Impact of different level of dietary protein content feedings on growth, feed utilization and hematological characteristics of common carp (C. Carpio(

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Abstract
The study was carried out at university of Sulaimani/college of agricultural engineering sciences, to determine the ideal protein amount in the diet for common carp. In order to do this, we developed three distinct protein levels: 28%, 30%, 32% and 34%. Subsequently, fish weighing from 20.68 ± 0.05 to 390.72 ± 0.93 g (mean ± SE) were arranged in 12 plastic aquariums, with 10 fish per tank. The food was given to the fish ad libitum, twice a day between 9:00 and 16:00. The findings demonstrated that the fish that were fed diets containing 30% and 32% protein had considerably greater WG and SGR following the 60-day feeding study. Regarding the fish's relative growth rate, there was no discernible variation across any protein diet regimens, nevertheless. Significant differences ($p < 0.05$) were seen for both lymphocyte and mch. Nevertheless, no statistically significant variations were seen for (rbc, mchc, plt, mcv, granules, hgb, and monocyte).Additionally, all biological characteristic metrics showed significant differences ($p<0.05$), with the exception of the fish weight index, intestinal length index, and intestine weight index. Total protein and globulin showed significant variations ($p < 0.05$) across treatments, however, albumin, blood glucose, ALT, and AST did not show any significant differences in fish plasma. It is advised that juvenile common carp require protein in the range of 28–32% for optimal development and effective feed utilization based on the aforementioned data.

Keywords: Common carp, Dietary protein, Growth performance, Hematology.

Introduction

Significant contribution in fisheries and aquaculture production in the last two decades enhanced the world capacity to consume diversified and nutritious food [1]. Fish and fishery product are more valued source of animal protein which contributes about 50–60 % the total protein in human diet on daily basis [2]. However, due to ever increasing population and health aware-ness, the demand of fish and fishery related products for human consumption has drastically increased [3]. In order to fulfill the gap between the demands and supply, the efforts has to be made to uplift fish production through aquaculture by formulating the nutritionally balanced least cost commercial feed to the concerned species. Appropriate amount of nutrients for best possible growth is essential to decrease feed cost, which accounts for a significant portion of overall expenditure of aquaculture venture [4 .[

Protein usage in several fish species has been extensively researched due to its importance in optimal fish growth [4]. Although appropriate dietary protein is essential for optimal fish development, excessive protein inclusion in

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diets increases both feed costs and nitrogen loss [5,6]. Based on existing data, three ways have been developed to reduce protein intake to fish while maintaining growth performance. To begin, lowering protein energy usage by increasing the inclusion of non-protein energy sources such as digestible carbohydrates in diets has been shown to be an effective method in yellow fin seabream Sparus latus [7] and other species [8].Second, in some fish species, compensatory growth can enhance feed conversion efficiency and lower feeding costs through starving and subsequent refeeding) [9,10]. Lastly, it has been reported that protein restriction-realimentation additionally may have a beneficial impact on compensatory development, protein efficiency ratio and nitrogen retention in a number of species such as juvenile Chinese shrimp Fenneropenaeus chinensis [11], Japanese flounder Paralichthys olivaceus [12]., soft shell turtle Pelodiscus sinensis [13] and rainbow trout Oncorhynchus mykiss [14]. The purpose of this study was to examine the effects of various feeding regimens that include dietary protein on growth performance, protein consumption, and hematological parameters of common carp (C.Carpio) were altered on a daily or weekly basis.

Material and Methods

Experimental fish: The research study was carried out on 108 common carp in 70 days. Fish brought from local ponds in Iraq's Sangasar/Qalladza. Fish were placed in several experimental plastic aquariums. Prior to the real feeding experiments, laboratory pre-acclimation and feeding with commercial pellets (their percentage of components and chemical makeup are shown in Tables 1 and 2) were took place for 21 days

Table 1: Chemical composition of the different diet by [15. [

Ingredients	Crude Protein %	Crude Fat %	Dry Matter %	Crude Fiber %	Energy Kcal/ kg
Animal protein Concentrate	40	5	92.9	2.2	2107
Yellow corn	8.9	3.6	89	2.2	3400
Soybean meal	48	1.1	89	7	2230
Barely	11	1.9	89	5.5	2640
Wheat bran	15.7	4	89	11	1300

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Table 2: Composition of experimental diet.

Ingredients (%)	Percent
Yellow corn	15 %
Wheat bran	15 %
Animal concentrate protein	20 %
Barley	15 %
Soya bean meal 48%	35 %
Total Crud protein	28.06
Gross energy (kcal/kg feed)	2242.7

Experimental system: Twelve plastic tanks (70 L water) were used in this investigation for four treatments, each with three duplicates. Each tank received suitable continual aeration using Chinese air compressors, Hailea ACO-318. Eight fish were distributed to each replication. Duplicates were distributed at random to reduce discrepancies across treatments. A siphoning method will be employed on a regular basis to remove any residual feeds and faeces from the system. T1: Food fish control, T2: Feeding fish with diets containing 28% protein, T3: Feeding fish with diets containing 30% protein, and T4: Feeding fish with diets containing 32% protein were the four treatments in the experimental study, each having three duplicates and eight fish.

Diet formulation: In the experimental diets, common foods found in Sulaimani city markets were employed. The ingredients were mixed together to make dough. Kenwood For pelleting, multi-processors employed an electrical mincer. Four days of drying at room temperature were used, followed by crushing to get fine particles. Feeding 3% of body weight was twice a day at 9:00 a.m. and 4:00 p.m. The fish in each tank were weighed together twice a month. The feeding levels were then adjusted to reflect the new weights .

Health and Biological parameters

All fish specimens were dissected, and the belly cavity were opened to weigh each organ separately, and the results were computed as follows.

Hepatosomatic index%=Liver weight (gm) / Fish weight (gm) x 100 [16 .[

Spleenosomatic index%=Spleen weight (gm) / Fish weight (gm) x 100 [16 .[

Gonadosomatic index% = gonad weight (gm) / fish weight (gm) multiplied by 100[17 .[

Intestine weight index% = Intestine weight (gm) / Fish weight (gm) multiplied by 100[17 .[

Intestine length index% = Intestine length (gm) / Fish length (gm) multiplied by 100

Condition factor= Fish weight (gm) / Fish length (cm) 3[17 .[

Gill index% = Gill weight (gm) / Fish weight (gm) multiplied by 100 [17 .[

Fish weight index% = fish weight (gm) / fish weight (gm) multiplied by 100[17 .[

Meat weight index% = fish weight (gm) minus viscera and head (gm) x 100[17 .[

Growth standards used in the study: Every two weeks, all duplicate fish were weighed (g). Each replicate's feed consumption was determined only by the biomass gathered every two weeks.

Weight increase (g/fish) = mean of weight (g) at the conclusion of the experiment minus weight (g) at the start of the trial.

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W2 - W1 = weight growth (g/fish(
Where:
W2: Fish weight (g) at the end of the experiment
W1: Fish weight (g) at the start of the trial .
Relative Growth Rate (RGR %)= Weight Gain / Initial Weight x 100
= W2 - W1 / W1 x 100 [18 .[
SGR = (ln final body weight -ln beginning body weight) /period of experimentation) defined X100 as ((In W2 - In W1) / T) times 100 [17 .[
At the end of the trial, three fish from each experimental group were picked at random. Each fish sample will be weighed and measured individually. Each fish in each group will have blood drawn from the caudal vein. Whole blood samples will be collected and stored in heparin-laced plastic vials [19].Several variables were determined: erythrocyte count (rbcs: 1012cells/l), average corpuscular hemoglobin (mch; pg), average corpuscular hemoglobin concentration (mchc; g/dl), mean corpuscular volume (mcv; fl), hemoglobin (hb; g/dl) and platelet (plt; 109 cells/l), differential leukocyte count (109 cells/l), granulocytes%, lymphocytes%, monocytes.%

Biochemical parameters

Alanine aminotransferase (alt), aspartate aminotransferase (ast), total proteins, globulin (g/dl), and albumin (g/dl) were measured.

Statistical analysis

The study was carried out using the XLSTAT 2016 Version.02.28451 one-way ANOVA with fully randomized design (CRD) and general linear models (GLM) technique. Duncan's test was used to compare the means of different treatments [20 .[

Results and Discussion

There were no significant differences (p< 0.05) in weight gain and relative growth rate among treatments, with treatment 2 having the greatest values of weight gain

Table 3: Effect of different protein levels on growth and feed utilization parameters of young common carp (C. Carpio.(

Parameters	t1 control 28%	t2 30 % *protien*	t3 32 %*protien*	t4 34 % *protien*
Weight gain	11.963±1.353 a	12.565±2.301 a	15.895±0.783 a	14.620±2.33 a
Relative growth rate	7.125±1.29 a	8.647±1.278 a	7.840±1.247 a	7.541±1.212 a
Specific growth rate	8.719±2.50 b	9.421±0.021 a	9.982±0.1 39 ab	8.257±0.065 ab

Table 4 shows mean se values for (rbc, hgb, mcv, mch, mchc, mcv, plt, wbc, granules, lymphocyte, and monocyte). There were significant variations (p< 0.05) in the results for (mch and lymphocyte). However, no significant changes were found for (rbc, mchc, plt, mcv, granules, hgb, and monocyte.(

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Table 4: Effect different protein levels on some hematological indices of young common carp (C. Carpio.(

Parameters	t1 control 28%	t2 30 % *protien*	t3 32 % *protien*	t4 34 % *protien*
Rbcs (10^{12}cells/l)	1.830±0.09 a	1.540±0.063 a	1.410±0.049 a	1.160±0.205 a
Hb (g/dl)	10.900±0.35 a	10.350±0.319 ab	9.000±0.070 b	8.950±0.248 b
Mch (pg)	32.50±3.12 a	31.17±16.18 a	32.475±2.96 a	33.625±10.04 a
Mchc (g/dl)	24.00±0.98 a	26.150±0.815 a	25.250±0.816 a	34.600±2.340 a
Mcv (fl)	100.00±1.46 a	92.500±1.773 a	94.500±0.354 a	97.000±2.127 a
Plt (10^{9}cells/l)	8.00±3.98 a	14.500±4.609 a	8.200±0.141 a	5.700±0.496 a
Wbc (10^{9}cells/1)	9.00±0.76 a	9.000±0 a	9.000±0 a	8.750±0 a
Granulocytes (%)	56.25±3.60 a	57.45±2.17 a	55.82±1.04 a	59.60±1.13 a
Lymphocytes (%)	8.500±3.18 a	46.2000±6.666 a	97.000±1.418 a	91.750±0.886 a
Monocytes (%)	0.000± a	0.150±0.0354 a	0.150±0.106 a	0.000±0 a

Except for the intestinal weight index, intestine length index, and fish weight index, there were significant differences ($p<0.05$) between treatments in all parameters given in table 6. Treatment 4 included the highest condition component. Treatment 2 also had the greatest meat weight index values.

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Table 5: Effect different protein levels on some physio-biological parameters of young common carp (C. Carpio.(

Parameters	t1 control 28%	t2 30 % *protien*	t3 32 %*protien*	t4 34 % *protien*
Hepatosomatic index	0.677±0.33 a	0.535±0.027 ab	0.447± 0.090 ab	0.142 ±0.074 b
Spleenosomatic index	1.420±1.89 b	1.846±0.049 a	1.416± 0.038 b	1.243 ±0.078 b
Gillsomatic index	6.534±2.56 a	4.846±0.077 b	6.090±0.027 a	5.884±0.433 ab
Intestine weight index	5.398±1.78 a	4.846±0.186 a	4.280±0.428 a	5.107±0.609 a
Intestine length index	200±10.22 a	172.839±9.204 a	138.925±14.785 a	155.417±19.795 a
Fish weight index	83.475±0.45 a	83.680± 0.999 a	82.862± 1.488 a	82.406±1.140 a
Meat weight index	61.080±0.38 ab	61.980±1.633 a	59.245± 0.935 ab	55.486±1.631 b
Condition factor	1.760±2.83 c	2.266±0.052 a	1.971±0.077 bc	2.168±0.070 a

Different letter in same rows mean significant differences (p<0.05.(

Table 6 shows the values of alt, ast, total protein, blood glucose, globulin, and albumin in fish plasma. There were significant changes (p<0.05) among treatments for total protein and globulin.

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Table 6: Effect of protein on some blood biochemical parameters of young common carp (C. Carpio.(

Parameters	t1 control 28%	t2 30 %*protien*	t3 32 %*protien*	t4 34 % *protien*
Alanine aminotransferase activity (alt)	130.450±0.49 a	45.980±2.91 a	105.015±1.64 a	56.960±1.66 a
Aspartate amino transferase activity (ast)	586.990±0.34 a	372.850±13.042 a	69.220±6.592 a	427.175±34.375 a
Total proteins	28.560±1.48 b	29.175±0.074 b	29.440±0.120 b	45.740±1.042 a
Blood glucose	6.400±2.34 a	8.550±1.312 a	2.500±1.276 a	4.800±0.425 a
Globulin (g/dl)	44.500±0.24 a	21.48±0.11 b	25.87±0.14 b	22.54±0.6 b
Albumin (g/dl)	0.920±0.14 a	0.685±0.046 a	32.115±22.612 a	0.245±0.173 a

Different letter in same rows mean significant differences (p<0.05.(

Discussion

The physiological state of farmed fish is an important factor in determining their health. Physiological changes, on the other hand, might be utilized as markers of inadequate environmental conditions or the presence of stressors such as toxic chemicals, excess organic compounds, and stressors found in intensive fish rearing [21,22]. Aside from their role as protein synthesis and gluconeogenic substrates, amino acids have been linked to a wide range of physiological processes [23.[

The protein requirements of fish vary by species [15]. Protein requirements fluctuate amongst fish species due to changes in food formulations, fish size, and procedures used [24]. Different lab settings, experimental design, e.g. feeding volume and frequency, water quality, water flow rate, stocking density, and protein sources in the diet might also be attributed to the variances [25]. Furthermore, the protein requirement of fish may vary depending on the feeding rate used. It has been found that increasing the feeding

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rate from 2-4% body weight reduced the dietary protein requirement of juvenile carp and rainbow trout from 60-65% to as low as 30-32% [15 .[

The current study's relatively high WG and SGR were compared to the findings of previously published research. In the current investigation, the IBM of large-sized Cyprinus carpio haematopterus was chosen and found to affect the SGR and WG in comparison to the same carp types [26,27]. The WG and SGR were significantly increased with an increase in dietary protein up to an optimal level, then slightly decreased, demonstrating that excessive dietary protein levels affect nutrient utilization and feed efficiency [28], resulting in clear growth inhibition of fish) [29]. Reductions in WG and SGR were observed in Ictalurus punctatus [30], Mystus nemurus [31], Tor putitora Hamilton [28], Scophthalmus maximus L. [32], Puntius gonionotus [33], and Pagrus (Schuchardt et Reductions in the WG and SGR have been seen in Ictalurus punctatus [30] and Mystus nemurus [31] with dietary protein levels above the optimum range.

Dietary protein intake had a substantial impact on lymphocyte and hemoglobin changes. According to [34], the amount of protein had a substantial effect on the Hb and rbc of rainbow trout. Serum protein levels tended to rise when dietary protein levels rose. Similar results were found in European eels, Rhamdia quelen, and Nile tilapia [35,36,3]. Despite the fact that serum protein levels increased. The amino acid excess from protein-rich meals cannot be stored directly in fish; instead, it may be deaminated and transformed into energy molecules [37, 38]. The increase in serum protein with dietary protein in this research was most likely due to the augmentation of digested protein [39.[

The lowest dietary protein intake had the highest HSI, which was considerably greater than all other dietary categories. Higher HSI values at lower protein diets reported in the current study could be due to low glycogen deposition or fat accumulations in the liver, which affected proper liver function and resulted in higher HSI [40,41,42,3,43,44.[

Conclusion

The current study shows that dietary protein level influenced fish growth, biological traits, and hemato-biochemical composition, and thus it is suggested that 30-32% dietary protein in the diet is optimal for the growth and efficient feed utilization of young common carp. The information gathered in this study will be valuable in establishing nutritionally balanced meals for this fish species' intensive and semi-intensive cultivation.

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