The effect of adding fenugreek leaves Trigonella foenum-graecumL. And clover Medicago sativaDried common carp feed Cyprinus carpioL. in rates Digestion and excretionThe chemical composition of fish meat

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Abstract

This current study was conducted to determine the effect of adding fenugreek and alfalfa leaf powder driedIn common carp fish diet 14 plastic tanks with a capacity of 110 liters were used. For a period of 60 days, 84 fish were distributed among seven treatments and fed on seven diets. The first treatment was the control, and for the rest of the treatments, fenugreek and alfalfa were added in proportions.(1, 2, 3)%, the results showedThe apparent digestibility coefficient of the diet, protein, carbohydrates, and ash improved when fenugreek and alfalfa were added compared to the control diet. As for fat, there were no differences between the treatments and with the control treatment. As for the chemical composition of fish meat, the experience is superior to the treatmentT6 in the moisture percentage of all fish in the experimental treatments, while the protein percentage is significantly higher for treatments T2 and T7 than all treatments. The percentage of fat in treatment T3 increased by 4.86% over the rest of the treatments. The study concludes that adding fenugreek and alfalfa leaf powder to common carp fish diets improves food digestibility rates and some chemical properties of fish meat.

Keywords: common carp fish , digestion factor, excretion factor

.1introduction

Fish are an important source of food rich in proteins, fats, vitamins and minerals such as iron for the synthesis of hemoglobin. And vitaminE and calcium, which prevents rickets and reduces osteomalacia and vitamin A, The important thing is normal growth, bone formation and support, and seleniumSe A deficiency of which leads to myocardial infarction, hypothyroidism, and other minerals such as phosphorus, zinc, iodine, etc.,Because it is an important source for building the human body [1]. The spread of diseases among fish is linked to their physiological state, which has called for researchers and specialists to use medicinal plants as nutritional supplements in feeds, which have attracted the attention of scientists and gained a great deal of interest over the past decade and at the present time as well because of the effective compounds they contain such as saponins, flavonoids, and alkaloids. [2,3].Most sources indicate that the original homeland of fenugreek is southeastern Europe, countries bordering the Mediterranean Sea, and northern and western Asia [4]. The plant is widely spread in Iraq in the cities of Shaqlawa, Dohuk, Hamrin, Abu Ghraib, and Basra, but its production is small and insufficient for local use, and it is imported from all over the world [5].Alfalfa is a widely grown, high-biomass perennial forage legume whose cultivation requires fewer agricultural inputs such as fertilizers and pesticides than annual crops of corn and soybeans [6.[

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The most important current study is to demonstrate the effect of adding vegetable and alfalfa leaf powder to common carp fish meat on the inquiries, discharge coupling, and clear composition of fish meat.

.2Materials and working methods

1-2Digestion experiments

This study was conducted in the field belonging to the University of Tikrit - College of Agriculture - Department of Animal Production for the period from 6/17/2023 to 8/16/2023, where powdered vegetable leaves and dried alfalfa were added to the feed of common carp Cyprinus carpio L. A 14-capacity plastic tank was used. 110 liters. 84 fish weighing 100-150 grams were randomly distributed among seven experimental treatments, with two replicates for each treatment and 6 fish for each replicate.

Digestion experiments were carried out according to the method mentioned Talbot [7] used diets containing 1% chromium oxide to calculate digestion rates. The fish were fed to the point of satiety and then the uneaten feed was withdrawn after more than 2 hours had passed after giving the feed. Waste was collected from the ponds after it was directly excreted by the fish. It is placed in petri dishes, washed well with distilled water, filtered with a clamp with holes size of 50 microns, and dried at field temperature. The waste collection process continues until a sufficient quantity is obtained to conduct chemical analysis on it. Concentrated nitric acid and perchloric acid are added to digest 0.5 of the sample to measure the concentration of chromium oxide.[8] The absorbance is read at a wavelength of 350 nm using an Atomic Absorption Spectrometer and the reading is substituted into the following equation- :

$Y= 0.2089X + 0.0032$

where (Y) = absorbance at wavelength (350nm(

)X) = concentration of chromium oxide (mg/100 ml.(

1-1-2Digestibility coefficient of nutrients

) × 100] - 100 =chromium oxide in food% ÷ chromium oxide in waste %) × (nutrient in waste% ÷ nutrient in food%)]. [9.[

2-2Food emptying rate

The food emptying rate of common carp fish was estimated in breeding ponds, where the fish were starved for three days in order to empty the digestive tract of its contents before the experiment. Provide the fish with food that contains 1% of the red carmine dye according to the method he mentioned Hyslop [10] then left the fish to feed for an hour and then removed the uneaten food using a siphon. The successive killing process took place at intervals of (0-4-8-16-20) hours, and the fish were frozen immediately after they were killed at a temperature of -18°C to obtain a single mass of food present in the digestive canal to facilitate the process of collecting and weighing according to the method.[11]The digestive canal was extracted and divided into three equal areas, and the weight of the food extracted from each part of the digestive canal (anterior-middle-back) was estimated. The rate of food emptying was estimated by taking the weight of the dry food to the dry weight of the fish for different time periods.

3-2Statistical Analysis:

The study data were analyzed using a completely randomized design (CRD) according to the statistical program SAS-Statistical Analysis System [12] at the probability level ($p\leq0.05$) according to the Duncan multiple test for significant differences between means [13.[

.3Results and discussion

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1-3Digestibility factor

Table (1) shows the effect of adding fenugreek and alfalfa leaf powder in different proportions on the apparent digestibility coefficient (protein, fat, carbohydrates, and ash)%. Record the apparent digestibility coefficient of the feed for the treatments T7, T4, T3, T6 were significantly superior ($P \leq 0.05$) if their percentages reached (94.85, 93.45, 93.03, 92.96)%, respectively, over the treatments T5, T2, T1 (92.32, 92.13, 83.8)%, respectively. It was observed that there were significant differences at the level of ($P \leq 0.05$) for the treatments T5 and T2 over the control treatment T1, which recorded the lowest percentage of 83.8%, and there was no significant difference between them, 92.32 and 92.13%, respectively. The apparent protein digestibility coefficient increased in treatment T2 to 93.52% over treatments T4, T7, T3, T6, and T1, and there were no significant differences between them and treatment T5 (92.32%). It was observed that there was a significant difference ($P \leq 0.05$) for the two treatments T4 and T7, which amounted to 91.04 and 90.82%, respectively, over the treatments T3, T6, and T1, 89.93, 89.93, and 78.46%, respectively, and there was no significant difference between the two treatments T3 and T6, and the control treatment T1 recorded the lowest percentage. Apparent protein digestibility coefficient 78.46%. Treatments T1, T5, and T6 were significantly ($P \leq 0.05$) superior to the rest of the treatments, which amounted to 99.13, 99.06, and 98.93%, respectively, in terms of apparent fat digestibility coefficient. There were also significant differences found for the two workers T4 and T2, 96.25 and 95.86% respectively, for the treatment T7, 93.75%, and there was no significant difference between them and the treatment T3, 95.43%. As for the apparent digestibility coefficient of carbohydrates, the treatment with the addition of 3% alfalfa exceeded 96.32% over all treatments, and it was noted that there were no significant differences between the treatments T4, T3, T6, and T2 if they reached 94.54, 94.42, 94.13, 93.14%, respectively. The treatment adding 1% fenugreek (90.65%) recorded a significant superiority over all treatments except the treatment adding 3% clover (89.36%). There was no significant difference between them in the apparent digestibility coefficient of ash. Treatments T4 and T3 outperformed treatments T6, T1, and T5, which amounted to 85.72, 79.46, and 79.12%, respectively. There was no significant difference between treatments T1 and T5, 79.49 and 79.12%, respectively.

Table (1) The effect of adding fenugreek and alfalfa leaf powder in different proportions on the apparent digestibility coefficients of the feed and each of (protein, fat, carbohydrates, and ash)% (average)± standard error.(

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Table (1) The effect of adding fenugreek and alfalfa leaf powder in different proportions on the apparent digestibility coefficients of the feed and each of (protein, fat, carbohydrates, and ash)% (average)± standard error.(

Apparent digestibility coefficient of ash %	Apparent digestibility coefficient of carbohydrates %	Apparent fat digestibility coefficient %	Apparent digestibility coefficient of protein %	Apparent digestibility coefficient %	Transactions
79.46±0.53 e	85.93±0.39 d	99.13±0.52 a	78.46±0.51 d	83.8±0.70 c	control T1
90.65±0.55 a	93.14±0.52 bc	95.86±0.55 b	93.52±0.49 a	92.13±0.53 b	Fenugreek leaf powder 1% T2
86.96±0.48 bc	94.42±0.49 b	95.43±0.48 bc	89.93±0.52 c	93.03±0.34 ab	Fenugreek leaf powder 2% T3
87.62±0.51 bc	94.54±0.52 b	96.25±0.45 b	91.04±0.43 bc	93.45±0.42 ab	Fenugreek leaf powder 3% T4
79.12±0.46 e	92.03±0.55 c	99.06±0.54 a	92.1±0.66 ab	92.32±0.37 b	Alfalfa leaf powder 1% T5
85.72±0.49 d	94.13±0.45 b	98.93±0.65 a	89.93±0.55 c	92.96±0.44 ab	Alfalfa leaf powder 2% T6
89.36±0.52 ab	96.32±0.47 a	93.75±0.46 c	90.82±0.48 bc	94.85±0.50 a	Alfalfa leaf powder 3% T7

*The different letters in the same column indicate significant differences ($p \leq 0.05$.(

Adding fenugreek and alfalfa leaf powder led to a significant increase ($P \leq 0.05$) for the apparent digestibility coefficient of the diet, protein, fat, ash, and carbohydrates compared to the control diet, except for the apparent digestibility coefficient of fat. There are no significant differences between the control treatment and the fifth and sixth treatments to which alfalfa was added, according to Al-Assadi (2020) when using a diet of date pits to which fenugreek seeds were added. The apparent digestibility coefficient of the diet, protein, fat, and fiber increased compared to the control diet. This may be due, according to what researchers reported [14,15,16], to the content of food additives and medicinal herbs that are A source of some natural antioxidants because it contains phenolic compounds, flavonoids and terpenes. Aqsa Mehboob and others [17] found that when fenugreek was added at a rate of 0.5 and 1% in the diet of striped catfish, an increase in the apparent digestibility coefficient of protein and fat compared to the control diet. Douglas [18] mentioned that high fat and low fiber in the diet lead to stimulating the secretion of the enzyme lipase, which works to digest fats in

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the digestive tract and break down large molecules into small ones by the action of bile, thus increasing fat digestion. I also agreed with what Al-Bassam [19] mentioned when using Powdered protein waste treated enzymatically and acidically in feeding common carp fish, where the apparent digestibility coefficient of protein, fat, carbohydrates and ash increased. The reason for the increased palatability of the feed containing the fenugreek plant may be its bitter taste resulting from the presence of the active ingredient glycosides, and thus the increased feed intake in the feed containing the fenugreek plant, which resulted in an increase in the apparent digestibility coefficient in this study.

2-3Food emptying rate

Food components and food quality play an important and significant role in the rate of digestion and absorption, and this is reflected in the speed of emptying the digestive tract. The figures show:(1) to (7) The results of the food emptying rate for all types of diets used in this experiment. The results of the front part of the digestive canal were the highest percentage of food present in the first hour after feeding in Treatment T3, Treatment T7, and Treatment T5, and their percentages were (2.796, 2.32, 2.109). (%), respectively, and the lowest percentage of food was in the control treatment T1 (without addition) 0.847% in the same hour, and the amount of food consumed in the treatment (T3, T7, and T5), respectively, was higher, and the reason for this difference could be in the palatability of the diets, and this is consistent with what Al-Bassam [20] mentioned that the palatability factor affects the rate of food intake because the fish senses the presence of an added substance, so it needs time to adapt to the feed, and thus it is reflected in the food content of the intestines. However, in the following hours, we notice a gradual decrease in food in the front part of the channel The digestive tract, which includes the stomach, where the lowest percentage was recorded in the T2 treatment, 0.083% at 20 hours, followed by the T4 treatment and the T7 treatment (0.203, 0.214)%, respectively. The percentage of food and the speed of the passage of food materials in the front part of the digestive canal containing the stomach depends on Several factors, according. [21], including feed size, temperature, fish size, hormones, and stress. Figures (1) to (7) show the results of the emptying rate for the middle part of the digestive canal, where the highest percentage of food in all treatments was recorded at 16 o'clock and was highest. Percentage in treatment (T1, T4, and T6) (2.574, 2.477, 2.15) %, respectively. The lowest percentage of food presence was recorded in the T3 treatment, which was 0.477% at the same hour at 16 hours, while the lowest percentage of food presence in the central part at 20 hours was recorded in the treatments (T1, T6, and T3) which are (0.018, 0.067, 0.148)%, respectively, and the decrease in the percentage of food in the treatments (T1, T6, and T3) is evidence of an increase in the digestion and absorption of nutrients from these diets, and this is consistent with what Al-Bassam et al. [20] mentioned when The use of the commercial enzyme mixture 2500 SAFIZYN JP in the diet of common carp fish, as it leads to an increase in the apparent digestibility coefficient of the fish and reduces the amounts of food in the front and middle parts, as well as the back part of the digestive canal. The results of the emptying rate in the back part of the digestive tract show that the highest percentage of food for all treatments was at 16 o'clock, and the highest percentage in treatment T4 was 2.915%. The percentages

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of the rest of the treatments ranged between 0.616 - 1.480%, and the control treatment was 1.156%, and the lowest percentage of food was in the back part of the digestive tract at o'clock. 20 for treatments T2 and T6 by (0.32 - 0.28)%, respectively. The difference in the duration of food emptying in fish is due to several factors, such as the size of the fish, the size of the feed composition, the amount of protein and energy in the feed, temperature, stress, and feeding ratio. The mechanisms controlling the intestinal emptying of fish are not well understood [22],[23] stated that controlling the suppression of gastric enzyme secretions is achieved by nervous and hormonal reactions caused by chemical and mechanical substances and stimulation of the anterior part of the intestine, which leads to slowing down stomach emptying

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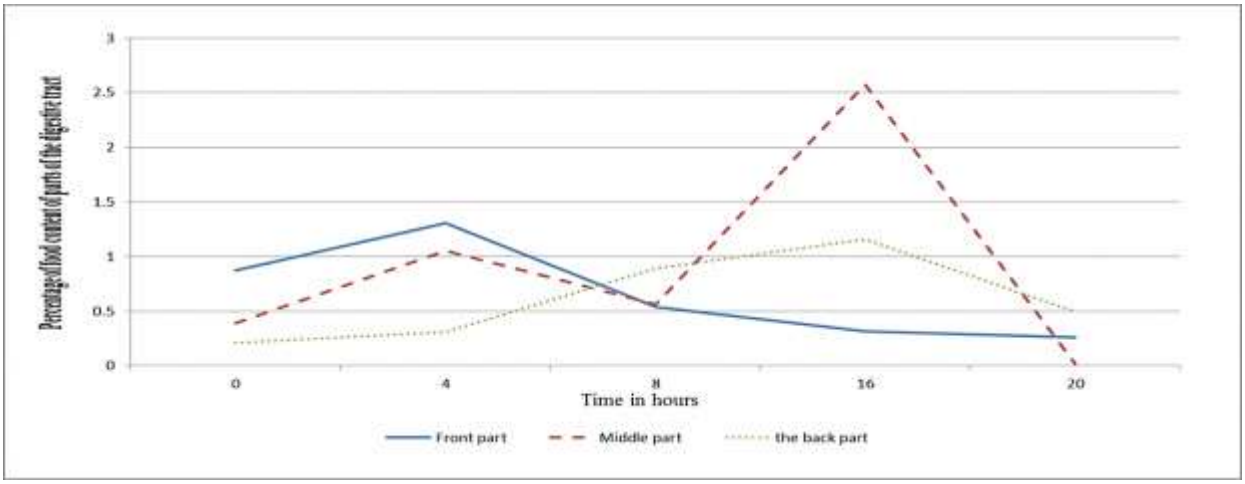

figure (1)Emptying rate of control diet (T1(

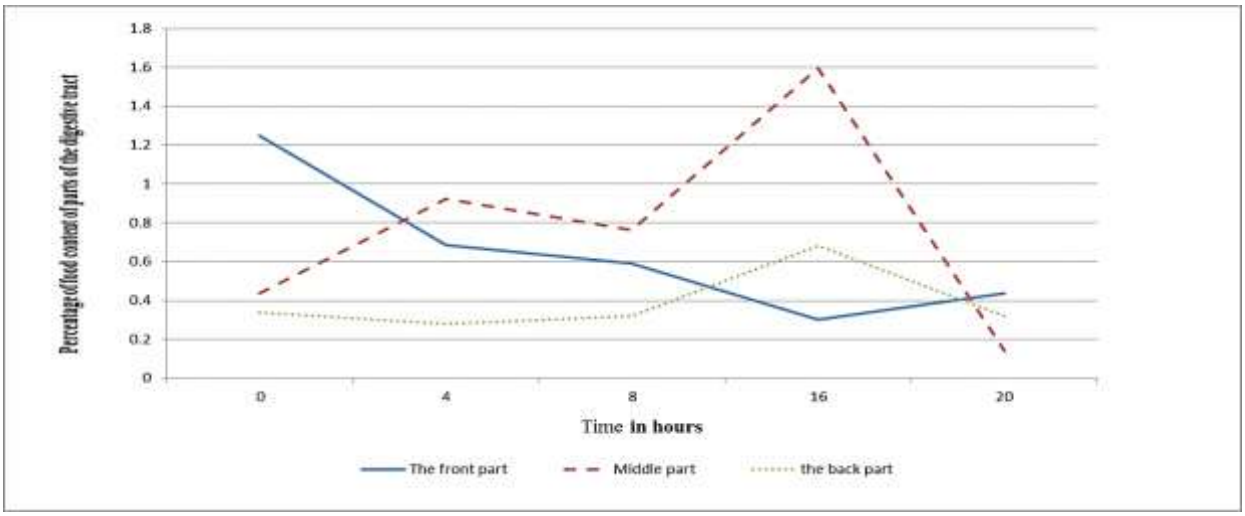

figure (2)Evacuation rate when adding fenugreek leaf powder 1%(T2(

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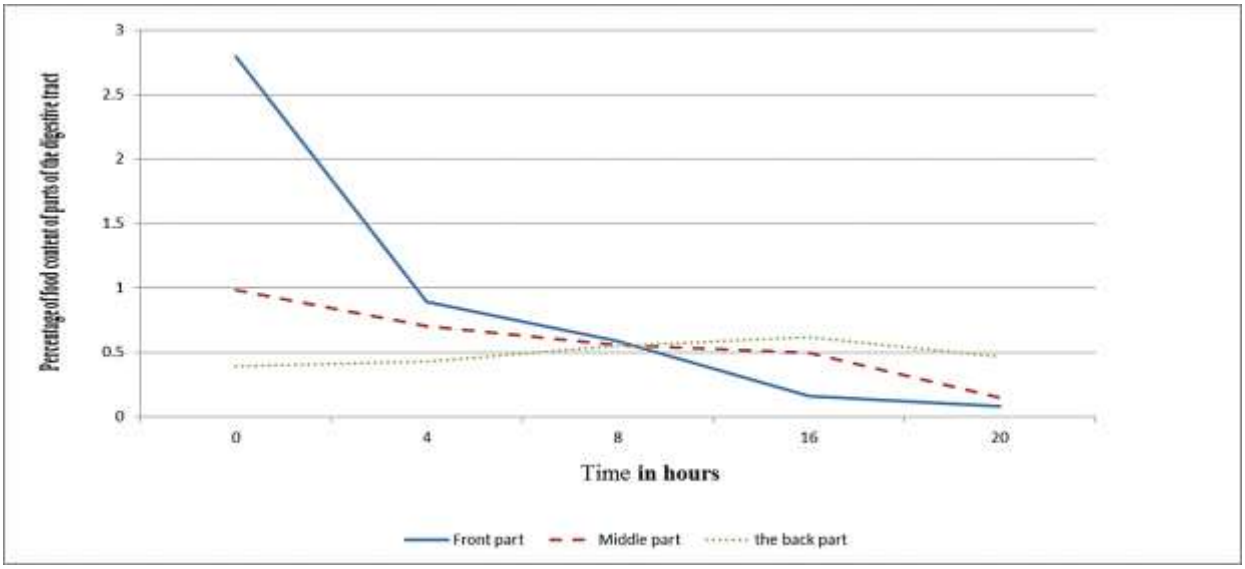

figure (3)Evacuation rate when adding fenugreek leaf powder is 2%(T3(

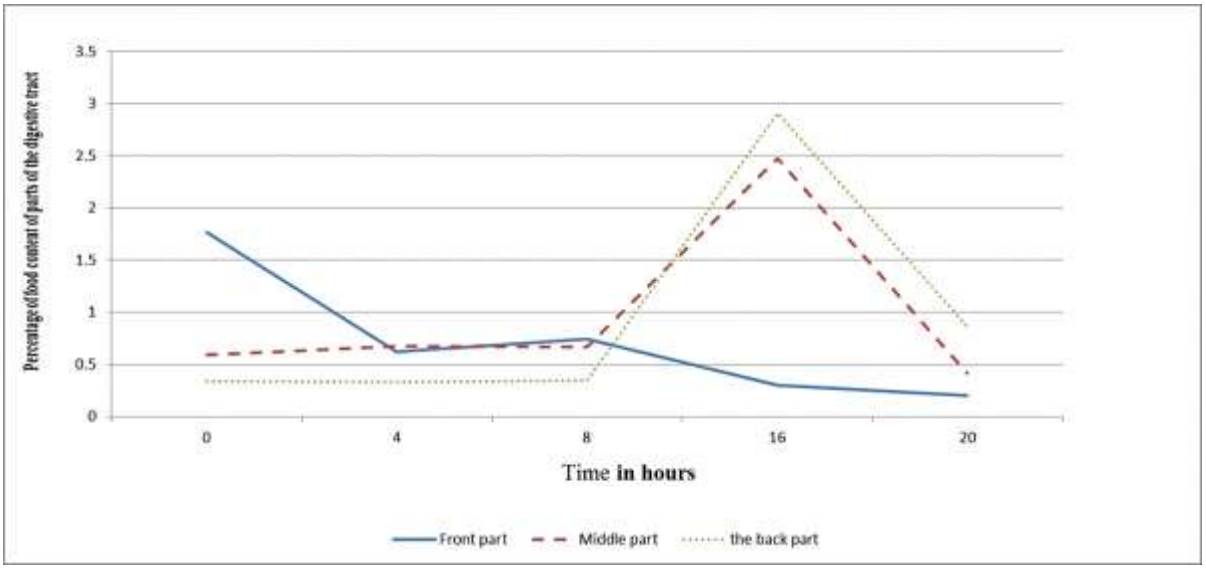

figure (4) Evacuation rate when adding fenugreek leaf powder is 3%(T4(

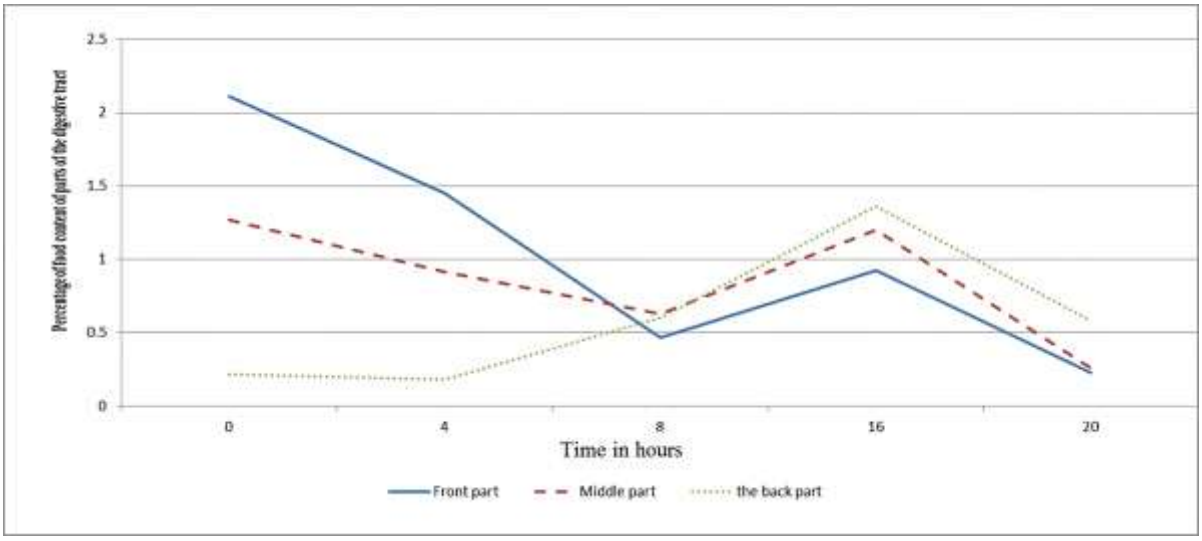

figure (5)Empty rate when adding 1% alfalfa leaf powder(T5(

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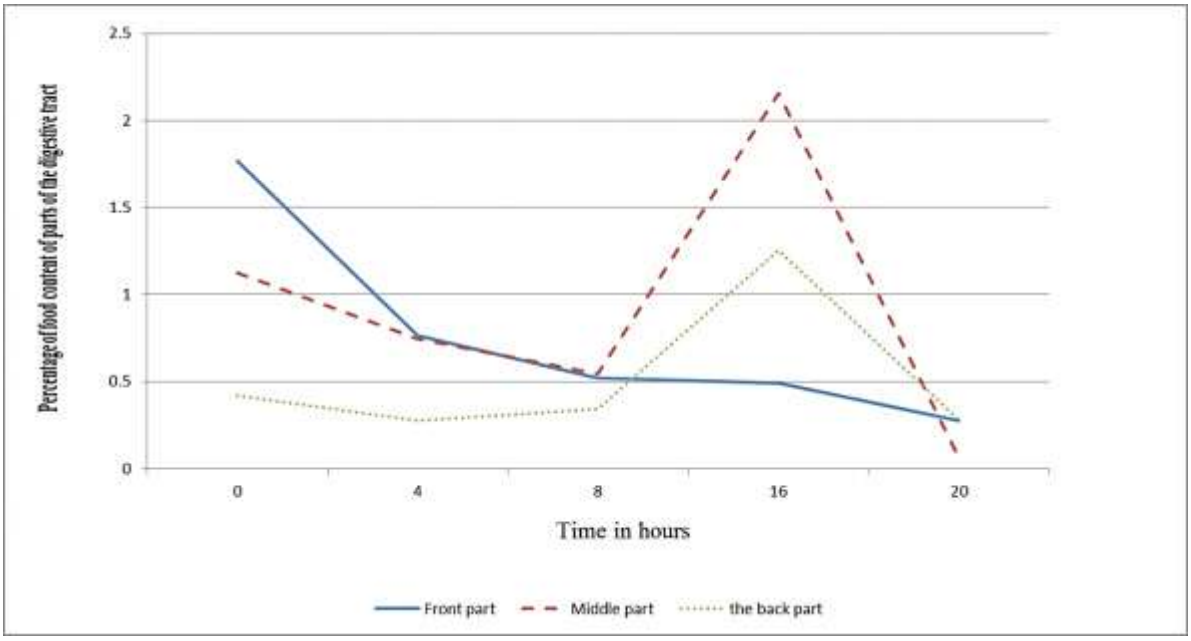

figure (6)Empty rate when adding 2% alfalfa leaf powder(T6(

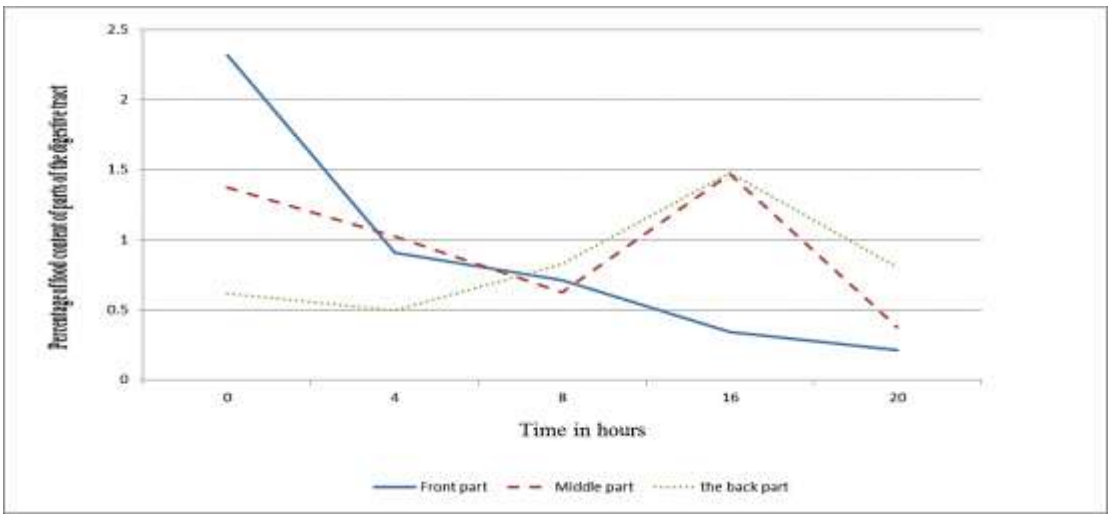

figure (7)Empty rate when adding alfalfa leaf powder 3%(T7(

3-3Chemical composition of fish meat

The results of the statistical analysis in Table (2) showed the superiority of the treatment T6 in the moisture content of the meat of the experimental fish was 81.92% for all experimental treated fish. It was noted that there were significant differences for treatments T1, T2, T4, and T5 compared to treatments T3 and T7, which recorded the lowest moisture percentage, reaching 75.93 and 75.36%, respectively. As for the percentage of protein, there was a significant superiority for treatment T2, 20.03%, over all treatments except treatment T7. There is no moral difference between them. It was noted that there were no significant differences ($P \leq 0.05$) between the treatments T6, T4, T5, T3, and T1, which amounted to (17.82, 17.73, 17.33, 16.73, 16.17)%, respectively. It was observed that treatments T7 and T3 were significantly superior ($P \leq 0.05$) in dry matter percentage over the rest of the treatments, and treatments T1, T2, T5, and T4 did not differ significantly between them. A decrease occurred in treatment T6 compared to all

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treatments. The percentage of fat in the treatment adding 2% fenugreek increased by 4.86% over the rest of the treatments, while the treatments T7, T4, T5, T6, T1 did not record any significant difference ($P \leq 0.05$), and the lowest percentage was in the treatment adding 1% fenugreek, amounting to 0.895%. Regarding the rest of the treatments, as for the percentage of ash, there were no significant differences between the treatments. The reason for the increase in the percentage of protein in the T2 treatment of fish meat may be due to the increase in the apparent digestibility coefficient of the protein and to the decrease in the T3 and T4 treatments due to the decrease in the digestibility coefficient and the speed of food passage in the digestive tract, and thus the proteins are not sufficiently exposed to digestive enzymes, which leads to them not being completely assimilated. and absorption [24]. The results of the chemical analysis of the fish agreed with the findings of Aqsa Mehboob and others (2017)[17], where the body content of the fish recorded an increase in the percentage of protein and fat when fenugreek was added at a rate of 0.5 and 1%, and there were no significant differences between the treatments in the percentage of ash.[25] found that the protein content of common carp fish increased significantly.[26] found an increase in the percentage of protein in the bodies of Nile tilapia fish when adding a 0.2% methanolic extract to the fenugreek and no differences in the percentage of fat and carbohydrates. [27] When adding 30% boiled fenugreek seeds to the diet of African catfish, the protein and ash content of the fish's body increased.The percentage of protein and fat increased in the treatment T7 agreed with his statement SA and Muley [28] When replacing fishmeal with alfalfa leaf powder in fish dietsCirrhinus mrigala Where compared with control fish. [29] when replacing soybeans with alfalfa powder in the feed of male Nile tilapia fish, gave the highest value for the percentage of body protein and moisture when adding 75% alfalfa and a higher value for the percentage of fat when adding 25% alfalfa compared to the control treatment. [30] mixed fish powder with alfalfa leaf powder and observed an increase in the percentage of protein and fat in the liver and muscles of fish. Cirrhinus mrigala compared to the control treatment.

Table (1) The effect of adding fenugreek and alfalfa leaf powder in different proportions on the apparent digestibility coefficients of the feed and each of (protein, fat, carbohydrates, and ash)% (average)± standard error.(

Table (2) The effect of adding fenugreek and alfalfa leaf powder in different proportions on the chemical composition (%) of the portion eaten by common carp fish (medium).±standard error.(

Ashes %	fat %	Dry matter %	Crude protein %	Humidity %	Transactions
3.35	2.41	21.42	15.94	78.55	Before starting the experiment
2.85±0.5 a	2.34±0.51 bc	22.36±0.53 bc	16.17±0.54 cd	77.62±0.51 bc	the control T1
3.15±0.2 a	0.895±0.49 c	22.32±0.50 bc	20.03±0.52 a	77.65±0.55 bc	Add fenugreek leaf powder 1% T2
2.45±0.3 a	4.86±0.39 a	24.04±0.49 ab	16.73±0.50 cd	75.93±0.50 cd	Add fenugreek leaf powder 2% T3
2.8±0.1 a	1.92±0.37 bc	22.05±0.44 c	17.73±0.46 bcd	77.93±0.54 b	Add fenugreek leaf powder 3% T4
2.9±0.6 a	1.91±0.44 bc	22.44±0.42 bc	17.33±0.42 bcd	77.52±0.49 bc	Adding alfalfa leaf powder 1% T5
2.1±0.4 a	1.85±0.50 bc	18.05±0.39 d	17.82±0.50 bc	81.92±0.46 a	Adding alfalfa leaf powder 2% T6
2.45±0.2 a	3.03±0.43 b	24.64±0.36 a	19.13±0.40 ab	75.36±0.43 d	Adding alfalfa leaf powder 3% T7

*The different letters in the same column indicate significant differences ($p \leq 0.05$.(

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