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The effect of using three different levels of Fish Meal on growth criteria and feeding efficiency in Cyprinus Carpio.

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Abstract

Study the effect of three different levels of adding a fishmeal protein concentrate on the growth rates of the common carp fish (*Cyprinus carpio*) through laboratory experiments, which lasted for 40 days. 27 common carp fish were used with a weight of 2 ± 93.27 g and distributed over 9 concrete ponds with a capacity (300) liters, according to three treatments T_1, T_2, and T_3 distributed in three replicates for each treatment, and put 9 fish (3 fish / repeated). The fish were fed on three different diets, with a protein concentrate ratio of 23%, 15% and 10%, respectively. Measurement of weight, relative specific growth rates and food conversion rates. The best total weight gain increase for the second treatment was recorded (35.478 ± 2.29 g). The best relative growth rates were (37.769 ± 2.51) and specific (0.346 ± 0.02)% g /day and protein efficiency ratio (2.365 ± 0.23) for the second treatment also, and significant differences were recorded at ($P < 0.01$) on the two treatments T_3; T_1 in all the studied characteristics.

Keyword: fish meal, protein, Common carp, Total weight gain.

1.Introduction
Food security is one of the lofty goals pursued by the countries of the world, especially the poor ones, as a result of the increasing population. The world has witnessed famines such as those that occurred in the early seventies in African countries [1].Common carp fish Cyprinus carpio L. are fish that are raised in warm water and have a market presence in the market [2,3]. Fish and aquatic organisms are an "important" food source for people all over the world, as fish provide about 24% of the animal protein revenue, while meat of various other types provides 40% of it [4]. Fish protein contains all essential amino acids necessary for human growth, which increases the nutritional value of fish as food [5]. In addition to containing fish fats a high percentage of unsaturated fatty acids, which work to reduce high levels of cholesterol in human blood, as well as help to reduce the incidence of heart disease [6]. Fish fat and liver also contain high amounts of vitamin A and B, and many different important minerals such as calcium, phosphorous, iodine and iron [7-9]. The aim of the research was to use low levels of animal protein (fish meal) to study its effect on growth criteria and feeding efficiency in common carp fish.

2.Materials and working methods

2.1. Source fish
The fish carp was brought in with a weight rate of (93.27 ± 2) g, sterilized the fish with a saline bath of Sodium chloride solution at a concentration of 3% for a period of five minutes, which is the period required for the appearance of stress marks for the purpose of disinfection from external parasites [10].

2.2. How to conduct an experiment
The experiment included forming three diets with different proportions of Fish meal:
T1: Contains 23% of fish meal.
T2: Contains 15% of fishmeal.
T3: Contains 10% of fish meal.
        The weight of the cysts was measured by an electronic balance scale not near a gram, after which the catches of common carp were distributed over 9 cement ponds (one pond) (1 x 1 x 2) meters, with three replications per treatment i.e. in

each repeater 9 fish, i.e. The volume of water was 300 liters per basin. The fish had been acclimated to the diets used in the experiment for a week before starting the experiment.

The diets formed (soy, flour, barley, corn) in the three treatments and added different proportions of fish meal (10%, 15%, 23%) by re-grinding the bush very smoothly with an electric grinding machine and in the above-mentioned proportions, after which the feed was reconfigured. Using a manual meat grinder to make pellets, they were dried, air-cooled, and kept cool for use.

Fish were fed until saturation in the morning for 40 days. Uneaten food was removed by siphon two hours after serving food and dried and weighed to calculate the weight of dry food intake. Physical and chemical properties of the experiment tanks were measured, which included Temperature (°C) and (pH). And dissolved oxygen (mg/l) and salinity (g/l).

2.3. The criteria studied

The growth criteria and nutrition efficiency were calculated at the end of the experiment. These measures were represented by weight gain, relative growth rate% (R.G.R.), Specific growth rate (S.G.R.), daily weight gain daily (D.W.G.), and nutrition conversion rate (F.C.R.) and Protein efficiency ratio (P.E.R.). Based on [11] According to the equations below.

- Total Weight Gain (T.W.G.) (gm)= F.W.– I.W.
- Relative Growth Rate (R.G.R.)%= {(W2 – W1)) / W1}* 100
- Specific growth Rate (S.G.R.)% = = { (L n W2– L n W1) / (T2 – T1) } * 100
- Daily weight gain (D.W.G.) = (W2 – W1) / (T2 – T1)
- Food Conversion Rate (F.C.R.) = R / G
- Protein Efficiency Rate (P.E.R.) = (T.W.G. / P.I.) * 100

Where:
- I.W. (W1) = Initial weight (gm)
- F.W. (W2)= Final weight(gm)
- L n = Normal logarithm.
- T1-T2 = Time between the two weights.
- R = Weight of food intake (gm)
- G = Total gain (gm)
- P.I. = Protein Intake (gm)

2.4. Statistical analysis

The Statistical computations were done using SAS software program [12] to explore the influence of treatment. [13] Duncan's multiple range test (1955) to compassion between means. The statistical model was as follows:

$Y_{ij} = \mu + T_i + e_{ij}$

Where:

Y_{ij} = dependent variable.

μ = overall mean.

T_i= Effect of treatment (T_1-Control, T_2 , T_3).

e_{ij} = Error term.

3.Results

3.1. Environmental factors for experiment water

The results of the water analysis in the study groups showed that there was no variation in environmental factors during the growth experiments between the studied parameters ponds, the average temperature $(24 \pm 2.13\text{-}23.5 \pm 1.17)$ ° C and the value of pH $(7.8 \pm 0.19\text{-} 7.4 \pm 0.14)$, while it was Salinity $(0.56 \pm 0.04\text{-}0.59 \pm 0.06)$ and the dissolved oxygen rate was $(6.12 +1.18\text{-} 6.86 +1.49)$ as shown in Table (1).

Table 1. Some environmental parameters in the experiment tanks

Water quality parameters	T_1	T_2	T_3
Temperature (C°)	23.5 $\pm$1.17a	23.7 $\pm$1.17a	24 $\pm$2.13aa
Dissolved oxygen (mg/L)	6.86 $\pm$1.49a	6.32 $\pm$1.3a	6.12 $\pm$1.18a

Salinity (‰)	0.58 ±0.03a	0.59 ±0.06a	0.56 ±0.04a
pH	7.6 ±0.17aa	7.4 ±0.14a	7.8 ±0.19a

3.2. Growth parameter

Table 2 shows that there were no significant differences (P> 0.01) in the primary biomass of carp fish common among the different treatments in growth experiments that lasted 40 days. While we found significant differences (P <0.01) in the total weight gain increase rate (gm) and the daily weight gain in favor of the treatment (T_2) by (35.478 and 0.886) gm, respectively. Also, it was noticed through the results of the statistical analysis that there was a significant difference (P <0.01) between the three different treatments in the rates of relative growth RGR and specific growth S.G.R. % (w/day) in favor of the T_2 treatment by an amount (37.769%, 0.346% g/day), respectively. Between the two groups.

Table 2. Effect of difference treatments in parameters study of (Cyprinus carpio).

Parameters	Mean ± SE			Level of Sig.
	T1	**T2**	**T3**	
Initial weight (gm)	92.611 ±1.04 a	94.078 ±1.29 a	95.267±1.20 a	NS
Final weight (gm)	105.690 ±1.24 c	129.560 ±2.63a	122.940±4.58 a	**
Total gain (gm)	13.078 ± 0.51 c	35.478 ± 2.29 a	27.678 ± 4.66 b	**
Daily gain (gm)	0.329 ± 0.01 c	0.886 ± 0.06 a	0.691 ± 0.11 b	**
RGR (%)	14.123 ± 0.54 c	37.769 ± 2.51 a	29.199 ± 5.11 b	**
SGR % (gm/day)	0.143 ± 0.01 c	0.346 ± 0.02 a	0.271 ± 0.04 b	**

Means having with the different letters in same row differed significantly ** (P<0.01).

3.3. Food efficiency

Efficiency of food is an important measure that must be studied in nutrition experiments, as it reflects the ability of each species or group of fish to convert the food consumed into an actual increase in weight while maintaining the state of health [14].

The results of the statistical analysis in Table 3 show the presence of significant differences in the criteria of food efficiency among the experiment coefficients, where the group (T_2) recorded a significant decrease (P<0.01) at (1.232 ± 0.22) achieving this low value of the F.C.R. compared to the two factors (T_3, T_1) The results of the analysis also recorded significant differences in the PER protein efficiency ratio between the different treatments in the fish of the experiment. The T_2 treatment recorded a significant superiority at the level of (P> 0.01) at the highest protein efficiency ratio of 2.365, by its superiority over the two factors (T_3, T_1) Which recorded the lowest protein efficiency ratio of (2.207±0.20; 0568± 0.05)%.

Table 3. Shows some of the criteria for feeding efficiency during the growth experiment in common carp fish.

Parameters	Mean ± SE			Level of Sig.
	T1	**T2**	**T3**	
Feed conversion ration (FCR) (gm/gm)	3.960 ± 9.85 a	1.232 ± 0.22 b	2.123 ± 1.45a	**

Protein Efficiency Rate (PER) (%)	0.568 ± 0.05 c	2.365 ± 0.23 a	2.207 ± 0.20 a	**

Means having with the different letters in same row differed significantly ** ($P<0.01$).

4.Discussion

The results of the current study showed when comparing different proportions of the use of Fish meal, which was used in feeding the cakes of common carp fish in a laboratory experiment, where Table 1 shows some physical and chemical properties of the water of the experimental fish ponds, which were within the ideal limits for the breeding of common carp fish . C. carpio can withstand a wide range of environmental conditions [15]. The sources indicated that the best growth temperature when breeding common carp fish ranges between 20-30 C° and the appropriate degree of pH is between 6.5–9. Common carp fish can withstand salinity with a concentration of about 3 parts per thousand. As for the oxygen concentration, it should not Less than 3 mg/l [16-18].

The daily weight increase and the relative and qualitative rate of growth are among the most important scientific and practical standards that are widely used in assessing growth rates. They are also considered one of the most important productive characteristics to assess fish productivity and express the yield of fish farmed in different farming systems [19]. The results of the laboratory experiment showed a comparison between three different concentrations of fish meal used to feed the common carp fish fry to the superiority of treatment T_2 with a concentration of 15% of fish meal significantly (P <0.01) in relation to all studied growth criteria. It is also important to determine the exact requirements of farmed fish from protein [20]. Common carp needs from protein range from 30-38% to reach the maximum growth of these fish [21]. [22] Indicated that if protein levels in common carp diets exceed the ideal level, they will be accompanied by a loss. A marked decrease in body weight due to the fact that if the fish were given a high protein content, it would work to remove the amine group from the protein that is accompanied by the exchange of body energy, which leads to a decrease in body weight.

The rate of relative growth and qualitative growth represents the percentage of weight gain, and these values are very practical when comparing growth between different groups of farmed fish for relatively short periods of time [23]. These measures are also considered a better way to express growth compared to the value of total or daily weight gain by reducing the variance in the final weights between the fish studied in the experiments [24]. The relative and qualitative growth rate recorded in the current study during the laboratory experiment indicated the superiority of T_2 treatment fish (37.769% and 0.346% g/day), respectively. Feed efficiency is one of the most important economic characteristics of aquaculture activities. Improving nutrition efficiency rates means that a greater amount of nutrients are transferred to fish tissues, which reduces waste disposal to the environment [14][25]. One of the important life standards in fish [26] is the FCR nutritional rate, which clarifies the relationship between the amount of feed consumed and the weight gain in fish. Improving feeding efficiency means reducing the amount of food eaten versus the resulting weight gain, or increasing fish productivity versus the same amount of food intake [27]. Significantly improved dietary conversion rates (P <0.01) in treatment fish T_2, which amounted to 1.232 compared to fish treated T_3, T_1). Where the study showed that the growth speed in fish with higher growth rates will have lower feed conversion rates (better). The results also reflected a clear improvement in the utilization rates of the protein intake in treatment fish T_2, this was evident by the values of the highest protein efficiency ratio in this treatment, which amounted to 2.365% and was significantly superior to the treatments T_1 and T_3. It is known that the protein efficiency ratio is related to a direct relationship with the wet weight increase in fish [28][29]. There is also an inverse relationship between the food protein and the ratio of the efficiency of the PER protein. In the case of an increase in the food protein, the value of the P.E.R. in fish decreases [30].

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