Effect of Shilajit enriched diet on growth performance in common carp

Research Project

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Abstract

Natural additives are crucial to maintaining healthy aquaculture practices as they boost fish wellness, reduce related environmental problems, and improve productivity. The current study aims to assess the effect of shilajit on common carp (*Cyprinus carpio*) metabolites, such as blood parameters, liver function, and growth performance. The fish were fed a basal diet supplemented with 0, 1, 2, and 3 g/kg shilajit for 60 days. The results showed that shilajit supplementation significantly improved the growth performance of the fish with increasing the shilajit concentration in the diet.

1. Introduction

Aquaculture and capture fisheries are essential sources of fish protein and income for a substantial percentage of the world's population (FAO, 2022). With the rapid rise in human population, demand for fish and fish products has gradually increased (FAO, 2020). Aquaculture has been considered to be the solution in fulfilling the rising demand for fish due to the continuous developments in the sector over time, and comparatively declining levels of fish production from capture fisheries (Obiero *et al*., 2022). The development and sustainability of aquaculture are limited by several factors including climate change, wars, pandemics, diet cost production and availability, water quality, and water pollution (Sharawy *et al*., 2022). As a result of the expansion of aquaculture activities, the concept of aquafeed must be developed to include new and sustainable feed ingredients and additives that can meet the challenges of diet cost production, availability, water quality, and water pollution (Ashour *et al.*, 2021).

Shilajit is a sticky substance sourced from the Himalayan regions of India and Nepal known for its exceptional properties with anti-inflammatory, antioxidant, and immunemodulatory effects, helping maintain overall health status (Stohs, 2014). Shilajit is a natural ingredient that has been used in traditional Ayurvedic medicine in India for generations, it contains organic and inorganic substances, including minerals, trace elements, fulvic and humic acids (Al-Salman *et al*., 2020).

Common carp (*Cyprinus carpio*) is widely distributed in eutrophic freshwater and is one of the most important cultured species in the cyprinid family, following grass carp, (*Ctenopharyngodon idellus*), and silver carp (Anwar, 2023). This species also is the fourth most important cultivated species in the aquaculture industry and is mainly produced in many Asian and some European countries (Action, 2020). The species is a highly valuable food source for the ever-growing human population with desirable aquaculture capabilities including a high growth rate, better feed conversion ratio, the higher capability of using carbohydrates and plant protein sources, along with relatively high resistance to variable environmental conditions, and diseases (Tasa, 2020).

The aim of the current article review is to evaluate the effects of dietary supplementation of shilajit on growth performance in fish.

2 Materials and Methods

The effects of shilajit on common carp (*Cyprinus carpio*) on growth performance were investigated (Ahmed *et al.,* 2023).

1.1 Shilajit composition

The composition of Shilajit samples is typically 13-17% proteins (including a wide range of amino acids), 4-4.5%, lipids 18-20% minerals, 14-20% humidity, 18-20% nitrogen-free substances, 3.3-6.5% steroids, 1.5-2% carbohydrates, and 0.05-0.08% alkaloids (Wilson *et al*., 2011).

2.2 Diet preparation

The control diet consisted of fish meal, wheat bran, wheat flour, soybeans, vegetable oil, and starch. To create experimental diets, shilajit powder was added to the control diet at varying concentrations (0, 1, 2, 3) g/kg. Following the mixing of all the dry ingredients, oil and water were combined. Warm water was added to achieve a consistency suitable for extruding into small pellets. The diets were air-dried and stored until use. The proximate composition of the experimental diets was analyzed using the AOAC (2000) method and included crude protein, crude lipid, crude ash, and crude carbohydrate. Table 1 and 2 shows the ingredient and proximate composition of the experimental diets.

Table 1. Ingredient and proximate composition of the experimental diets

Ingredients (%)	Control	T1	T2	T3
*Fish meal	22	22	22	22
Wheat bran	25	24	23	22
Wheat	20	20	20	20
Soybean	30	30	30	30
Vegetable oil	2	2	2	2
Starch	1	1	1	1
Shilajit powder (g/kg)	0	1	2	3

*Fish meal (55% protein) is locally produced by the Agriculture Collage, food industries department, University of Basrah. All other diet ingredients have been purchased from the local market.

Source (Ahmed *et al*., 2023)

Table 2: Proximate composition of experimental diets

Proximate composition	Control	T1	T2	T3
Moisture %	2.84	2.95	2.88	3.06
Protein %	30.45	30.2	31.81	30.54
Lipid %	9.41	9.42	9.52	9.32
Ash %	5.85	6.10	5.88	5.85
Carbohydrate %	50.21	49.5	48.83	48.25

Source (Ahmed *et al*., 2023)

2.3 Experimental fish and husbandry

The nutrition trial was conducted at the fish nutrition laboratory, Agriculture College, University of Basrah, Iraq. After a week of acclimatization, 120 specimens of fish were weighed individually (average initial weight: 108.9±2.20 g) and randomly distributed into 12 indoor plastic tanks with a closed recirculation system (40 L capacity for each tank). The design of the experiment included 10 fish per tank and 3 tanks per treatment. Fish were fed 3% of their body weight twice daily for 60 days. Fish were weighed collectively every week following a 24-hour starvation period.

2.4 Growth performance evaluation

Growth parameters, such as weight gain (WG), specific growth rate (SGR), feed conversion ratio (FCR), and protein efficiency ratio (PER), were evaluated and calculated using standard protocols in each replication following the methodology described in the previous study by Ahmed *et al.* (2012). The growth performance of the fish and feed utilization were measured according to the following formulae; Specific growth rate (SGR %) = (In FBW-In IBW)/ T×100, Feed Conversion Ratio (FCR g) = (Feed intake (g)) / (weight gain (g) Survival (%) = 100 –Mortality (%) =Final Nb /Initial Nb×100. Where In FBW:

final body weight, In IFW: initial body weight, T: times (number of days), IFW: initial fish weight, FBW: final body weight, WG: weight gain (g), FI: feed intake (g), Initial Nb: initial number of fish, Final Nb: final number of fish.

2.5 Statistical Analysis

Statistical analysis was conducted using one-way analysis of variance (ANOVA), followed by Fisher's LSD post hoc test to determine if significant group differences occurred.

3. Results

Table 3 presents growth performance parameters. The study shows significant differences ($P < 0.05$) in growth parameters between the different groups. The T3 group had the best FBW, SGR, and FCR values. The FCR values are also significantly different between the groups, with the control group having the highest FCR. Significant differences ($P < 0.05$) are indicated by different letters, Data are means ± SE. IBW (Initial Body Weight), FBW (Final Body Weight) SGR (Specific Growth Rate), FCR (Feed Conversion Ration)

Table 3. Growth and feed utilization performance of *C. carp* fed diets containing different levels of shilajit over 8 weeks

Parameter	Control	T1	T2	T3
IBW (g)	108.55 ± 4.75^{a}	112.15 ± 5.47^{a}	107.43 ± 5.62^{a}	107.51 ± 5.74^{a}
FBW (g)	153.71 ± 6.68^{a}	171.08 ± 9.73^{b}	169.35 ± 8.28^{b}	180.80 ± 10.03^{c}
SGR(g)	0.58 ± 0.02^{a}	0.70 ± 2.02^{b}	0.76 ± 0.02^{c}	0.86 ± 0.02^{d}
FCR	2.72 ± 0.11^{a}	1.64 ± 0.15^{b}	1.60 ± 0.13^{b}	1.55 ± 0.07^{c}

Source (Ahmed *et al*., 2023)

*The values are expressed as mean ± standard errors of mean. Means in a given row with different superscript letters were significantly different at ($P < 0.05$)

4. Discussion

The current study found that shilajit had beneficial effects on *C. carpio* growth performance compared to the control group. This finding is consistent with Musthafa et al., (2018), who reported that varied doses of shilajit increased the growth performance of *O. mossambicus*. The high concentration of minerals and trace elements found in shilajit is believed to be a key factor behind this advantage. In this context, Al-Salman *et al*., (2020), reported that shilajit samples from various sources contain minerals and trace elements such as copper, iron, chromium, selenium, and zinc. All these components are required for a variety of biological processes, including fish growth and development (Watanabe *et al*., 1997). In addition to a high mineral content (18-20%), shillajit samples contain 13-17% proteins (with a variety of amino acids) and 4-45% lipids (Wilson *et al*., 2011), both of which play a critical role in feed utilization and growth performance. Furthermore, shilajit may include beneficial substances such as fulvic acid, which is known to increase nutrients absorption (Agarwal *et al*., 2007).

5. Conclusion

The experiment showed significant differences in growth performance parameters among *C. carpio* fed with varying concentrations of shilajit. The T3 (3g/ kg) group showed the best performance in terms of final body weight, specific growth rate, and feed conversion ratio.

Long-term studies and field trials are necessary to evaluate the sustainability, economic feasibility, and potential effects of shilajit supplementation on fish health and the ecosystem.

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