

The Effect of Different Commercial Diets on the Growth and Feed Conversion Efficiency of Common Carp (*Cyprinus carpio*)

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Abstract

This study was conducted at the Fish Laboratory, College of Agriculture, University of Diyala, over the period from February 10 to May 10, 2025, for a duration of twelve weeks. The experiment aimed to evaluate the effects of four commercially available feeds commonly used in local markets on selected growth performance and health indicators of common carp (*Cyprinus carpio* L.).

A total of 84 common carp with an initial mean body weight of 31 ± 2 g were used. Fish were randomly allocated into twelve glass aquaria arranged in four dietary treatments with three replicates per treatment, at a stocking density of seven fish per aquarium. Prior to the start of the trial, fish were acclimated to laboratory conditions. Throughout the experimental period, fish were fed daily at a rate of 3% of body weight, divided into three equal meals. Water quality parameters, including temperature, dissolved oxygen concentration, pH, and ammonia level, were regularly monitored to ensure optimal environmental conditions for fish growth.

Statistical analysis revealed significant differences ($P \leq 0.05$) among treatments in final body weight, weight gain, and all evaluated growth indices. The group fed the Extra diet attained the highest final weight (662 g) and weight gain (440 g), followed by the Arasco diet with a final weight of 556 g and a weight gain of 335 g. In contrast, the Fidco and Ferdana diets resulted in the lowest and comparable values for these traits. Moreover, the Extra treatment recorded the highest daily growth rate, specific growth rate, and relative growth rate (DGR, SGR, and RGR), whereas the Ferdana treatment exhibited the lowest values, with significant differences among treatments. The respective values were (7.33 g/day, 1.82%/day, 198.19%), (5.58 g/day, 1.53%/day, 151.58%), (4.06 g/day, 1.23%/day, 110.40%), and (3.88 g/day, 1.20%/day, 105.85%).

Feed utilization efficiency results demonstrated a significant superiority ($P \leq 0.05$) of the Extra diet, which achieved the lowest feed conversion ratio (FCR = 3.87), compared with the Arasco, Fidco, and Ferdana diets that showed higher FCR values (T3 = 4.68, T2 = 5.60, and T4 = 5.95,

respectively). This indicates a greater efficiency of the Extra feed in converting dietary intake into biomass gain. No significant differences ($P > 0.05$) were observed between the Fidco and Ferdana treatments in FCR, while both treatments performed significantly better than the Arasco diet.

Keywords: Common carp, commercial diets, growth performance, feed conversion ratio, aquaculture.

Introduction

Aquaculture represents one of the fastest-growing sectors of global food production, providing high-quality protein and essential nutrients. Among the most widely cultured fish species is the common carp (*Cyprinus carpio*), valued for its adaptability, rapid growth, and suitability for various aquaculture systems (1). This species plays a pivotal role in meeting the increasing global demand for animal protein.

Fish protein is highly digestible and contains 18–22 essential amino acids, making fish an economically significant component of human nutrition. In 2018, global fish production reached 179 million tons, of

which aquaculture contributed nearly 50% (2). Such rapid growth in aquaculture highlights the importance of optimized feeding strategies.

Modern aquaculture practices emphasize efficient feed management to enhance growth performance while minimizing environmental impacts. Feed quality and formulation directly influence growth rates, nutrient utilization, and economic returns. Therefore, evaluating the efficiency of different commercial diets is essential for improving production in common carp farming (3).

Materials and Methods

The experiment was conducted in the Fish Laboratory, College of Agriculture, University of Diyala, from 10 February 2025 to 10 May 2025, for a total duration of 12 weeks. Fish were acclimated for 10 days prior to the start of the experiment (Picture 1). This acclimation period included initial preparations, setting up and filling glass tanks with water, purchasing feeds, and obtaining the fish. The experiment aimed to investigate the effect of commercially available feeds on the growth performance and health status of common carp (*Cyprinus carpio* L.) Laboratory analyses were conducted at the end of the experiment.

Experimental Design**

Eighty-four common carp were randomly assigned into four dietary treatments with three replicates each:

- **T1:** Extra (Egyptian origin)
- **T2:** Fidco (Iraqi origin)
- **T3:** Arasco (Saudi origin)
- **T4:** Ferdana (Iranian origin)

Chemical Analysis of Diets

Samples from each diet were collected for chemical analysis to determine proximate composition, including crude protein, ether extract (fat), crude fiber, ash, and soluble carbohydrates. Analyses were performed at the Laboratory for Standardization and Quality Control (Department of Agricultural

Research, Ministry of Higher Education and Scientific

Research, Baghdad) following standard methods described by AOAC (2000). The proximate composition of the experimental diets is shown in Table 1

Table 1. Chemical composition of experimental diets

Treatment	Protein (%)	Moisture (%)	Fat (%)	Fiber (%)	Ash (%)
T1 Extra	32	12	6	5	12
T2 Fidco	32	11	6	6	5
T3 Arasco	32	12	4	3.5	10
T4 Ferdana	32	10	7	3	10.5

Growth and Feed Utilization Parameters

Growth parameters were calculated as follows:

- **Total Weight Gain (TWG)(13):** Final Weight – Initial Weight
- **Daily Weight Gain (DWG)(11):** TWG / Duration (days)
- **Specific Growth Rate (SGR)(10):** $[(\ln \text{ Final Wt} - \ln \text{ Initial Wt}) / \text{ Days}] \times 100$

- **Relative Growth Rate (RGR)(10):** $[(\text{Final Wt} - \text{Initial Wt}) / \text{Initial Wt}] \times 100$
- **Feed Conversion Ratio (FCR)(10):** Feed Intake / Weight Gain
- **Feed Conversion Efficiency (FCE)(12):** $(\text{Weight Gain} / \text{Feed Intake}) \times 100$

A Completely Randomized Design (CRD) was used. Differences among means were tested using Duncan's multiple range test (1955) in SPSS.

Results and Discussion

Table 2 shows the average final weight of common carp in the four experimental treatments. The highest final average weight (662.33 g) was recorded for fish fed the Extra diet (T1), followed by the Arasco diet (T3) group. No significant differences were

observed between the Fidco (T2) and Ferdana (T4) treatments, which recorded final weights of 465 g and 457 g, respectively.

The total weight gain results indicated that fish fed T1 (Extra) achieved the highest

weight gain compared to the other treatments, reflecting the high nutritional efficiency of this diet due to its balanced protein and energy content. The T3 (Arasco) treatment showed relatively good weight gain, while T2 (Fidco) and T4 (Ferdana) had the lowest gains, suggesting lower feed utilization or reduced ingredient quality.

Daily weight gain (DWG) also showed that T1 (Extra) had the highest values, attributed to efficient feed conversion and optimal utilization of the diet formulation. T3 (Arasco) followed, whereas T2 and T4 had the lowest daily gains.

Table 3 presents the relative growth rate (RGR) and specific growth rate (SGR). Fish fed T1 (Extra) achieved the highest RGR, indicating high feed efficiency and effective conversion of protein and energy into growth. T3 (Arasco) showed good relative growth, whereas T2 (Fidco) and T4 (Ferdana) recorded the lowest RGR, likely due to lower ingredient quality or imbalanced protein-to-energy ratios in these diets.

Statistical analysis of SGR revealed significant differences among treatments. T2 and T4 recorded the lowest SGR values (0.34 and 0.35%/day, respectively), suggesting that these diets did not meet the nutritional requirements for optimal growth. T3 showed better performance (0.44%/day) but was still lower than T1, which achieved the highest SGR (0.52%/day), significantly surpassing all other treatments. This confirms the high efficiency of the T1 diet in meeting the nutritional requirements of common carp and promoting optimal growth during the experimental period.

Feed conversion efficiency results indicated that T1 (Extra) significantly

outperformed all other treatments, with a value of 26.03%, followed by T3 (Arasco) at 21.53%. T2 and T4 recorded lower values (17.82% and 16.85%, respectively), which were not significantly different from each other. The superior performance of T1 is attributed to the high quality and balanced composition of the feed, allowing maximum utilization and true growth in common carp. The lower efficiency of T2 and T4 reflects less balanced feed formulations.

Analysis of feed conversion ratio (FCR) also revealed significant differences among the four treatments. T1 (Extra) achieved the lowest FCR (3.87), followed by T3 (Arasco) with 4.68, both outperforming T2 (Fidco, 5.61) and T4 (Ferdana, 5.96), which did not differ significantly from each other. The superior performance of T1 indicates better alignment with the nutritional needs of common carp, whereas T2 and T4 likely contained less balanced compositions, affecting feed conversion efficiency.

The results of the current study are consistent with the findings of (4), who reported that diets with higher-quality protein sources and balanced lipid content significantly improved the growth performance of common carp. Their study demonstrated that improved nutrient digestibility and optimized feed formulation directly contribute to higher SGR, RGR, and FCE values—similar to the superiority observed in T1 (Extra) in the present study.

Furthermore, (3) emphasized that commercial feeds with well-balanced macronutrient profiles enhance feed conversion efficiency and minimize nitrogen waste. This aligns with the high FCE recorded for T1 and the lower efficiency observed in T2 and T4. The findings also agree with (6), who found that growth rates

of common carp varied significantly when fish were fed diets differing in energy-to-protein ratios, confirming that minor variations in formulation can have considerable impacts on growth performance.

Overall, the similarity between the present results and previous research

highlights the importance of precise nutritional formulation in commercial fish diets and reinforces that superior diet quality—such as that of T1—results in enhanced biological performance across multiple growth and feed utilization parameters.

Table 2: Growth Performance of Common Carp Fed Different Commercial Diets

conversion efficiency.

TRT	Initial Weight (g)	Final Weight (g)	Total Weight Gain (g)	Daily Weight Gain (g/day)
Extra (T1)	222 ± 1.45 a	662 ± 41.21 a	440 ± 42.51 a	7.33 ± 0.47 a
Fidco (T2)	221 ± 1.52 c	465 ± 22.51 c	244 ± 22.64 c	4.06 ± 0.03 c
Arasco (T3)	221 ± 1.40 b	556 ± 22.81 b	335 ± 23.24 b	5.58 ± 0.26 b
Ferdana (T4)	222 ± 1.20 c	457 ± 23.45 c	235 ± 23.49 c	3.91 ± 0.26 c

LSD` Means with different letters are significantly different (P<0.05)

Table 3: Specific Growth Rate (SGR), Relative Growth Rate (RGR), FCR, and Feed Conversion Efficiency (FCE) of Common Carp

TRT	SGR (%/day)	RGR (%)	FCR	FCE (%)
Extra (T1)	1.82 ± 0.035 a	198.19 ± 20.40 a	3.87 ± 0.26 a	26.03 ± 1.71 a
Fidco (T2)	1.23 ± 0.003 c	110.40 ± 1.5 c	5.60 ± 0.01 c	17.85 ± 0.049 c
Arasco (T3)	1.53 ± 0.020 b	151.58 ± 10.72 b	4.68 ± 0.27 b	21.53 ± 1.25 b
Ferdana (T4)	1.20 ± 0.026 c	105.85 ± 10.78 c	5.95 ± 0.28 c	17.85 ± 0.82 c

LSD` Means with different letters are significantly different (P<0.05)

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