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Impact of adding different levels of Moringa oleifera leaf powder to the diet on some growth parameters of common carp Cyprinus carpio L.

Eadhra'a Juhi[1] and Ali Salman[2]

[1] Animal Production Department, Agriculture College, Al-Muthanna University, Iraq.

[2]Faculty of Health and Medical Technology, Sawa University, Iraq.

Email: athraa.kaeem@mu.edu.iq, alihassain@sawauniversity.edu.iq

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Abstract

The aim of this investigation was to investigate the effects of varying concentrations of Moringa oleifera leaf powder in the feed on specific growth parameters of the common carp Cyprinus carpio L. from 1/10/2023 to 22/12/2023. Five distinct regimens were randomly assigned to 90 common carp fish, each of which contained three replicates and six fish, with an average weight of 50-60 gm. The fish were administered experimental diets that were divided into five protocols with identical protein ratios. For T1, T2, T3, T4, and T5, the treatments contained 0, 0.5, 1, 1.5, and 2% of Moringa leaf powder, respectively. The statistical analysis demonstrated that the experimental interventions exhibited significant differences (P≤0.05) in the growth properties that were examined. The final weight, weight gain, daily growth rate, relative growth rate, specific growth rate, feed conversion ratio, feed conversion efficiency, and protein efficiency ratio of the fish in T5 were significantly higher than those in the other experimental treatments. The average values were 95.88 gm, 42.19 gm, 00.60 gm, 5.34%, 4.13%, 3.43, 29.29%, and 0.97 gm, respectively.

Key words: common carp Cyprinus carpio L.,growth parameters ,Moringa oleifera leaf

Introduction

Fish wealth is a major aspect in providing food security, it represents an important food source for humans. Humans may resort to meeting their protein needs, particularly animal protein, by raising living organisms in an aquatic environment, these organisms include fish, crustaceans and molluscs. Approximately 16% of the animal protein consumed by the global population is derived from the flesh of these organisms, which is a critical source of high-quality protein. This is a result of the presence of minerals, lipids, and protein[1].

One of the most significant natural sources of antioxidants, including flavonoids and phenolic chemicals, is medicinal plants, which have shown great superiority over both vitamins C, E and carotenoids [2, 3]. All plants contain biologically active substances with medicinal properties, which are a mixture of secondary substances found in plants, most of these substances are secondary metabolites of these plants, these substances include tannins, steroids, alkaloids, phenolic compounds, glucosinolates, saponins, anthraquinones, terpnoids, sterols [4].

Consequently, the leaves of Moringa oleifera are regarded as an alternative food source for human nutrition and animal feed in numerous countries, as they are used as a dietary supplement to improve the growth and reproductive efficiency of animals, particularly fish[5].

Fresh leaves of Moringa oleifera, commonly known as "drumsticks," serve as a very nutritious supplement for the diets of herbivorous fish species, including tilapia, staghorn, and fancy carp[6]. The amount of protein, fats, vitamins, and minerals that they contain is substantial. Therefore, the leaves, kernels, and pods are utilized in the production of fertilizers for aquaculture. This is a consequence of the fact that [7].

Fresh Moringa leaves offer supplementary protein, vitamins, and amino acids, including methionine, cysteine, and tryptophan, which can enhance the health and growth of fish. [8]. Afuang et al. [9] replaced fish meal with varying amounts of Moringa leaf meals for Oreochromis niloticus. The liver index (HSI), which ranges from 1.5 to 2.7 and is linked to body fat incorporation and is obviously influenced by nutrient intake and availability, was found to be significantly impacted by the relative liver weight. They also discovered that prefeeding Puntius altus fish with a semi-powdered extract of Moringa oleifera leaves will protect fish

exposed to waterborne lead contaminated environments by lowering lead burdens. [10].

The purpose of this research is to illustrate the impact that consumption of Moringa oleifera leaf powder in varying quantities has on the growth indices of common carp, also known as Cyprinus carpio L.

Material and methods

The experiment was carried out in the First Agricultural Research and Experiment Station, Department of Agriculture, College of Agriculture, Al-Muthanna University, located in the Umm Al-Agaf neighborhood of Al-Muthanna Governorate, beginning on October 1, 2023 and continuing until December 22, 2023. As part of the experiment, a dugout pond with dimensions of 45 meters in length, 35 meters in breadth, and 1.5 meters in depth was utilized. The pond was located approximately 570 m from the Euphrates River at coordinates E 45.189309N, 31.321394.

Fingerlings of common koi Cyprinus carpio L. were transported from the fish farming station in Babylon Governorate, southern Iraq, with an average weight of 50-60gm. When the fish arrived at the location where the experiment was being carried out, they were immediately placed in plastic basins and prepared in advance as a 0.3% salt bath for a period of five minutes, or until the fish showed evidence of suffering from stress. This process was repeated until the fish showed signs of being stressed. In order to eliminate any external parasites that may have been present in the fish in the past, this technique was carried out on them. Following that, the fish were moved and placed in a cage made of iron mesh that was situated within the earthen basin and was in close proximity to the cages that were used for the experiments for a period of twenty-four hours. It was decided not to include the dead fish during this time.

Moringa leaves were obtained by purchasing them from local markets in Muthanna, they were washed from dirt and dust stuck to them, they were exposed to sunlight for several days with continuous stirring until they were completely dry, after drying them well, they were ground using a home grinding machine, then they were packed in tightly sealed bags for use in formulating feed. A sample was taken from them for the purpose of conducting laboratory tests and knowing their chemical composition. Table, as for the rest of the materials used in formulating the feed, they were purchased from local markets and ground well and transported to one of the feed pressing factories. The

feed was manufactured, dried and cut, then transported to the experimental site.

Five treatments with equal protein ratios were used in this investigation. Treatments T1, T2, T3, T4, and T5 each had varying amounts of Moringa leaf powder added to them (Tables 1 and 2). The percentages were 0, 0.5, 1, 1.5, and 2%.

Table (1) Composition of the feeds used in the experiment.

Items	T1	T2	T3	T4	T5
Animal Protein concentrate*	20.00	20.00	20.00	20.00	20.00
Soybean meal**	35.00	35.00	35.00	35.00	35.00
Bran	15.00	15.00	15.00	15.00	15.00
Maize***	15.00	15.00	15.00	15.00	15.00
Barley	10.00	10.00	10.00	10.00	10.00
Wheat flour	3.00	2.50	2.00	1.50	1.00
Oil	1.00	1.00	1.00	1.00	1.00
Vitamins and Minerals***	1.00	1.00	1.00	1.00	1.00
Moringa leaf powder	0	0.50	1.00	1.50	2.00
Total	100	100	100	100	100

* WAFI animal protein concentrate of Dutch origin.

** Soybean meal (EAGLE) is of Argentinian origin.

*** Yellow corn (EAGLE) is of Argentinian origin. **** Each kilogram contains Vitamin A (400 IU), Vitamin D3 (160 IU), Vitamin E (1200 mg), Vitamin B1 (120 mg), Vitamin B2 (280 mg), Vitamin B6 (160 mg), Vitamin B12 (1400 mg), Vitamin H (4 mg), Calcium (20.08%), Phosphorus (4.90%), Sodium (5%).

Table (2) Chemical analysis of experimental diets.

Items	Chemical Content				
	Protein (%)	**Ether extract (%)**	**Ash (%)**	**Fiber (%)**	**Carbohydrates (%)**
Animal Protein concentrate	00.40	5.00	23.45	2.81	28.74
Soybean meal	43.80	2.72	7.21	6.9	39.37
Maize	9.68	5.04	2.09	2.72	80.27
Barley	11.83	1.53	4.11	7.0	75.81
Bran	15.72	4.47	5.52	11.8	62.49
Wheat flour	10.50	1.50	0.44	0.50	76.0

The experiment was conducted over a period of 83 days, during which five distinct experimental diets were prepared with varying percentages of Moringa leaf powder to determine the impact of their use on the productivity of common carp fish. Acclimatization was also implemented. During the initial thirty days of the experiment, During the course of the experiment, the fish were given three

meals per day, at 7 a.m., 11 a.m., and 13 p.m., with each meal containing 1% of their live weight. In accordance with the fish's periodic weight, the feed was modified every 14 days to the nearest decimal place. The method of weighing the experimental fish was carried out with the assistance of a sensitive balance (0.05 gm) type DIGITAL SCALE that was manufactured in China. This was done after the fish were dried with a piece of cotton fabric. Because the fish are frequently agitated following the weighing process, When it came to the feeding schedule, it was made sure that the first meal and the second meal were not served at periods that coincided with the weighing of the animal. This was done on the day that the fish were being weighed.

As for the studied characteristics were total Weight Gain(WG), Daily Growth Rate (DGR), Relative Growth Rate (RGR) and Specific Growth Rate (SGR).

Statistical Analysis

To investigate the impact of transactions on the characteristics under investigation, a Completely Randomized Design (CRD) was implemented. The Duncan [11] multiple range test was employed to evaluate significant differences between means at a significance level of 0.05, utilizing the pre-existing statistical software SPSS, version (20).

Results and discussion:

Weight gain and daily growth rate:

Table (3) shows significant differences at the probability level (P≤0.05) in the weight gain rate of fish in T4, T5 then T1 treatments, respectively, while no differences appeared between T2 and T3. As fish in T5 (42.19 gm fish), which was significantly superior to T4 (40.29 gm fish), which in turn was superior to T1 (32.06 gm fish). T2 and T3 treatments recorded the lowest values, reaching 39.57 and 36.33 gm fish, respectively, and no significant differences appeared between them.

The experimental treatments exhibited significant differences (P≤0.05) in the daily growth rate, as indicated in the same table. The fish with the greatest recorded value were T5 (0.60 gm/day/fish), T4 (0.57 gm/day/fish), and T1 (0.45 gm/day/fish). The daily growth rate of T2 and T3 was 0.56 gm/day/fish, respectively, and there were no significant differences between the two groups.

Relative growth rate:

Table (3) shows the presence of significant differences (P≤0.05) among the experimental treatments, T5 recorded the highest relative growth rate of 78.49%, then it was followed by T4 with a value of 74.95%, then T2 with a value of 72.86%, while there were no significant differences between T1 and T3, as each of them recorded a relative growth rate of 67.46 and 60.68% respectively.

Specific growth rate:

The same table indicates that there are significant differences (P≤0.05) between the experimental treatments. T5 had the highest specific growth rate, at 4.13%, followed by T4 at 3.99% and T2 at 3.90%. T1 and T3 treatments did not differ significantly, as each had a specific growth rate of 3.38 and 3.68%, respectively.

Table (3) Some growth parameters (mean ± standard error) of common carp fed diets containing Moringa leaf powder during the experimental period.

Growth parameters	Treatments					Sig.
	T1	T2	T3	T4	T5	
Initial weight (IW) (gm/fish)	0.41±52.90	0.37±54.30	0.23±53.86	0.07±53.75	0.57±53.68	N. S
Final weight (FW) (gm/fish)	2.08±84.96 b	3.50±93.88 a	0.28±90.19 ab	0.82±94.04 a	3.83±95.88 a	*
Weight gain (WG) (gm/fish)	2.45±32.06 b	3.37±39.57 ab	0.43±36.33 ab	0.90±40.29 a	3.28±42.19 a	*
Daily growth rate (DGR) (gm/day)	0.03±0.45 b	0.04±0.56 ab	0.006±0.51 ab	0.01±0.57 a	0.04±0.60 a	*
Relative growth rate (RGR) (%)	60.68±5.06 b	72.86±6.05 ab	67.46±1.05 ab	74.95±1.78 ab	78.49.±5.34 a	*
Specific growth rate (SGR) (%/day)	0.230.±3.38 b	0.251.±3.90 ab	0.045±3.68 ab	0.072±3.99 ab	0.211±4.13 a	*

* Different letters indicate significant differences between means. N.S: no-significant.

The results in the table above showed that the fish of T4 and T5 treatments outperformed all experimental treatments in the rate of weight gain and daily growth rate. When compared to the other experimental treatments, the fish that were given the T5 therapy fared better in terms of both their relative and qualitative growth rates. This superiority, as well as the favorable outcomes that were obtained, can be attributed to the incorporation of Moringa leaf powder into the experimental treatment feeds at a rate of 2.1.5%. One of the reasons for the increase in growth may be due to the diversity of protein sources in the experimental feeds, which contributes to meeting the deficiency in amino acids necessary for fish growth, in addition to the integration of the feeds and increasing their content of important mineral elements [12]. The study conducted by Olaniyi et al., [13] Our results did not agree with the results of their study, only the agreement in the qualitative growth rate, it showed that adding Moringa leaf powder to the feed of African catfish at a rate of 12.50%, led to the superiority of fish in the fifth treatment in terms of the qualitative growth rate, since the fish fed on this ratio achieved excellent performance. Tilapia fish fed a diet containing Moringa leaf powder at doses of 100 and 130 gm kg, when replaced by a dietary protein based on fish powder at 150 gm kg, did not negatively affect growth performance [9, 14]. The results of the study conducted by Bbole et al. [15] also

confirmed that including Moringa leaf powder in Nile tilapia fish feed at high rates of 5, 10 and 15%, no significant differences were shown with the control group in most of the studied growth parameters, the researchers attributed the reason for the lack of an increase in fish growth to the presence of high rates of anti-nutritional factors such as phenols, saponins and phytic, these results not agreed with Yuangsoi and Masumoto [16] reached in their study conducted on common carp fish, No discernible effects on growth or digesting parameters were observed when Moringa leaves were added to the feed at a rate of 2%, or 20 gm kg. A comparison with the fish in the control group revealed that there were no discernible differences between the two groups.

Feed conversion rate:

Table (4) showed a significant superiority (P≤0.05) in T5 treatment on the feed conversion rate compared to the other treatments in the experiment, as the recorded value reached 3.43, followed by T2, whose value was close to the value of T4 (3.68), then followed by T3 with a value recorded 3.94, which did not record significant differences between it and T1, which recorded a feed conversion rate of 4.30.

Feed conversion efficiency:

The statistical analysis of the same table revealed that T5 exhibited a significant superiority (P≤0.05) in feed conversion efficacy compared to the other treatments, with values reaching 29.29%. T2 recorded a feed conversion efficiency with a value of 27.32%, a value close to recorded by T4, which reached 27.18%, then followed by T3 (25.34%), with the fish that were subjected to the control treatment, which did not register a significant significant difference, which recorded a low feed conversion efficiency of 23.47%.

Protein efficiency ratio:

The protein efficiency ratio of T5 was significantly different (P≤0.05) from that of the other treatments, with a value of 0.97. T2 was second, with a value that was nearly identical to that of the fish in T4, which was 0.90 for each. T3 was third, with a value of 0.83, which did not exhibit any significant differences from T1, which had a value of 0.77.

Table (4) Growth properties for feed efficiency, feed conversion and protein efficiency ratio (mean ± standard error) of common carp fed diets containing Moringa leaf powder during the experimental period.

Growth parameters	Treatments					Sig.
	T1	T2	T3	T4	T5	
Feed Intake (FI) (gm fish)	1.26±136.48 b	3.93±144.40 ab	0.71±143.37 ab	0.97±148.17 a	3.59±143.65 ab	*
Protein intake (PI) (gm fish)	0.38±41.21 b	1.18±43.60 ab	0.21±43.29 ab	0.29±44.74 a	1.08±43.38 ab	*
Feed conversion ratio (FCR) (gm feed/gm weight gain)	0.31±4.30 b	0.22±3.68 ab	0.03±3.94 ab	0.06±3.68 ab	0.17±3.43 a	*
Feed conversion efficiency (FCE) (%)	1.66±23.47 b	1.62 ±27.32 ab	0.22± 25.34 ab	0.45±27.18 ab	1.55±29.29 a	*
Protein efficiency ratio (PER) (gm weight gain/gm protein intake)	0.055±0.77 b	0.053±0.90 ab	0.007±0.83 ab	0.01±0.90 ab	0.05±0.97 a	*

When comparing the fish of T5 with those of the other experimental regimens, it is observed that the fish of T5 exhibit the most significant difference ($P<0.05$) in terms of the feed conversion rate, feed conversion efficiency, and protein efficiency ratio. The results of the present study were not in accordance with those of the study conducted by Ayoola et al. [17], as it showed that adding Moringa leaf powder to the feed of African catfish, led to the superiority of the fish in T3 on the feed conversion rate and the superiority of the fish of the two treatments in the protein efficiency ratio. The researchers attributed the noticeable increase in some growth parameters to the high nutritional value of Moringa, when added to the feed at low rates of 8.2 and 12.3 gm kg, which contain low rates of anti-nutritional or what is known as growth inhibitors, and thus the effectiveness.

Moringa in stimulating fish growth without activating the negative effect of growth inhibitory substances, while the results reached by Chen et al. [18] differed from the results of our current study, as the addition of Moringa leaf powder at rates of 0.50, 1.00 and 2.00% did not show any significant differences among the addition treatments and the control treatment in the criteria related to the amount of feed consumed and the feed conversion rate, they attributed the poor growth criteria of the experimental fish. The lack of effect of adding Moringa to the presence of phytic acid and saponins in Moringa present in the experimental diets, as these factors were considered influential in reducing growth performance [19, 20].

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