

Effects of Anise and Caraway Seed Powder Supplementation on Growth Performance and Blood Parameters of Common Carp (*Cyprinus carpio* L.)

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Abstract

This study was conducted to investigate the effect of adding anise and caraway seed powders to the diet of common carp (*Cyprinus carpio* L.). Fourteen plastic tanks with a capacity of 110 liters each were used over 60 days. A total of 84 fish were distributed into seven experimental treatments, with 12 fish per treatment and two replicates per treatment, and were fed seven different diets. The first treatment served as the control, while the remaining treatments were supplemented with anise and caraway powders at concentrations of 1%, 2%, and 3%. Results for growth parameters showed that treatment T2 ($P \leq 0.05$) achieved the highest final weight (210.865 g), weight gain (50.700 g), daily growth rate (1.125 g/day), and specific and relative growth rates (0.0265 g/day, 31.935%). In contrast, treatment T4 exhibited the highest ($p \leq 0.05$) feed conversion efficiency (38.235%). Regarding blood biochemical traits, glucose, cholesterol, and triglyceride levels were highest in treatment T1 compared to the other treatments. Protein levels were elevated ($p \leq 0.05$) in treatments T4 and T2 (2.740, 2.805 g/100 mL) relative to the others, while albumin levels were highest ($p \leq 0.05$) in T2 (1.345 g/100 mL). The globulin percentage was higher ($p \leq 0.05$) in T4 (1.830 g/100 mL) than in all other treatments. Among the aminotransferase enzymes, aspartate aminotransferase (AST) was highest in T5 (231.230 IU/L) relative to the other treatments, whereas alanine aminotransferase (ALT) showed little variation. In conclusion, the 1% anise supplementation treatment showed a significant improvement in growth indices and feed efficiency, while the 2% caraway supplementation treatment improved the chemical composition of flesh. The combined treatment showed better overall results, indicating their potential as effective natural feed additives in common carp.

Keywords: Growth Parameters, Biochemical Blood Traits, Common Carp.

Introduction

Common carp (*Cyprinus carpio* L.) are characterized by their ability to tolerate various environmental conditions and achieve high production rates in Iraqi fish farms due to their ease of cultivation and acceptance by consumers [1]. There is considerable interest in using medicinal plants in aquaculture to provide safe and environmentally friendly compounds as alternatives to antibiotics and chemical agents, as well as to enhance immune status and control fish diseases (Awad et al.,

2017). Anise (*Pimpinella anisum*) is a widely cultivated plant, native to the Mediterranean region. Its essential oil can be utilized in various fields such as food, beverages, pharmaceuticals, and cosmetics [2]. Anise seeds contain numerous bioactive components, including phenolic acids, essential oils, eugenol, anisaldehyde, trans-anethole, coumarin, polyacetylenes, polyenes, and estragole [3]. Anise is known for its growth-promoting effects, antibacterial activity, immune-stimulating properties, and antioxidant effects [4]

Caraway (*Carum carvi*) is one of the oldest cultivated herbs in Asia, Europe, and Africa. Its seeds are known for their antispasmodic effects, as well as for treating stomach disorders, diarrhea, indigestion, and improving liver functions. The main phytochemicals in caraway seeds include limonene, carvacrol, carvone, linalool, and carvone oxide [5]. On the other hand, some recent studies have shown the impact of herbal and natural supplements on the growth, blood characteristics, and biochemical constituents of common carp (*Cyprinus carpio* L.).

Al-Turaihi et al. [6] found that the supplement of *Tinospora cordifolia* leaf powder to the diet of common carp significantly ($P < 0.05$) increased growth rate, red blood cell count, hematocrit, hemoglobin, total protein, albumin, globulin, and the activity of antioxidant enzymes such as superoxide dismutase and glutathione peroxidase compared to the control group. This is an indication of the overall improvement in the health status of the fish with the rise in the levels of supplementation, hence the sustainability of aquaculture. On a similar note, a study

conducted by Habib et al. [7] on the impact of *Withania somnifera* (Ashwagandha) root powder supplementation revealed that the dietary inclusion of *Withania somnifera* root extracts effectively improved growth performance, blood characteristics, antioxidant system, immune system, and disease resistance in common carp, particularly at dietary inclusion levels of 2.5% to 4%. Moreover, Guz et al. [8] found that the addition of *Echinacea purpurea* (EP) root powder at a concentration of 10 g EP kg⁻¹ and 20 g EP kg⁻¹ of diet to the diet of common carp caused significant increases in weight gain, growth rate, and red and white blood cell counts and hemoglobin concentration, as well as improved survival rates after challenge with *Aeromonas hydrophila*. The above-mentioned recent studies emphasize the significance of plant-based supplements in improving growth performance, blood characteristics, and biochemical values in common carp, thus justifying the need to investigate the effect of adding anise and caraway seed powders to the diet of common carp (*Cyprinus carpio* L.) on growth performance and blood biochemical values.

Material and Methods

Experimental Diets

Commercial diet was bought from the Feed Erbil factory through one of its agents in the city of Samarra. Anise seed and caraway seed powders were bought from local markets in Babil Governorate. The commercial diet was ground and reprocessed after adding the required percentages of anise seed and caraway seed powders. The control diet (T1) was not mixed with any additives. Anise seed powder was added at concentrations of 1%, 2%, and 3% to diets T2, T3, and T4, respectively. Similarly, caraway seed powder was added at the same

concentrations (1%, 2%, and 3%) to diets T5, T6, and T7, respectively.

Growth Measurements:

Total Weight Gain

The total weight gain was calculated according to the following formula:

$$\text{Total Weight Gain (g)} = \text{Final Weight (g)} - \text{Initial Weight (g)}$$

Daily Growth Rate (DGR)

The daily growth rate was calculated using the equation described by Schmalhusen [9]:

$$\text{DGR (g/day)} = \frac{\text{Weight Gain (g)}}{\text{Time Period (day)}}$$

Specific Growth Rate (SGR)

The specific growth rate was calculated according to the equation reported by Brown [10] and Jobling & Kokela [11]:

$$\text{SGR (g/day)} = [(\log \text{ Final Weight} - \log \text{ Initial Weight}) \div \text{ Experiment Duration (days)}] \times 100$$

Relative Growth Rate (RGR)

The relative growth rate was calculated as described by Jobling [12]:

$$\text{RGR (\%)} = [(\text{Final Weight (g)} - \text{Initial Weight (g)}) \div \text{Initial Weight (g)}] \times 100$$

Feed Conversion Efficiency (FCE)

Feed conversion efficiency was calculated according to McCormick et al. [13]:

$$\text{FCE (\%)} = [(\text{Wet Weight Gain of Fish (g)} \div \text{Feed Intake (g)}) \times 100]$$

Blood Serum Analyses:

Blood samples were collected from the fish before the start of the experiment (one sample per group for baseline comparison) and at the end of the experiment (three fish per treatment). Before blood collection, the fish were fasted for 12 hours to reduce the impact of feeding on the blood biochemical parameters. Blood was drawn from the caudal vein using a sharp scalpel to cut the tail. The blood was collected into 10 mL tubes containing gel to prevent coagulation and then transported for analysis [14,15].

Glucose Measurement:

The concentration of glucose in serum was measured using a commercial kit (Linear Company) and analyzed spectrophotometrically at a wavelength of 500 nm.

Cholesterol Measurement:

The level of serum cholesterol was measured using a commercial kit (Biomaghreb Company) based on the enzymatic method of Allain et al. [16], and the absorbance was read at a wavelength of 505 nm.

Triglycerides (TG):

Triglycerides (TG) were estimated using a commercial kit based on the enzymatic hydrolysis method described by Fossati and Prencipe [17], with absorbance measured at 500 nm using a spectrophotometer (SP-3000 Plus, Germany).

Total Protein Measurement:

Total protein was measured using a commercial kit (Biomaghreb Company) according to Falkner and Meites [18], with absorbance recorded at 550 nm.

Albumin Concentration Measurement:

Serum albumin was measured using a commercial kit (Raudox, USA) at 630 nm.

Globulin Concentration Measurement:

Globulin concentration was calculated by subtracting albumin from total protein values [19].

Liver Enzyme Assays:

Liver enzymes, Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT), were determined using a Mindray analyzer (Germany).

Statistical Analysis

Data were analyzed using a Completely Randomized Design (CRD) with the Statistical Analysis System (SAS, 2012) at a significance level of ($p \leq 0.05$). Duncan's multiple range test was applied to determine significant differences among treatment means [20].

Results and Discussion

Effect of Treatments on Growth Parameters:

Total Weight Gain and Daily Growth Rate

Results in table (1) shows the effect of adding anise and caraway seed powders at different levels on growth parameters, including final weight, total weight gain, and daily growth rate of common carp. Treatment T2 showed a significant superiority ($P \leq 0.05$) over all other treatments, recording a final weight of 210.865 g. Significant differences ($P \leq 0.05$) were also observed in treatment T7, which

recorded 205.330 g compared to treatments T5, T3, T4, T6, and the control treatment T1. In addition, treatment T3 showed significant differences ($P \leq 0.05$) compared to treatments T5, T4, T6, and T1. Treatment T6 recorded the lowest final weight, reaching 173.355 g. Regarding total weight gain, the control treatment T1 recorded the lowest value, at 27.080 g. Treatment T2 showed a significant superiority ($P \leq 0.05$) over all treatments, with a value of 50.700 g. Significant differences ($P \leq 0.05$) were also observed between treatment T3 (43.300 g) and treatments T7, T6, T4, T5, and T1, which recorded 41.000, 36.275, 36.245, 33.105, and 27.080 g, respectively.

Table 1. Effect of dietary supplementation with anise and caraway seed powders at different levels on growth parameters, final weight, total weight gain, and daily growth rate of common carp (mean ± standard error)

Treatments	Initial Weight (g)	Final Weight (g)	Total Weight Gain (g)	Daily Growth Rate (g/day)
Control (T1)	147.830 ± 4.83 bc	174.910 ± 5.41 ed	27.080 ± 0.58 e	0.600 ± 0.01 e
Anise seed powder 1% (T2)	160.165 ± 4.665 ab	210.865 1.365 a	50.700 ± 0.300 a	1.125 ± 0.005 a
Anise seed powder 2% (T3)	144.330 ± 5.50 c	187.630 ± 5.03 cd	43.300 ± 0.53 b	0.960 ± 0.01 b
Anise seed powder 3% (T4)	139.330 ± 4.670 c	175.575 4.075 ed	36.245 ± 0.595 c	0.805 ± 0.015 c
Caraway seed powder 1% (T5)	161.830 ± 3.500 ab	194.935 3.245 bc	33.105 ± 0.255 d	0.735 ± 0.005 d
Caraway seed powder 2% (T6)	137.080 ± 1.920 c	173.355 2.535 e	36.275 ± 0.615 c	0.805 ± 0.015 c
Caraway seed powder 3% (T7)	164.330 ± 4.50 a	205.330 ± 4.33 ab	41.000 ± 1.83 b	0.910 ± 0.04 b

Different letters within the same column indicate the presence of significant differences ($p \leq 0.05$).

Results of the daily growth rate indicated that treatment T2 was significantly superior ($P \leq 0.05$) to all treatments, recording a daily growth rate of 1.125 g/day. Treatments T3 and T7, which recorded values of 0.960 and 0.910 g/day, respectively, were significantly superior ($P \leq 0.05$) to treatments T1, T5, and

T6, with no significant difference between them. Likewise, treatments T4 and T6 were significantly superior ($P \leq 0.05$) to T1 and T5, with no significant difference between T4 and T6.

It can be concluded that the treatment supplemented with 1% anise seed powder was superior to all treatments in terms of total weight gain and daily growth rate. These results are consistent with those reported by Ashry et al [21], who found that dietary supplementation with anise seed powder at 3.5 g/kg in European seabass diets resulted in significant improvements ($P \leq 0.05$) in total weight gain and daily growth rate, reaching 179.43 g and 1.495 g/day, respectively.

Regarding growth parameters of diets supplemented with caraway seed powder, the best inclusion levels were 2% and % for final weight, daily growth rate, relative growth rate, specific growth rate, and feed conversion efficiency. These findings agree with those reported by Ahmad [22], who studied the effect of adding caraway seed powder to Nile tilapia diets for 12 weeks. The treatment supplemented with 10% caraway seed powder showed the highest mean final weight, initial weight, and total weight gain, reaching 32.3 g, 3.6 g, and 28.7 g, respectively.

Specific and Relative Growth Rate and Feed Conversion Efficiency:

The results in Table (2) show the effect of adding anise and caraway seed powders at different ratios on the relative and specific growth rates and feed conversion efficiency in common carp feeding. The relative growth rate significantly increased ($p \leq 0.05$) in the treatments with 1%, 2%, 2% (T2, T3, T6, T4, T7) with values of 31.935%, 30.895%, 26.455%, 26.115%, and 25.165%, respectively, compared to treatments T1 and T5. No significant difference was observed between the control (T1) and T5. Regarding the specific growth rate, it significantly increased ($p \leq 0.05$) in treatments T2, T3, T6, T4, and T7 with values of 0.265, 0.260, 0.230, 0.250, and 0.215 g/day, respectively, compared to T1 and T5 (0.160, 0.180 g/day), with no

significant differences between them. Also, there was no significant difference between the control (T1) and T5.

Concerning feed conversion efficiency, significant superiority ($p \leq 0.05$) was observed in treatments T4 and T2 with values of 38.235% and 35.020%, respectively, over treatments T7, T3, T6, and T5, which recorded 32.110%, 31.690%, 28.605%, and 22.205%, respectively, with no significant differences between them. The control treatment (T1) recorded the lowest feed conversion efficiency at 19.290%.

The improvement in growth performance is attributed to anise seeds, which enhance intestinal function and exhibit antibacterial activity to eliminate harmful gut microorganisms [21]. Additionally, adding anise seeds to the diet positively affects fish growth, physiological health, antioxidant defense, metabolic balance, and tissue integrity [20]. These results are consistent with Mansour [24], who reported that adding anise at 1–2% in Nile tilapia diets significantly ($p \leq 0.05$) improved both specific and relative growth rates. Similar results were reported by Ashry et al. [21] when adding 3.5 g/kg anise seed powder to European perch diets, showing significant superiority ($p \leq 0.05$) in both specific and relative growth rates, with specific growth of 1.11 g/day and relative growth of 179.432%.

Tok et al. [23] observed that adding 2% anise to Nile tilapia diets significantly increased ($p \leq 0.05$) specific and relative growth rates, to 1.32 g/day and 69.52%, respectively. Rashidian et al. [25] reported significant improvements ($p \leq 0.05$) in specific and relative growth when adding 20% anise seed powder to rainbow trout fry diets. Yasami et al. [26] reported that supplementing caraway seed powder at 15% in juvenile grass carp diets improved growth rates and feed conversion efficiency.

Mirfalah and Khara [27] observed significant improvements ($p \leq 0.05$) in specific and relative growth rates when 1%

caraway seed powder was added to African jewel fish diets.

Table 2. Effect of adding anise and caraway seed powders at different ratios on relative and specific growth rates (g/day) and feed conversion efficiency (%) in common carp feeding (mean \pm standard error)

Treatments	Relative Growth Rate (%)	Specific Growth Rate (g/day)	Feed Conversion Efficiency (%)
Control (T1)	18.320 \pm 0.21 b	0.160 \pm 0.01 b	19.290 \pm 0.84 d
Anise seed powder 1% (T2)	31.935 \pm 3.115 a	0.0265 \pm 0.0250 a	35.020 \pm 0.020 ab
Anise seed powder 2% (T3)	30.895 \pm 5.095 a	0.260 \pm 0.04 a	31.690 \pm 0.343 bc
Anise seed powder 3% (T4)	26.115 \pm 1.865 ab	0.225 \pm 0.015 ab	38.235 \pm 3.245 a
Caraway seed powder 1% (T5)	20.496 \pm 0.980 b	0.180 \pm 0.010 b	22.205 \pm 0.255 d
Caraway seed powder 2% (T6)	26.455 \pm 0.075 ab	0.230 \pm 0.010 ab	28.605 \pm 0.125 c
Caraway seed powder 3% (T7)	25.165 \pm 1.875 ab	0.215 \pm 0.015 ab	32.110 \pm 1.200 bc

Different letters within the same column indicate the presence of significant differences ($p \leq 0.05$).

Blood Serum Analysis

Glucose, Cholesterol, and Triglycerides

The results of the statistical analysis in Table (3) indicated an increase in blood serum glucose levels in fish for treatment T1, at a significance level of ($P \leq 0.05$), reaching 92.225 g/100 mL compared to all other treatments. Significant differences were observed between treatment T6 and treatments T3, T7, T4, and T2, which recorded glucose levels of 63.120, 60.090, 59.235, and 56.180 g/100 mL, respectively. A significant decrease in blood glucose ($P \leq 0.05$) was observed in treatment T5, reaching 52.140 g/100 mL, compared with all other treatments. The results showed that glucose levels in the blood serum decreased in treatments supplemented with caraway compared to other treatments. This may be due to the effects of medicinal plants, which

stimulate digestion by increasing bile secretion and activating pancreatic secretion [28], as well as the presence of Trigonelline, which inhibits glucose absorption in the stomach [29]. Jarvill-Taylor et al. [30] reported that polyphenols mimic insulin's action to stimulate glucose metabolism in blood serum. Additionally, caraway contains saponins and alkaloids that reduce blood glucose levels [31]. The saponins and alkaloids in caraway inhibit glucose absorption, explaining the lower glucose levels in caraway-supplemented treatments, with the lowest level observed in the 1% caraway treatment. The addition of 1% caraway in the diets of Johara fish reduced blood glucose levels [24]. Cholesterol levels increased in treatment T1, reaching 126.070

g/100 mL compared to all other treatments. Significant differences were observed between treatment T2 and treatments T5, T4, T2, and T6, which recorded 95.100, 82.130, 77.150, and 74.350 g/100 mL, respectively. Treatment T7 showed a significant decrease ($P \leq 0.05$) in cholesterol, reaching 63.200 g/100 mL compared to all other treatments. As for triglycerides, a significant increase ($P \leq 0.05$) was observed in treatment T1, reaching 273.140 g/100 mL compared to all other treatments. Treatment T2 outperformed treatments T6, T7, T4, T3, and T5, which recorded 86.250, 73.280,

71.075, 67.430, and 58.210 g/100 mL, respectively. Treatment T5 showed a significant decrease ($P \leq 0.05$) in triglyceride levels, reaching 58.210 g/100 mL, the lowest among all treatments. Ali et al. [32] reported increases in blood glucose, cholesterol, and triglycerides in *Labeo catla* when 1% anise was added to the diet. These results agree with Roohi [33], who reported that adding caraway at 0.5%, 1%, and 1.5% to the diet of common carp significantly decreased cholesterol levels in all groups compared to the control and gradually reduced glucose and triglycerides in fish blood serum.

Table 3. Effect of adding different levels of anise and caraway seed powders on glucose, cholesterol, and triglyceride concentrations in the blood serum of common carp (mean ± standard error)

Treatments	Glucose (g/100 mL)	Cholesterol (g/100 mL)	Triglycerides (g/100 mL)
Control (T1)	92.225 ± 0.015 a	126.070 ± 0.030 a	273.140 ± 0.10 a
Anise seed powder 1% (T2)	56.180 ± 0.150 f	102.360 ± 0.350 b	242.465 ± 0.425 b
Anise seed powder 2% (T3)	63.120 ± 0.100 c	74.350 ± 0.300 f	67.430 ± 0.400 f
Anise seed powder 3% (T4)	59.235 ± 0.195 e	82.130 ± 0.100 d	71.075 ± 0.065 e
Caraway seed powder 1% (T5)	52.140 ± 0.100 g	95.100 ± 0.050 c	58.210 ± 0.180 g
Caraway seed powder 2% (T6)	68.015 ± 0.005 b	77.150 ± 0.110 e	86.250 ± 0.200 c
Caraway seed powder 3% (T7)	60.090 ± 0.050 d	63.200 ± 0.180 g	73.280 ± 0.250 d

Different letters within the same column indicate the presence of significant differences ($p \leq 0.05$).

Similarly, De Souza et al. [34] found that adding anise at 0.25%, 0.50%, 1.00%, and 2.00% to the diet of Nile tilapia resulted in a significant decrease in glucose and triglycerides for the 2% treatment, reaching 45.57 and 92.94 g/100 mL, respectively. Ashry et al. [21] observed that adding 3.5% anise to European sea bass diets significantly decreased cholesterol levels compared to other treatments, reaching 971.33 g/100 mL.

However, these results differ from those of Tok et al. [23], who reported that adding 3% anise to Nile tilapia diets significantly increased cholesterol, triglycerides, and glucose in fish blood serum, reaching 140.69, 119.97, and 54.74 g/100 mL, respectively.

Total Protein, Albumin, and Globulin Concentrations

The results of the statistical analysis in Table (4) indicated a significant increase in total protein levels in fish blood serum at a significance level of ($P \leq 0.05$) for treatments T4 and T2, reaching 2.805 and 2.740 g/100 mL, respectively, compared to all other treatments, with no significant

difference between them. Significant differences ($P \leq 0.05$) were also observed for treatments T6 and T7, which exceeded the levels of T3, T4, and T5, recording 2.305, 2.235, and 1.935 g/100 mL, respectively, with no significant difference between T6 and T7.

Table 4. Effect of adding different levels of anise and caraway seed powders on total protein, albumin, and globulin concentrations in the blood serum of common carp (mean \pm standard error)

Treatments	Total Protein (g/100 mL)	Albumin (g/100 mL)	Globulin (g/100 mL)
Control (T1)	2.235 \pm 0.035 d	1.110 \pm 0.010 b	1.230 \pm 0.030 ef
Anise seed powder 1% (T2)	2.740 \pm 0.040 ab	1.345 \pm 0.045 a	1.415 \pm 0.015 cd
Anise seed powder 2% (T3)	2.305 \pm 0.005 d	0.905 \pm 0.005 c	1.440 \pm 0.040 c
Anise seed powder 3% (T4)	2.805 \pm 0.005 a	1.140 \pm 0.040 b	1.830 \pm 0.030 a
Caraway seed powder 1% (T5)	1.935 \pm 0.035 e	0.940 \pm 0.040 c	1.145 \pm 0.045 f
Caraway seed powder 2% (T6)	2.505 \pm 0.105 c	1.155 \pm 0.055 b	1.315 \pm 0.015 de
Caraway seed powder 3% (T7)	2.585 \pm 0.085 bc	0.930 \pm 0.030 c	1.655 \pm 0.055 b

Different letters within the same column indicate the presence of significant differences ($p \leq 0.05$).

Additionally, significant differences ($P \leq 0.05$) were observed between treatments T1 and T3, which exceeded T5, which recorded the lowest total protein level at 1.935 g/100 mL. Regarding albumin in fish blood serum, treatment T2 showed a significant increase ($P \leq 0.05$), reaching 1.345 g/100 mL, the highest value among all treatments. Treatments T6, T4, and T1 recorded 1.155, 1.140, and 1.110 g/100 mL, respectively, showing a significant increase ($P \leq 0.05$) compared to treatments T5, T7, and T3, which recorded 0.940, 0.930, and 0.905 g/100 mL, respectively, with no significant differences among the latter three.

Globulin levels increased in treatment T4, reaching 1.830 g/100 mL compared to all other treatments. Treatment T7 showed a significant increase ($P \leq 0.05$) compared to treatments T3, T2, T6, T1, and T5, which recorded 1.440, 1.415, 1.315, 1.230, and 1.145 g/100 mL, respectively.

These findings are consistent with de Souza et al. [34], who reported that adding anise at 0.25%, 0.50%, 1.00%, and 2.00% to Nile tilapia diets significantly increased total protein and albumin levels in fish blood serum at 2% anise, reaching 4.02 g/100 mL and 2.22 g/100 mL, respectively, while globulin levels increased at 1% anise, reaching 2.76 g/100 mL. However, the

current study disagrees with Mirfalah and Khara [27], who reported that adding caraway seed powder at 0.5%, 1%, and 1.5% to Johara fish diets increased albumin, globulin, and total protein levels in fish blood serum at 1% caraway compared to the control treatment.

Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT) Enzymes

Table (5) presents the statistical analysis of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) enzymes. Treatment T5 showed the highest AST enzyme activity, reaching 231.230 IU/L, compared with T1, T2, T3, T7, and T6, which recorded 219.195, 202.270, 151.070, 144.315, and 139.090 IU/L, respectively. AST activity decreased in treatment T4, reaching 126.100 IU/L.

ALT enzyme activity increased in treatment T1, reaching 45.290 IU/L compared to treatments T6, T5, T4, T3, and T2, which recorded 41.330, 39.145, 35.055, 28.400, and 45.290 IU/L, respectively. Treatment T7 showed the lowest ALT activity, reaching 18.080 IU/L. The decreased levels of ALT and AST in treatments T4 and T7 may be attributed to the protective role of medicinal plants, which enhance immunity and stabilize the body by stimulating or inhibiting AST, ALT, and other enzymes through their

presence in blood serum. These values can also indicate potential tissue damage, including liver tissue [35].

The reduced activity of liver enzymes may indicate the effectiveness of medicinal plants, specifically anise and caraway powders, in protecting the liver from fibrosis and damage. The current study agrees with Mirfalah and Khara [27], who reported that adding caraway seed powder at 0.5%, 1%, and 1.5% to Johara fish diets increased AST enzyme activity in fish serum at 1% caraway compared to the control. Similarly, Ashry et al. [21] reported that adding anise seed powder as a dietary supplement to European sea bass diets at 2.5 g/kg decreased AST and ALT activities to 87.39 and 82.33 IU/L, respectively, compared with other treatments.

However, the current study disagrees with Tok et al. [23], who found that adding 1–2% anise to Nile tilapia diets increased AST and ALT activities, and that 3% anise supplementation further increased liver enzyme activities, reaching 330.17 IU/L for AST and 32.54 IU/L for ALT, along with moderate tissue damage, indicating potential side effects at higher doses.

Additionally, the results differ from those of de Souza et al. [34], who reported that adding 2.00 mL/kg of anise to Nile tilapia diets increased ALT activity compared with other treatments.

Table 4. Effect of adding different levels of anise and caraway seed powders on ALT and AST liver enzyme concentrations in the blood serum of common carp (mean ± standard error).

Treatments	ALT (IU/L)	AST (IU/L)
Control (T1)	45.290 ± 0.270 a	219.195 ± 0.175 b
Anise seed powder 1% (T2)	25.215 ± 0.205 f	202.270 ± 0.240 c
Anise seed powder 2% (T3)	28.400 ± 0.350 e	151.070 ± 0.050 d
Anise seed powder 3% (T4)	35.055 ± 0.025	126.100 ± 0.050

Caraway seed powder 1% (T5)	d 39.145 ± 0.125	g 231.230 ± 0.190
Caraway seed powder 2% (T6)	c 41.330 ± 0.300	a 139.090 ± 0.050
Caraway seed powder 3% (T7)	b 18.080 ± 0.050	f 144.315 ± 0.295
	g	e

Different letters within the same column indicate the presence of significant differences ($p \leq 0.05$)

Conclusion

According to obtained results, the addition of anise and caraway seed powders led to improvement in all studied growth parameters compared with the control. Supplementation with anise seed powder at 1% had a significant effect on final weight, total weight gain, specific growth rate, relative growth rate, and feed conversion efficiency of common carp. Likewise, the addition of caraway seed powder at 2% gave the best results in improving the chemical composition of the edible parts of fish. Moreover, the use of anise and caraway powders enhanced blood biochemical parameters, including reduction in glucose, cholesterol, and triglycerides in certain treatments. The combination of 1% anise seed powder and 2% caraway seed powder showed superior effects on both growth performance and chemical composition compared with the control. Additionally, applying these treatments under practical rearing conditions is recommended to confirm their effectiveness on a larger scale.

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