short time (Abdelwahab and El-Bahr, 2012). Fish starving for different periods and fed with supplementary diet is the mainly purpose for rapid growth as well as increasing in fish resistance against disease (Abu-,Elheni *et al*., 2013; Tripath and Verma, 2003). The most important of these fish supplementation diets are the powder of black seed *Nigella Sativa*, Family: Ranunculaceae (Al-Shawy and Al- zaidi, 2009) and garlic powder *Allium sativum* Family: Aliaceae (Al-atabby, 2012). The aim of the present study are :

1-To observe the effect of fish starvation and then provided with supplementary diet on growth and health status.
2- Reducing in the main fish diet amount and its effect on growth and health status.

Materials and Methods

I. Experimental Fishes

Fishes of *Cyprinus carpio* L. (average weight of 22.5 ± 0.6 gm / fish) were transferred from a civilian fish farm, to the laboratories of Fish Research Department/ Fish and Animal Research Center/ Al-Zuaafaraniyah south of Baghdad during 2013. Fish were exposed to saline water (3‰) for a period of five minutes to clean them from external parasites until appearance signs of stress (Al-Atabby, 2012). A total of 120 fishes were distributed randomly on 4 treatments with 3 replicates / treatment (10 fish / glass aquarium size of (60 × 30 × 30 cm). These fishes were adapted for two weeks on the laboratory conditions, and fed by 2% of its weight commercial diet of 32 % protein (fish meal 25%, soybeans 35%, maize 4%, barley 6%, wheat bran 25%, vitamins, 3%, oil food 1.5%, 0.5% antioxidants).

2 - Experimental design

Fish were fed for sixty days (from 25 April to -26 June 2013) on four different diets by 3% of its weight (Table 1). Starvation for one day fed next day for experimental fish was carried out of 60 days before introducing meal as in table (1). Tables 2 and 3 represents the chemical composition of cumin and garlic, respectively

Table (1) The Components (%) of Supplementary Diet for the Experimental Fishes.

Components %	Treatments			
	T1	T2	T3	T4 (control)
Meal protein	10	10	10	10
Soybean	15	24	15	25
Yellow corn	15	15	14	15
Local barley	22	22	22	22
Wheat bran	25	25	25	25
Vitamins	2	2	2	2
Neutral salt	1	1	1	1
Powderof cumin	10	-	10	-
Powder of garlic	-	1	1	-
Protein ratio	21.1	23.5	23.3	23 6.

Total Colum = 100%

Table (2) **The Chemical Composition of Black Seed (Cumin)** ***Nigella sativa*** **Seed According to Menounos *et al*.,(1986)**

Components	Percentage
Fat	33.5
Protein	18
Carbohydrates	33.5
Fiber	5.5
Ash	5.5
Moisture	6

Table (3) The Chemical Compostition of Garlic Powder *Allium sativum* According to Purenik *et al*. (2012)

Components	Percentage
Fat	0.10
Protein	30.6
Carbohydrates	29.0
Fiber	0.80
Ash	1.0
Moisture	66

3- Biological Aspects Measurements

A- Growth Parameters

Fishes weights were measured nearest to 0.1 gm for each 15 days using following equations : Fish weight increment (g) = fish final weight – fish primary weight, Feed Conversion Ratio efficiency % = (Fish weight increment gm/ food concept gm) X 100 (McCormick *et al*., 1989).

B- Chemical Analysis of Fish Meat

Standard methods described in the AOAC (2000) were used to estimate the percentage of crude protein, ash and fat in fish meat. For calculating the proportion of crude protein Micro Kieldahll (Model- Macmern 3500 SA) was used to measure the total nitrogen in fish meat (and output = Nitrogen x 6.25). While Soxhlet Apparatus (Model- Elfin 250) was used to estimate the proportion of crude fat using solvent and heating for 5 hours at the temperature of 105 ºC for half an hour in oven and then sample weighed and the fat percentage was calculated. The ratio of ash calculated by burning ash sample using Maflferanse (Model- Naber thermo) at a temperature of 600 ºC for 2 hours.

C- Standards Doll

Blood parameters were measured using methods described by Close (1986). As percentage of packed cell volume (PCV %), Hemoglobin concentration (Hb as gm/ 100ml) and a total account of red blood corpuscles (RBC´s as 10^6 cell/ cm^3) and white blood corpuscles (WBC´s as 10^4 cell/ cm^3).

4- Statistical Analysis

Statistical analysis was performed using the Analysis of a variance (ANOVA) One-way classification and Duncan's multiple range test, to determine the differences between treatments means at significance rate of ($P \leq 0.05$). All statistics were carried out using Statistical Analysis System SAS Program (2012).

Results and Discussion

Some of water properties in the experimental aquarium were measured. Water temperatures ranging between 23 to 27 °C, dissolved oxygen between 7.0 to 9.0 mg / l , pH values between 7.1 to 7.9 . Jauncey (1982) was noticed that these values were performance for fishes of common carp *Cyprinus carpio* L to growth. Experiment Fish in all treatments were fed once every 24 hours on the four different supplementary diets (Table 1). Results of Table (4) illustrated significant increases ($P\leq 0.05$) in the growth of fishes of treatment T2 fortified by 1% of garlic powder ,these, increments of total weight of 17.4 gm/fish and daily weight of 0.29 gm/fish. As well as slightly increases was shown by fishes of the control treatment (T4) with total and daily weight values of 15.6 gm/fish and 0.26 gm/fish respectively. Fishes of T2 and then followed by T4 were recorded the highest efficiency values for feed intake by 1.85% and 1.65%, respectively, compared with the other supplementary diet treatments. The cumin *Nigella sativa* and the garlic *Allium sativum* maybe promoted growth of common carp because the digestive stimulating effect their aromatic substances and essential oil . These results agreed with the study of Diab *et al*., (2002), who indicated improved positive growth for fishes of tilapia *Oreochromis niloticus* with increasing in garlic powder rates of 1%, 1.5%, 2% and 2.5% up to the top of increasing in total and daily weight and the efficiency of

conversion feed with the highest percentages of garlic powder rates. A study of Khalil *et al*, (2001) indicated that the activity of garlic due to the effectiveness of homocysteine Alicin, which role the increasing the efficiency of the microorganisms in the stomach and intestines during digestion and making useful of the energy that is an increase in muscle growth. The total and daily weight increments in the present study overall growth and daily fish in addition to that fishes of T2 (which fed on garlic powder 1%) has better growing with fish starving for one day and fed the next day, These may stimulates the increase in the efficiency of feed consumption (Abu-Elheni *et al*., 2013). Table (5) showed fluctuation in the chemical components values of fish meat during experimental period. Fish meat of treatment T2 were recorded ($P \leq 0.05$) the highest protein values of 62.5% , the lowest of both ash content of 15.4% and the fatty amount of 22.6% within the end of the experiment, compared with the rest of the other fish meat treatments diet. The results by Xie *et al.* (2005) confirmed that the protein levels inversely proportional to the levels of ash and fat in fish meat, whenever, fish meat within greater percentage of protein ratio became the best-developed and high nutritional value. Abu-Elheni *et al*. (2013) noticed that feeding of fishes every 24 hours has the role of amino acids regulation of body proteins and therefore supports the growth of fishes. The current results indicate that the increasing in weight of fishes may due to the addition of garlic powder 1% with fish starving for every 24 hours for the treatment T2. Agatha (2012) study confirmed the importance of diet supplemented with garlic powder for finger fish of *Clarias gariepinus* that led to give triangular shape harmonious through the increase in the dimensions of its body (length, depth and width), and recommended fish diets garlic powder of 0.5% for fish farmers. Table (6) illustrate the fluctuation in the blood standards picture for fish's *C. carpio* after sixty days of the experiment. These results recording a significant decrease ($P \leq 0.05$) in the rate of PCV% and Hb values for fishes fed by 1% of garlic powder. These fishes of treatment T2 were recorded the lowest values of 23.6% and of 6.9 g / 100 ml, respectively. Also fishes of same treatment T2 were recorded significant increases ($P \leq 0.05$) in blood RBCs numbers reached to 2.7×10^6 and in blood WBCS numbers which reached to 24.3×10^4 cells / cm^3, compared to the other fishes treatments. The results of table (6) which also shown that the fishes of T2 which fed by 1% of garlic powder has reduced in blood PCV% and Hb values, as well as, with a marked increase in RBC_S and WBCs numbers, which refers to the situation improves Fish health (Al-Atabby ,2012).

Our results were approached Metwally (2009) results who indicate improving growth, health status and physiological status for fishes of tilapia *Oreochromis niloticus* fed by diet supplemented with different forms of garlic (mountain or wild, crude oil and powder). Tamminga (1990) sacrificed the effect of Allicin on beneficial bacterial stimulating in digestive system which enhances the process of digestion and making use fully of food contain garlic. Hormones (as growth hormone GH and Thyroxin) were involved from Pituitary and Thyroid glands when stimulated by slightly flowing of Sugars into these tissue glands is one of the main action of garlic in the body of fishes (Alishahi, *et al*., 2012). As well as, Sulfur compounds and microbiology antioxidants for fishes feeding by diet supplemented by garlic within starved for 24 hr may increase body growth and activated fish immunity as antibiotics to increase body's resistance to disease (Diab *et al*., 2002; Abu-Elheni *et al*., 2013). These, may correspond with the obtained results in the present study.

Finally, our suggestion depending on current results to add 1% of garlic powder in fish diet as well as starvation every 24 hours , which leads to increase fish growth and improve its healthy.

Table (4) Fish Weights (Mean Values ± Standard Error) During the Period for Sixty Days of the Study.

Treatments	Experimental fish weight (gm/ fish)					Food Conversion Ratio
	Before treatment	After 30 days	After 60 days	Total	Daily	
T1	**22.5 ±0.7 a**	**27.7 ± 0.7 c**	**32 ± .08 b**	**9.5 ± 0.8 c**	**0.16**	**1.3**
T2	**22.6 ±0.7 a**	**32.5 ± 0.8 a**	**40 ± 0.7 a**	**17.4 ± 0.8 a**	**0.29**	**1.85**
T3	**22.7 ±0.7 a**	**28.4 ± 0.8 bc**	**32.7 ±0.9 b**	**10 ± 0.5 c**	**0.17**	**1.45**
T4 (control)	**22.6 ± 0. 7 a**	**29.8 ± 0.5 b**	**38.2 ±0.6 a**	**15.6 ± 0.7 b**	**0.26**	**1.65**

Different small letters within Colum indicate significant differences ($P \leq 0.05$) between treatment according to Duncan's multiple range test for equal numbers of replicates.

Table (5) Chemical Analysis of Fish Body for the Period for Sixty Days of the Study.

Experimental Period	Treatments	Crude protein (%)	Ash (%)	Fat (%)
Before treatment	_____	57.2 ± 0.6 a	17.4 ± 0.9 a	25.4 ± 0.8 a
After 60 days	T1	55.8 ± 0.8 b	18.5 ± 1.2 a	25.7 ± 0.4 a
	T2	62.5 ± 0.2 a	15.4 ± 0.9 c	22.1± 0.7 b
	T3	56.5 ± 0.5 b	17.9 ± 0.7 ab	25.6 ± 0.5 a
	T4 (control)	56.9 ± 0.6 b	16.9 ± 1.1 b	24.2 ± 0.9 a

Different small letters within Colum indicate significant differences ($P \leq 0.05$) between treatment according to Duncan's multiple range test for equal numbers of replicates.

Table (6): Experimental Fishes Blood Picture (Mean Values ± Standard Error) During the Period for Sixty Days of the Study.

Parameters / Treatments	Packed cell volume (PCV %)			Hemoglobin (gm/ 100 ml)			RBCs (10^6 cell / cm^3)			WBCs (10^4 cell / cm^3)		
	Before treatment	After days	After 60 days	Before treatme	After 30 days	After 60 days	Before treatment	After 30 days	After 6 days	Before treatment	After 30 days	After 6 days
T1	26.9 ± 0. a	29 ± 0 a	28.7 ±0.3 a	8.2 ± 0. a	10.4 ±0.2 a	10.8 ±0.2 a	1.4± 0.2 a	1.4 ±0.3 b	1.7 ±0. b	21 ±0.3 a	21.3 ±0.3 b	21.6± b
T2	27 ± 0. a	25± 0 b	23.6± 0.2 c	8.5 ±0.2 a	8.1 ±0.2 b	6.9 ±0.3 b	1.4 ±0.2 a	2.4 ± 0.3 a	2.7 ± 0 a	21.3 ±0.2 a	23.9 ±0.2 a	24.2 ± a
T3	27.3 ± 0 a	28 ±0 a	29.5 ± 0.2 a	8.1 ±0.2 a	11.9 ±0.4 a	11.2 ±0.2 a	1.3 ±0.2 a	1.5 ±0.2 b	1.8± 0. b	21.1± 0.3 a	21.5 ±0.3 b	21.8 ± b
T4 (control)	26.7 ± 0. a	24.7± b	26.1± 0.2 b	8.2 ±0.3 a	7.9 ±0.2 b	9.9 ±0.2 a	1.4 ±0.2 a	1.8 ± 0.3 a	2 ± 0.2 b	21.9 ±0.3 a	20.7 ±0.3 b	21.4 ± b

Different small letters within Colum indicate significant differences ($P \leq 0.05$) between treatment according to Duncan's multiple range test for equal numbers of replicates.

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