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EVALUATION OF ADDING SWEET BEAN SEED (*FOENICULUM VULGARE*) AND ROSELLE (*HIBISCUS SABDARIFFA*) SEED ON ENHANCING GROWTH AND PERFORMANCE OF COMMON CARP CYPRINUS CARPIO

Hasan A. H. Al-Kattan [1], Nuha H. S. Al-Bassam [2]
Department of Animal Production, College of Agriculture, Tikrit University, Salahaddin, Iraq 1,2

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Correspondence Email:
hasan.a.haydar@st.tu.edu.iq

ABSTRACT

Seven experimental diets were prepared to feed the common carp *Cyprinus carpio* L. They are the control diet without additives T1 and three diets to which sweet bean seed powder was added in three proportions, namely 0.5%, 1% and 1.5%, respectively, for the diets T2, T3 and T4, and the diets contained T5 and T6. And T7 on Roselle seed powder at rates of 0.5%, 1% and 1.5%, in an experiment that lasted for 60 days. The results showed a greater weight elevate in the T5, T6, and T7 treatments (21.24, 24.07, and 22.12 grams) compared to the T1 and T4 control treatments (18.06, 19.29) grams. These treatments contained Roselle seeds. At 0.401 grams per day, treatment T6 exceeds all other treatments and control treatment, which recorded 0.250 grams per day. Between the roselle seed powder treatments and the control and sweet bean seed powder treatments, there was a substantial ($P \leq 0.05$) increase in the specific growth rate. With percentages of 13.873, 11.035, and 11.053%, respectively, the relative growth rate increased significantly ($P \leq 0.05$) in treatments T5, T6, and T7 compared to treatments T1, T3, and T4. Continuous feed conversion rate. In treatment T6, the feed efficiency rate increased up to 19.26%. This study concludes that the addition of sweet bean powder and Roselle's to fish meals enhances the nutritional value of the diets as well as the fish's development, and general health.

INTRODUCTION

Aquatic products are among the major sources of food and animal protein produced worldwide. In 2020, global production of aquatic products for human consumption was 157.4 million tons (excluding aquatic mammals, crocodiles and algae). Consumable aquatic products can be obtained through extractive fishing or agricultural systems. Aquatic organisms and eating aquatic products meet the needs of consumers looking for alternatives to a healthier diet (Presenza *et al.*, 2023). Common carp (*Cyprinus carpio* L.) is a freshwater fish that is easy to culture, due to its ability to resist diseases, its tolerance to tropical climates, and its high nutritional and economic value (Sarhadi *et al.*, 2020). Nutrition has an important role in the development of fish farming projects, so paying attention to fish nutrition and deepening knowledge are among the most important endeavors to develop fish wealth, and the great scientific progress that has been achieved in all fields, including

animal production sciences, in addition to the facts, research and experiments that have been discovered in general in the fields Nutrition, especially fish nutrition, in countries that have been able to use modern information and communication technologies on a large scale has been of great importance as a result of the progress in fish feeding and breeding technologies, increasing fish density and the desire to raise growth rates and improve the efficiency of food utilization. It was necessary to pay attention to science. Nutrition based on medicinal plants and herbs and attention to them in the study of natural food development (ÖZEL *et al.*, 2023). The study of medicinal plants has great nutritional, medicinal and economic value (Mohammad, 2017 and 2021). The sweet bean plant is considered one of the best medicinal plants in the world. It is a type of spice and contains phenolic chemicals that are beneficial to human health and has many uses and great importance in the production of many medicines (Noreen *et al.*, 2023). The Gujarat plant is widely used because it contains extracts that have therapeutic effects, such as antioxidants, anti-obesity, anti-cancer, inhibiting bladder and uterine contraction, lowering blood pressure, and antibacterial and anti-microbial due to the presence of phenolic compounds (El Mesallamy *et al.*, 2016). Roselle can be used as feed in fish production, as in China, where its seeds are used for its oil and the rest of the plant is used for its medicinal properties, while the dried leaves and seeds are used and included in meals in West Africa. It is used in the pharmaceutical and food industries (Usman *et al.*, 2023). The current study aimed to add sweet bean seed powder and Roselle s in different proportions to the diet of common carp *Cyprinus carpio* L., to study its effect on growth performance.

MATERIALS AND METHODS

Study site

The research experiment was conducted in the tanks of the Fish Laboratory in the fields of the Animal Production Department, College of Agriculture/ Tikrit University for the period from 9/19/2022 until 11/20/2022. fourteen plastic ponds with a capacity of 110 liters were used, and the ponds were equipped with 14 Chinese-made air pumps, so that the Pump air into each 3 tubs evenly from 3 air pumps. 70 carp fish, with an average weight of 175 ± 20 gm/fish, were distributed to 14 plastic tanks at a rate of 5 fish/tank before starting the experiment for a period of 60 days. The fish were acclimatized for a week so that the fish could become accustomed to the environment of the plastic tanks and prepare to eat food.

Chemical composition of sweet bean seeds and Roselle

Table (1): Shows the chemical composition of the seeds of the sweet bean and Roselle plants

Chemical composition	Estimated sweet bean powder	Estimated Roselle seeds powder
Dry matter %	94.48	94.90
Moisture %	5.52	5.10
Crude protein %	17.15	21.43
Fiber %	47.18	44.33
Ether extract %	2.07	2.27
Ash%	11.05	6.30
*NFE (%)	17.03	20.57

*Nitrogen- free extract: (NFE %) = 100 - (% moisture + % extract ether + % ash + % crude protein).

Central Laboratory of the College of Agriculture, University of Mosul. Calculated on the basis of dry matter.

Table (2): Components of the experimental diets (%) containing sweet bean seed powder and currants

Ingredients	T1 Control (0%)	T2 Sweet bean (0.5%)	T3 Sweet bean (1%)	T4 Sweet bean (1.5%)	T5 Roselle seeds (0.5%)	T6 Roselle seeds (1%)	T7 Roselle seeds (1.5%)
Soybean meal	53	53	53	53	53	53	53
Soybean oil	2	2	2	2	2	2	2
Sweet bean seed powder	-	0.5	1	1.5	-	-	-
Roselle seed powder	-	-	-	-	0.5	1	1.5
Yellow corn	22	22	22	22	22	22	22
Spelled flour	20	20	20	20	20	20	20
Premix	3	3	3	3	3	3	3

Table (3): Chemical composition of feed components

Ingredients	Moisture %	Crude protein %	Ash%	Ether extract %	Fiber %	Carbohydrate %
Soybean meal	9.82	45	1.84	6.33	5.76	31.25
Soybean oil	0.5	-	99	-	-	-
Spelled flour	8.86	12.80	1.63	1.95	2.24	72.52
yellow corn	10.80	9.03	4.34	2.33	2.01	71.49

Based on a dry matter calculation (NRC, 1993).

Table (4): Chemical analysis of the edible portion of fish (averages ± standard error)

Treatments	DM %	Moisture %	Protein %	Fiber %	Ash %	Fat %	NFE %
T1 Control (0%)	94.44g	5.56 a	14.76 f	21.94 c	4.74 a	12.85 a	40.15 e
T2 Sweet bean (0.5%)	94.52 f	5.48 b	13.47 g	19.67 d	3.67 e	10.40 e	47.31 a
T3 Sweet bean (1%)	95.34 a	4.66 f	21.70 a	14.47 g	2.21 g	10.75 c	46.21 b
T4 Sweet bean (1.5%)	94.90 e	5.10 c	20.82 b	26.76 a	3.34 f	10.20 g	33.78 g
T5 Roselle seeds (0.5%)	95.00 d	5.00 d	19.60 d	19.18 e	3.84 d	10.35 f	42.03 d
T6 Roselle seeds (1%)	95.18 c	4.80 e	18.37 e	23.98 b	4.01 c	10.90 b	37.92 f
T7 Roselle seeds (1.5%)	95.20 b	4.80 e	20.21 c	15.40 f	4.70 b	10.65 d	44.24 c

*Different lowercase letters within one column indicate the presence of significant differences ($p \leq 0.05$) between the treatments.

Growth standards

The following criteria were used to demonstrate the effect of adding sweet bean seed powder and Roselle to fish diets on growth. These criteria are:

Total weight gain of fish

Total weight gain (g) = Final weight (g) - Initial weight (g) Schmalhusen, 1926)

Daily growth rate

(g/day) = ((fish/g) weight gain)/((day) experiment duration) Schmalhusen, 1926)

Relative growth rate

Relative growth rate % = ((g) primary weight - final weight)/((g) primary weight) x 100 (Uten, 1978)

Specific growth rate

Specific growth rate %g/day = ((g) initial log weight -((g) final log weight)/((day)experiment duration) x 100 (Brown, (1957)

Survival rate

The following criterion was used to calculate the survival rate. Survival rate % (SR) = (remaining fish number)/(total fish number) x 100 (Farsani *et al.*, 2019).

Feed conversion rate

Feed conversion rate = ((g) feed intake quantity)/((g) wet fish weight gain) (Uten, 1978)

Feed efficiency ratio

Feed efficiency ratio (%) = ((g) wet weight gain)/((g) provided feed weight) x 100 (Uten, 1978)

Chemical composition of fish meat

At the end of the experiment, the fish were killed and dissected, and the eaten part was isolated from the bones, skin, and the rest of the viscera, Measurements were made of the fish meat for protein, fat, moisture, and ash.

Statistical analysis

Complete Randomized Design (CRD) was used to analyze the data using version 25 of the ready-made statistical program Statistical Package for Social Science in analyzing the effect of experimental parameters on the studied criteria, and the significant differences between the averages of the studied characteristics were tested using Duncan's multiple test. The range is Duncan's multiple range test (Duncan, 1955) according to the following mathematical equation:

$$\boldsymbol{Y_{ij} = \mu + T_i + e_{ij}}$$

Since:

Yij = the jth observation value of transaction i.

μ = the general average of the studied trait.

Ti = effect of treatment i.

eij = random error is normally and independently distributed with a mean equal to zero and a variance of Se.

RESULTS AND DISCUSSION

Growth criteria

Table (5) shows the growth characteristics of fish fed on diets containing sweet bean powder and pellets, where the treatments T5, T6, and T7 weighing (21.24, 24.07, 22.12) grams, respectively, of pellets outperformed the treatments T1 and T4 (15.02, 15.08) grams in weight gain rates. It was shown through this study that the use of powdered sweet bean seeds and currants led to a significant increase ($P \leq 0.05$) in the

daily growth rate of fish, as the T6 treatment of 0.401 grams outperformed the rest of the treatments. The best treatment was 1% of seed powder. It was also observed that the T5 and T7 treatments, with weights of (0.354 and 0.368) grams, respectively, outperformed the control treatment T1 (0.250 grams) and the rest of the treatments. These results were in agreement with the study of Nazari and Roozbehani (2015) when using ornamental fish (guppie) by adding sweet bean seeds in the form of a solution added to the feed in proportions of (75, 100, 125) microliters/gram, which is equivalent to 7.5%, 10%, and 12.5%, where The treatment containing (75, 100) microliters/g, (7.5, 10)%, gave the best growth rates and recorded (0.297, 0.520, 0.466) g, respectively, and with Sotoudeh and Yeganeh (2017) where a type of fish was fed Ornamental convict tilapia (*Amatitlauia Nigrofasciata*) was placed on a ration containing sweet bean plants in proportions of (0.75, 1, 1.25, 1.5)%, which gave (0.98, 1.01, 0.79, 0.98) grams. The percentage of 1% achieved the highest percentage of weight gain of 1.01 grams.

The growth in the response of common carp fish to diets supplemented with different levels of sweet bean seed meal may be attributed to improving performance in this experiment because sweet bean seed meal is rich in calcium, phosphorus, and magnesium, and also contains large amounts of potassium, iron, zinc, and manganese (Abd El Hakim *et al.* 2010), and Roselle have antibacterial activity and against pathogenic A. hydrophila infection in fish. Thus, fish fed with diets containing currants become significantly effective in resisting germs and thus benefiting from the food, especially in the 1% of the diet (El Mesallamy *et al.*, 2016). The specific growth rate increased significantly ($P \leq 0.05$) in the kajrat treatments over the control treatment and the sweet bean treatments, where the T5 treatment, 0.216 g/day, outperformed all treatments, including the control treatment. Treatments T6 and T7, with the same values of 0.175 g/day, outperformed the control treatment T1, 0.120 g/day, and the rest of the treatments. Treatments T5, T6, and T7, with percentages (13.873, 11.035, and 11.053) %, respectively, recorded the highest rates of relative growth over each of the treatments and not It varies with treatment T2 by 10.558%. Hussein and Esmail (2023) conducted an experiment in which they used Nile tilapia fish, and the fish's feeding system was by adding various herbs of fenugreek, rosemary, thyme, and sweet seed to the feed, at a rate of 1% of the feed, each separately. The fish fed with the addition of sweet seed, thyme, and fenugreek had a higher weight than the fish. Fed with the control diet and rosemary, the results showed that the fish fed the diet supplemented with sweet pepper recorded a specific growth rate of 2.55% and the highest survival rate of 100%. This experiment agreed with what was reported by ÖZEL *et al.*, (2023) when adding sweet seed oil to the diet of black sea salmon (*salmo labrax*) at rates (0.5, 1, 2, 4) %, as it gave the best relative growth rate (2.32, 2.35, 2.29, 2.33) % respectively, and the best one was 1%. The superiority of the T2 treatment containing 0.5% of the sweet seed over the T3 and T4 treatments (1 and 1.5) % in the specific and relative growth rate may be due to its presence in a location exposed to sunlight for a long period compared to the rest of the treatments, as this led to an increase in feed consumption. (Di *et al.*, 2023; Wang *et al.*, 2023). Treatments T1 and T4, with percentages of (8.322 and 8.289) grams respectively, outperformed all the remaining treatments. While there was no significant difference between the treatments T2, T3, T5, T6, and T7 with values of

(6.921, 6.480, 5.885, 5.193, 5.650) grams, respectively, in the food conversion rate. As for the effect of both sweet berries and galls on the feed efficiency ratio, it was noted that treating fish with galls led to a significant increase ($P \leq 0.05$) in the feed efficiency rate in treatment T6, which amounted to 19.256%, as this treatment outperformed all treatments, including the control treatment with 12.016%. %. A 100% survival rate was recorded for all experimental fish.

Table (5): Effect of sweet bean powder and Roselle on growth parameters of fish

Studied standards	Initial weight (g)	Final weight (g)	Total weight gain (g)	DGR (g/day)	SGR %	RGR %	FCR %	FCE %	SR%
T1 Control (0%)	202.02	217.04 ± 0.190b	15.02 ± 0.312b	0.250 ± 0.222e	0.120 ± 1.345e	7.434 ± 1.821c	8.322 ± 1.088a	12.016 ± 0.719e	100 %
T2 Sweet bean (0.5%)	171.04	189.10 ± 0.125c	18.06 ± 1.144ab	0.301 ± 0.516d	0.168 ± 0.632c	10.558± 0.146ab	6.921 ± 0.814b	14.448± 1.501d	100 %
T3 Sweet bean (1%)	215.21	234.50 ± 1.120ab	19.29 ± 0.461ab	0.321 ± 1.321c	0.143 ± 0.701d	8.963 ± 1.552b	6.480 ± 0.461b	15.432 ± 0.611c	100 %
T4 Sweet bean (1.5%)	216.22	231.30 ± 0.314ab	15.08 ± 0.351b	0.251 ± 0623e	0.111 ± 0.546f	6.974 ± 0.710d	8.289 ± 0.109a	12.064 ± 0.517e	100 %
T5 Roselle seeds (0.5%)	153.10	174.34 ± 0.172d	21.24 ± 1.211a	0.354 ± 1.022b	0.216 ± 1.331a	13.873± 0.566a	5.885 ± 0.612b	16.992± 0.981b	100 %
T6 Roselle seeds (1%)	218.11	242.18 ± 0422a	24.07 ± 1.271a	0.401 ± 0.152a	0.175 ± 1.391b	11.035± 0.623a	5.193 ± 1.216b	19.256 ± 0.618a	100 %
T7 Roselle seeds (1.5%)	200.12	222.24 ± 1.103b	22.12 ± 0.213a	0.368 ± 0.471b	0.175 ± 0.382b	11.053± 1.092a	5.650 ± 0.412b	17.696± 0.812b	100 %

*Different lowercase letters within one column indicate the presence of significant differences ($p \leq 0.05$) between the treatments

Chemical composition of fish bodies

The study's findings indicate that the percentage of moisture in the fish's edible portion varied slightly ($P \leq 0.05$) when sweet bean seed powder and Roselles were added in amounts of0.5,1, and 1.5%. A significant increase in this percentage was seen in the control treatment T1, which had 76.90% of the moisture. 76.63% of patients with treatment T1 saw a significant ($P \leq 0.05$) reduction in comparison to treatment T2, whereas no significant changes were seen with the remaining treatments.

There were no significant differences found between the control treatment T1 (17.02%) and the treatments T2 and T5 with ratios (17.01 and 17). However, the treatments T3, T4, T6, and T7 with ratios (17.26, 17.27, 17.41, 17.65) %, respectively, outperformed the treatments T1, T2, and T5 (0.03 %), respectively, in terms of protein percentage. Regarding the fat content of the consumed piece of fish flesh, there were no noteworthy variations across the treatments at ($P < 0.05$). According to Table (6), the control treatment T1 performed better than the other treatments in terms of ash by 5.04%.

Table (6): Sweet bean powder and Roselle seeds impact on the fish's edible portion's chemical analysis

Treatments	Moisture%	Protein%	Fat%	Ash%
Before the experiment	77.76	16.07	0.73	5.11
T1 Control (0%)	76.90 ± 0.24 a	17.02 ± 0.08 b	1.04 ± 0.12 a	5.04 ± 0.20 a
T2 Sweet bean (0.5%)	76.63 ± 0.20 b	17.01 ± 0.05 b	1.33 ± 0.09 a	4.22 ± 0.09 b
T3 Sweet bean (1%)	77.25 ± 0.17 ab	17.26 ± 0.10 a	1.14 ± 0.06 a	4.27 ± 0.15 b
T4 Sweet bean (1.5%)	77.23 ± 0.07 ab	17.27 ± 0.05 a	1.32 ± 0.26 a	4.16 ± 0.13 b
T5 Roselle seeds (0.5%)	77.37 ± 0.18 ab	17.03 ± 0.13 b	1.14 ± 0.17 a	4.18 ± 0.05 b
T6 Roselle seeds (1%)	77.09 ± 0.01 ab	17.41 ± 0.30 a	1.21 ± 0.17 a	4.29 ± 0.12 b
T7 Roselle seeds (1.5%)	77.09 ± 0.03 ab	17.65 ± 0.03 a	0.91 ± 0.02 a	4.23 ± 0.01 b

*Different lowercase letters within one column indicate the presence of significant differences

Hussein and Esmail (2023) employed Nile tilapia fish in their experiment, and the fish were fed by adding different herbs to their food—fenugreek, rosemary, thyme, and sweet seed—at a rate of 1% of the diet each herb, and individually. The fish fed on the diet were confirmed by the results of the chemical analysis of the fish meat. Fennel provides 26.70% dry matter, 56.96% protein, 13.69% fat (highest amount after fenugreek), and 12.80% ash to meals.

It is possible to ascribe the superiority of T3, T4, T6, and T7 to the antioxidant properties of sweet corn and currants. Additionally, they enhance the percentage of protein in fish muscles by stimulating the synthesis of digestive enzymes and enhancing the efficiency of feed utilization through enhanced liver activities (Khan *et al.*, 2022).

CONCLUSIONS

From this study, it can be concluded that the final weight, total and daily weight increase, relative and specific growth rate, and the addition of currants were all positively impacted by the addition of sweet bean seed powder.

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CONFLICT OF INTEREST

None of the authors has a financial or personal relationship with other people or organizations that could inappropriately influence or bias the content of the paper.

تقييم إضافة مسحوقي بذور الحبة الحلوة (*Foeniculum vulgare*) والكجرات (*Hibiscus sabdariffa*) في تحسين نمو وأداء أسماك الكارب الشائع *Cyprinus carpio* L

حسن علي حيدر القطان [1]، نهى حميد صادق البصام [2]
قسم الإنتاج الحيواني / كلية الزراعة / جامعة تكريت / صلاح الدين / العراق [1،2]

الخلاصة

حضرت سبع علائق تجريبية لتغذية أسماك الكارب الشائع *Cyprinus carpio* L. وهي عليقة السيطرة الخالية من الإضافات T1 وثلاث علائق تم إضافة مسحوق بذور الحبة الحلوة اليها بثلاث نسب وهي 0.5% و1% و1.5% على التوالي للعلائق T2وT3 وT4 واحتوت العلائق T5 وT6 وT7على مسحوق بذور الكجرات بنسب 0.5%و1%و1.5%، في تجربة استمرت مدة 60 يوماً. تفوقت المعاملات T5 وT6 وT7 الحاوية على بذور الكجرات ذات الوزن (21.24، 24.07، 22.12) غم على التوالي في الزيادة الوزنية على معاملة السيطرة T1 وT4 (18.06 19.29). سجلت المعاملة T6 في معدل النمو اليومي 0.401 غم متفوقة على كل المعاملات. ارتفع معدل النمو النوعي حيث تفوقت المعاملة T5 0.216 غم / يوم على كل المعاملات. وتفوقت المعاملة T2 0.168 غم/ يوم على T1وT3وT4 (0.143 ، 0.111) غم/ يوم. معدل النمو النسبي ارتفع في المعاملات T5 وT6 وT7 ذات النسب (13.873 ، 11.035، 11.053)% على التوالي على كل من المعاملات T1 وT3 وT4 ولم تختلف مع T2 10.558%. سجلت المعاملتين T1 وT4 (8.322 و8.289) غم على التوالي تفوقت على جميع المعاملات الباقية فيما لم يظهر هنالك اختلاف معنوي بين المعاملات T2،T3، T5،T6،T7 ذات القيم (6.921، 6.480، 5.885، 5.193، 5.650) غم على التوالي في معدل التحويل الغذائي. ارتفعت نسبة كفاءة العلف في المعاملة T6 البالغة 19.256% حيث تفوقت هذه المعاملة على كل المعاملات. يستنتج من هذه الدراسة بأن إضافة مسحوقي الحبة الحلوة والكجرات الى علائق الأسماك لها اهمية في تحسين القيمة الغذائية للعلائق وتحسين المناعة والنمو والحالة الصحية للأسماك. تهدف الدراسة الحالية الى إضافة مسحوق بذور الحبة الحلوة والكجرات بنسب مختلفة في علائق أسماك الكارب الشائع *Cyprinus carpio L.* لدراسة تاثيرها على أداء النمو.

الكلمات المفتاحية: بذور الحبة الحلوة ، بذور الكركديه، الكارب الشائع، أداء النمو.

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