

## Effect of Raw and Boiled Oak *Quercus brantii* in Performance, Biochemical and Blood Indices, and Proximate Composition of *Cyprinus Carpio* L.

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### Abstract

This study was conducted in fish diseases lab. / College of veterinary medicine/ university of Sulaimani to evaluate the effect of boiling oak as compared with raw oak on performance of common carp at 0.05 significant level for all studied parameters. This study was carried out on *C. carpio* L. for five treatments/ three replicates. The experimental trial consists of five treatments with three duplicates, each containing seven fish: Group 1: Diet without any supplement as control group, Group 2: adding 10g raw oak/ kg diet, Group 3: adding 20g raw oak/kg diet, Group 4: adding 10g boiled oak/kg diet, Group 5: 20 grams of boiling oak / kg diet. The second group with 10g raw oak/ kg diet and T5 with 20g boiled oak/ kg diet was high significantly in the final weight, weight gain, significant and relative growth rate. T3 with 20g raw oak/ kg diet was higher significantly in FCR, T4 with 10g boiled oak/kg diet was higher significantly in FER. RBC \*10<sup>12</sup>/L was higher in T4 with 10g boiled oak/ kg diet and T5 with 20g boiled oak/ kg diet were higher significantly, in HGB g/L the T2 with 10g raw oak/ kg diet and T3 with 20g raw oak/kg diet were higher significantly. T3 with 20g raw oak/kg diet was significant in each of the indices MCH pg and MCHC g/L. T4 with 10g boiled oak/kg diet was higher significantly in each of HCT %. The control was significantly higher in PLT \*10<sup>9</sup>/L. T5 with 20g boiled oak/ kg diet was significantly high in Sugar and HDL. Total Protein was significantly high in control and T2 with a 10g raw oak/ kg diet. Cholesterol was significantly high in T2, T4, and T5 as compared to control group. GOT and CKI was significant in T3. A Hepatosomatic index was higher significantly in each of T2, T3 and T5. Gill somatic Index was significant in all treatments as compared to T3. Gonadosomatic Index was significant in all treatments as compared to T2 and T4, in the Intestine Weight Index and Intestine Length Index, all treatments were significantly different from the control. In the Intestine Length (Fish Length) Index, T2 was substantially greater. The current study's findings imply that oak acorn powder is a viable feed additive, indicating a starting point for additional research into its potential use as an antioxidant and immune booster in various fish species.

**Keywords:** *Cyprinus carpio*; oak *Quercus brantii*; blood indices; proximate analyses

تأثير البلوط *Quercus brantii* النقي والمغلي في اداء النمو والقياسات الجسمية و الدمية و التحليل الكيميائي للكرب الاحادي  
*Cyprinus carpio*

الخلاصة

اجريت الدراسة الحالية في مختبر امراض الاسماك/ كلية الطب البيطري/ جامعة السليمانية على اسماك الكرب العادي بخمس معاملات/

ثلاث مكررات. المجموعة الاولى كانت بدون اية اضافات كعصارة السيطرة، في المجموعة الثانية تم اضافة 10 غم بلوط نيئ/ كغم علف، وفي المجموعة الثالثة تم اضافة 20 غم بلوط نيئ/ كغم علف، وفي المجموعة الرابعة تم اضافة 10 غم بلوط مغلي/ كغم علف، وفي المجموعة الخامسة تم اضافة 20 غم بلوط مغلي/ كغم علف. كانت المعاملة الثانية بنسبة اضافة 10 غم بلوط نيئ/ كغم علف والمعاملة الخامسة بنسبة 20 بلوط مغلي/ كغم علف اعلى معنويا في كل من الوزن النهائى و الزيادة الوزنية و معدلى النمو النوعى والنسبى. زادت المعاملة الثالثة بنسبة 20 غم بلوط نيئ/ كغم علف معنويا فى معدل التحويل الغذائى، والمعاملة الرابعة بنسبة 10 غم بلوط مغلي/ كغم علف فى نسبة كفاءة العلف. كريات الدم الحمر  $10^{12}$  لكل لتر فى المعاملة الرابعة بنسبة 10 غم بلوط مغلي/ كغم علف والمعاملة الخامسة بنسبة 20 غم 10 غم بلوط مغلي/ كغم علف، والهيموغلوبين فى المعاملة الثانية بنسبة اضافة 10 غم بلوط نيئ/ كغم علف و المعاملة الثالثة بنسبة 20 غم بلوط نيئ/ كغم علف. زادت معنويا المعاملة الثالثة بنسبة 20 غم بلوط نيئ/ كغم علف فى كل من MCH و MCHC. وزادت المعاملة الرابعة بنسبة 10 غم بلوط مغلي/ كغم علف فى كل من HCT. كانت معاملة السيطرة اعلى معنويا فى نسبة الصفائح الدموية. ان والمعاملة الخامسة بنسبة 20 غم 10 غم بلوط مغلي/ كغم علف زادت معنويا فى نسبة السكر و HDL. ارتفعت معنويا البروتين الكلى فى معاملة السيطرة و المعاملة الثانية بنسبة اضافة 10 غم بلوط نيئ/ كغم علف. ارتفع الكوليسترول معنويا فى المعاملة الثانية و الرابعة و الخامسة. زادت كل من GOT و CKI فى المعاملة الثالثة. ارتفع معنويا الاليومين و الكلوبولين فى كل من معاملة السيطرة و الثانية و الرابعة. كان دليل الكبد مرتفعا معنويا فى المعاملة الثانية و الثالثة و الرابعة. اختلفت معنويا جميع المعاملات مقارنة بمعاملة السيطرة فى دليل وزن و طول الامعاء. كان دليل طول الامعاء اعلى معنويا فى المعاملة الثانية. ونستنتج من نتائج الدراسة الحالية امكانية استخدام مسحوق البلوط كاضافات غذائية وكبدائية لدراسات اضافية حول استخدام البلوط كمضادات تاكسدية و محسنة للمناعة فى العديد من الاسماك.

## Introduction

Aquaculture has evolved rapidly during the last few decades (1980–2010) at an average yearly rate of 8.8% to meet the world's high needs, resulting in intensive and super-intensive cultures (1). As a result, a wide range of disorders appeared, and stresses such as overcrowding, transportation, handling, grading, and poor water quality all played a role in the disease epidemic in these cultures (2). Various techniques, such as antibiotics, chemotherapeutics, and vaccinations, have been used to combat these issues. Antibiotics and chemotherapeutics are known to cause resistance in infections and to be damaging to humans and the environment. Vaccines are not a viable solution since they are costly and designed for certain infections (3).

The Valonia oak (*Quercus aegilops L*) is the common native species in the Iraqi Kurdistan region, which is a medium-sized deciduous tree (4). Herbal extracts, which are a type of immunostimulant, have been used to boost the immune system and have been widely utilized to improve defective immunological functioning (5,6,7).

This species' extracts contain antibacterial and wound-healing properties, while its tannins have contractive and disinfecting properties (8,9,10), Oak is also utilized as animal feed in various places of Iran due to its low cost and availability. External and interior layers cover oak fruit, with the internal layer known as jaft in the area. Some microorganisms are inhibited by ethanolic and methanolic extracts of Persian oak fruits at varied doses. (10). *Quercus brantii*, The Brant's oak is a native of Western Asia, including Kurdistan, Iran, Iraq, Syria, and Turkey. The most significant tree species in the Zagros in Iran is *Quercus brantii*, which covers more than half of the Zagros Forest area. Traditional Iranian medicine makes use of their seed. Fuelwood, charcoal, and timber hardwood are some of the other essential products made from oaks.

Though the exact nutrient profile depends on the species of acorn, all are packed with essential nutrients. Acorns are especially high in potassium, iron, vitamins A and E, and several other important minerals. Plus, these nuts are low in calories. Most of their calories come in the form of healthy unsaturated fats. This study was conducted to assess the effect of oak fruit powder

affected common carp growth, hematological, and immunological measures.

## Materials and methods

### Experimental fish

On 105 common carp *C. carpio* L. collected from local fish ponds in Peramagrun/ Sulaimani/ Iraq, the experiment lasted 60 days. The weight of the fish varied ( $116.61 \text{ gm} \pm 5.8$ ). 30 days of laboratory pre-acclimation and commercial pellet feeding preceded the real feeding experiments.

### Experimental system

In this study, fifteen plastic tanks (70 L) were utilized for five treatments, each with three duplicates. Each tank received proper continuous aeration thanks to fifteen small aquarium air pumps, Luckiness 828 (power: 5 watts, air flow: 3.5L/min), and Chinese air compressors, Hailea ACO-318 (power: 45 watts, air flow: 70L/min), Hailea ACO-328 (power: 55 watts, air flow: 82L/min), Resun ACO-010 (power: 200 watts, air flow: 0.135 m Each replicate was stocked with seven fish. The duplicates were set at random to minimize variations between treatments. To eliminate any remaining feeds and excrement from the system, a daily cleaning by siphoning approach is used.

The experimental trial consists of five treatments with three duplicates, each containing seven fish: group 1: Diet without any supplement as a control group, group 2: adding 10g raw oak/ kg diet, group 3: adding 20g raw oak/kg diet, group 4: adding 10g boiled oak/kg diet, group 5: 20 gm boiled oak/kg diet.

### Diet formulation

Standard components found in Sulaimani city markets are supplemented with raw and cooked oak powder in the experimental meals. To make dough, combine the ingredients. Then, Kenwood Multi-processors use an electrical mincer to pelletize the material. Three days of room temperature drying were utilized, followed by crushing to get fine particles. Using Albumin and

Globulin were higher significant in each of control, T2, and T4 when compared with each other, as biomass twice a day at 9:00 a.m. and 2:00 p.m. Bimonthly, the fish in each tank were weighed together. The feeding amounts were then revised based on the new weights. Growth and feed utilization parameters, biological parameters (indices), Proximate composition, Blood picture and Biochemical measurements were studied.

### Growth and feed utilization parameters

The fish were weighed every two weeks for all replicates in order to calculate growth performance metrics. Every two weeks, the feed intake of each treatment was monitored and modified according on the biomass gained.

The following formulae were used to determine weight increase and daily weight gain:

$$\text{“Weight gain (gm. /fish) = } W_2 - W_1$$

Where  $W_1$ : Fish weight (gm.) at the beginning of the experimental period and  $W_2$ : Fish weight (gm) at the end of the experimental period.

Relative growth rate was calculated according to the method described by Brown, (11) as follows:

$$\text{Relative growth rate (RGR \%)} = \text{Weight gain/Initial weight} \times 100 = (W_2 - W_1) / W_1 \times 100$$

Specific growth rate was calculated according to the method described by Uten, (12) as follows:

$$\text{Specific growth rate (SGR) \%} = (\text{Ln final body weight} - \text{Ln initial body weight}) / \text{experimental period} \times 100 = ((\text{Ln } W_2 - \text{Ln } W_1) / T) \times 100$$

Feed conversion ratio was calculated as follows:

$$\text{Feed conversion ratio (FCR)} = \text{Total feed fed (gm.)} / \text{Total wet weight gain (g)}$$

Feed efficiency ratio was calculated as previously described by Uten (12) as follows:

$$\text{Feed efficiency ratio (FER)} = \text{Total weight gain (gm.)} / \text{fish Total feed fed (gm.)}$$

Protein efficiency ratio was calculated as follows:

$$\text{Protein efficiency ratio (PER)} = \text{Total wet weight gain (gm./fish)} / \text{Amount of protein fed (gm./fish). “}$$

## Blood and biochemical parameters

At the end of the experiment, three fish were chosen at random from each replication, weighed, and their length measured, before piercing the caudal peduncle to obtain blood samples, which were collected in heparinized plastic vials and preserved under refrigeration. All blood tests were performed by a hematological analyzing instrument of the type ACCENT 200 specialists to veterinary which was made in Poland. The enzyme levels were measured according to the instructions that came with the enzymatic kits. Biochemical parameters include, Aspartate aminotransferase activity (AST), Total proteins, Alanine aminotransferase activity (ALT), Globulin (g/dL), Albumin (g/dL).

## Biological parameters (indices)

The liver, gills, viscera, and kidney of the fish were dissected and weighed. Fish organ-somatic indices were computed as follows:

“Hepatic somatic index (HSI, %) = 100 (liver weight (gm) / fish weight (gm));

Gills somatic index (GSI, %) = 100 (gills weight (gm) / fish weight (gm));

Spleensomatic index (SSI, %) = 100 (Spleen weight (gm) / fish weight (gm));

Kidney somatic index (KSI, %) = 100 (kidney weight (gm) / fish weight (gm)).”

## Statistical analysis

The experiment will be done using SPSS Version 20's one-way analysis of variance (ANOVA) with fully randomized design (CRD) and general linear models (GLM) approach. At a P value of 0.05, Duncan's test will be performed to compare the means of the treatments.

## Results and Discussion

Table 1 show the effect of boiling oak on growth performance in which T2 with 10g raw oak/kg diet and

T5 with 20g boiled oak/kg diet were high significantly in final weight, weight gain,

significant and relative growth rate.

T3 with 20g raw oak/kg diet was higher significantly in Feed conversion ratio, T4 with 10g boiled oak/kg diet was higher significantly ( $p < 0.05$ ) in FER, T2 with 10g raw oak/kg diet and T5 with 20g boiled oak/kg diet were high significantly in Protein ER as seen in table (2).

Table (3) showed the effect of boiling and raw oak on RBC  $\times 10^{12}/L$  in which T4 with 10g boiled oak/kg diet and T5 with 20g boiled oak/ kg diet were higher significantly, in HGB g/L the T2 with 10g raw oak/ kg diet and T3 with 20g raw oak/kg diet were higher significantly. T3 with 20g raw oak/kg diet was significant in each of the indices MCH pg and MCHC g/L. T4 with 10g boiled oak/kg diet was higher significantly in each of HCT % and MCV fL. The control group had a much higher significantly in PLT  $\times 10^9/L$ .

Table 4 showed that T5 with 20g boiled oak/ kg diet was significantly high in Sugar and HDL. Total Protein was significantly high in control and T2 with 10g raw oak/ kg diet. Cholesterol was significantly high in T2, T4 and T5. Triglyceride was significantly high in T4 with 10g boiled oak/ kg diet. LDL was higher in T2 with 10g raw oak/ kg diet as shown in table (4).

GPT was higher significantly in T3 and T4. GOT and CKI were significant in T3. Albumin and Globulin were higher significant in each of control, T2 and T4 as observed in table (5).

Hepatosomatic index was higher significantly in each of T2, T3 and T5. Gillsomatic Index was significant in all treatments as compared to T3. Gonadosomatic Index was significant in all treatments as compared to T2 and T4. As seen in the table (6), there were no significant changes in the Spleen and Kidney Indexes.

The effect of boiling on oak quality in terms of chemical composition is seen in Table (8); there are no significant variations in crude protein, crude lipid, or ash. T3, T4, and T5 had much more moisture than the other treatments.

No significant differences seen in meat indices in table (9).

Abdel-Tawwab et al., (13) found that Fish in low stocking density (LSD) conditions and fed with the dietary oak acorn powder presented the highest final weight (75.1 g) compared to those in the LSD conditions and fed with the control diet ( $P < 0.05$ ) with the feed utilization parameters. Supplementation with the dietary oak acorn powder has modified hematological parameters related to stocking density stress effects. The dietary oak acorn powder caused a significant increase in RBCs count, Hb, and Hct values in fish of LSD conditions.

Boiling the oak substantially increased the performance of common carp in this investigation. Furthermore, owing to the presence of oak in the diet, feed consumption rose as a consequence of increased need for nutrients during the fish's development or as a result of sensory stimulation and better appetite. Oak contains phenolic compounds, vitamins, minerals, essential oils, and aromatic substances, as well as lipids, amino acids, proteins, carbohydrates and different sterols (10,14), all of which have digestive and stimulatory qualities (15,16).

Cheyrier (17) found a wide range of phenolic chemicals in *Quercus* acorns, ranging from simple molecules (e.g., phenolic acids) to polyphenols (e.g., stilbenes, flavonoids, and derived polymers), with antioxidant, antibacterial, anti-inflammatory, and anticarcinogenic properties (18,19). These chemicals improved the overall performance and immunity of fish, consequently enhancing the fish's health and productivity (20).

Rashidian et al. (21) observed that feeding rainbow trout, *O. mykiss*, fingerlings (10.46 g) on diets enriched with alcoholic extract of acorn (*Q. brantii*) significantly boosted growth performance, feed intake, and digestive enzyme activity as levels of acorn extract rose. In contrast to the findings of the current investigation, Bohlouli et al. (22) fed Persian oak (*Q. brantii*

*var. persica*) acorn extract to rainbow trout fingerlings (6.25 g) during 8 weeks at 0.5, 1.0, and 2.0 g/ kg diet. They discovered that survival and growth parameters did not differ significantly across treatments ( $P 0.05$ ).

The oak (*Q. castaneifolia*) leaf extract demonstrated no growth-promoting effects in common carp, according to Paray et al. (23) implying that this extract may not activate digestive enzymes and/or gut absorption. They also related the fish's slowed growth to decreased feed intake. These discrepancies might be due to variances in oak species, fish type, size, and rearing circumstances, among other things. Abdel-Tawwab et al., (13) conclude that dietary oak powder supplementation not only promoted common carp development but also mitigated the stress caused by high stocking density, resulting in improved health. This might assist enhance aquaculture productivity while also improving fish resilience to unfavorable culture conditions.

## Conclusion

The current study's findings imply that oak acorn powder is a viable feed additive, indicating a starting point for additional research into its potential use as an antioxidant and immune booster in various fish species.

**Table 1:** Effect of using raw and boiled oak on growth performance of common carp *Cyprinus carpio* 60 days rearing

Treatments	Initial Wt.	Final Wt.	Wt. gain	SGR	RGR
T1 Control	127.735 ±0.02 a	154.815 ± 0.05 b	27.080 ±0.01 b	0.150±0.001 b	21.33 ± 0.04 b
T2 10g raw oak/kg diet	129.425 ±0.03 a	162.785 ± 0.01 a	33.360 ±0.01 a	0.17±0.002 a	25.018 ±0.01 a
T3 20g raw oak/kg diet	126.875 ±0.02 a	154.345±0.04 b	27.47 ± 0.05 b	0.15 ± 0.001 b	21.49 ± 0.01 b
T4 10g boiled oak/kg diet	126.32± 0.01 a	146.38 ±0.05 c	20.065 ±0.03 c	0.115±0.006 c	15.875 ±0.02 c
T5 20g boiled oak/kg diet	129.910± 0.01 a	162.56±0.05 a	32.65± 0.07 a	0.174±0.001 a	25.128± 0.01 a

At P < 0.05, means in the same column with different letters are significantly different.

**Table 2:** Effect of using raw and boiled oak on diet utilization of common carp *Cyprinus carpio* 60 days rearing

Treatments	FCR	FER	Protein ER
T1 Control	1.42 ± 0.001 b	62.021 ± 0.01 b	0.946 ± 0.002 b
T2 10g raw oak/kg diet	1.36 ± 0.004 c	59.20 ± 0.03 c	1.165 ± 0.004 a
T3 20g raw oak/kg diet	1.66 ± 0.002 a	61.61± 0.04 b	0.96 ± 0.001 b
T4 10g boiled oak/kg diet	1.49 ± 0.001 c	72.52 ± 0.05 a	0.701 ± 0.001 bc
T5 20g boiled oak/kg diet	1.31± 0.001 c	55.38 ± 0.06 c	1.140 ± 0.002 a

At P < 0.05, means in the same column with different letters are significantly different

**Table 3:** Effect of using raw and boiled oak on some blood indices of common carp *Cyprinus carpio* 60 days rearing

Treatments	RBC *10 <sup>12</sup> /L	HGB g/L	MCH pg	MCHC g/L	HCT %	MCV fL	PLT *10 <sup>9</sup> /L
T1 Control	0.690b ± 0.001	91.000b ± 0.06	131.400 bc± 0.05	612.500b ± 0.08	14.900bc ± 0.02	217.100b ± 0.05	15.000a ± 0.02
T2 10g raw oak/ kg diet	0.695b ± 0.004	94.500a ± 0.04	141.100b ± 0.01	666.500b ± 0.03	14.750bc ± 0.05	213.150b ± 0.09	13.500b ± 0.02
T3 20g raw oak/kg diet	0.470c ± 0.001	94.500a ± 0.01	211.900 a ± 0.06	1054.000 a ± 0.06	9.650c ± 0.06	203.900c ± 0.05	12.500bc ± 0.04
T4 10g boiled oak/kg diet	1.220a ± 0.002	90.000b ± 0.06	73.700d ± 0.04	313.000d ± 0.05	28.700a ± 0.05	235.800a ± 0.04	10.000c ± 0.01
T5 20g boiled oak/kg diet	1.900a ± 0.001	90.000b ± 0.04	112.850c ± 0.02	582.000c ± 0.08	16.950b ± 0.01	192.400d ± 0.08	10.500c ± 0.02

At P < 0.05, means in the same column with different letters are significantly different

**Table 4:** Effect of using raw and boiled oak on some blood biochemicals of common carp *Cyprinus carpio* 60 days rearing

Treatments	Sugar mmol/L	Total Protein gL <sup>-1</sup>	Cholesterol mg/dl	Triglyceride mg/dl	LDL mg/dl	HDL mg/dl
T1 Control	62.10±0.01 de	28.00±0.001 a	89.0b ±0.02	185.40±0.02 b	20.75 ±0.01 b	38.70±0.05 c
T2 10g raw oak/ kg diet	74.05±0.01 d	29.850±0.002 a	92.90±0.06 ab	181.10±0.03 b	25.750±0.01 a	46.45±0.06 b
T3 20g raw oak/ kg diet	93.60±0.03 c	25.30 ± 0.001 d	85.15 ±0.02 b	145.70±0.01 c	22.45 ± 0.01 b	44.50±0.04 b
T4 10g boiled oak/ kg diet	108.0±0.03 b	27.40 ± 0.001 c	92.90 ±0.04 ab	203.10±0.02 a	15.500±0.02 c	46.50±0.03 b
T5 20g boiled oak/ kg diet	125.30±0.01 a	25.90 ± 0.002 d	93.65 ±0.06 a	181.00±0.02 b	17.80 ± 0.03 bc	56.150±0.02 a

At P < 0.05, means in the same column with different letters are significantly different

**Table 5:** Effect of using raw and boiled oak on some blood enzymes of common carp *Cyprinus carpio* 60 days rearing

Treatments	GPT UI/ l	GOT UI/ l	Albumin g/dL	Globulin g/dL	CKI UI/ l
T1 Control	64.250c ± 0.06	141.450c ± 0.08	1.950a ± 0.002	26.050a ± 0.02	744.550b ± 1.25
T2 10g raw oak/kg diet	62.400c ± 0.02	206.150b ± 0.09	2.115a ± 0.006	27.750a ± 0.01	793.050b ± 1.65
T3 20g raw oak/kg diet	186.100a ± 0.01	235.950a ± 0.06	1.800c ± 0.001	23.500c ± 0.01	1966.000a ± 1.28
T4 10g boiled oak/kg diet	174.100a ± 0.06	158.400c ± 0.05	1.900b ± 0.002	25.500b ± 0.03	542.500c ± 1.96
T5 20g boiled oak/kg diet	98.950b ± 0.01	171.850b ± 0.04	0.190c ± 0.004	25.710b ± 0.03	770.350b ± 1.21

At P < 0.05, means in the same column with different letters are significantly different

**Table 6:** Effect of using raw and boiled oak on some somatic indices of common carp *Cyprinus carpio* 60 days rearing

Treatments	Hepatosomatic index	Spleensomatic Index	Gillsomatic Index	Gonadosomatic Index	Kidneysomatic Index
T1 Control	1.476c ± 0.01	0.163a ± 0.001	6.104a ± 0.01	4.786 ab ± 0.01	0.307a ± 0.004
T2 10g raw oak/ kg diet	1.979a ± 0.02	0.181a ± 0.002	5.410ab ± 0.01	3.309b ± 0.01	0.346a ± 0.005
T3 20g raw oak/ kg diet	1.898ab ± 0.01	0.168a ± 0.001	2.838c ± 0.02	5.086a ± 0.02	0.394a ± 0.004
T4 10g boiled oak/ kg diet	1.672c ± 0.03	0.194a ± 0.003	5.205ab ± 0.02	1.505c ± 0.03	0.459a ± 0.005
T5 20g boiled oak/ kg diet	1.807ab ± 0.01	0.132a ± 0.001	6.282a ± 0.01	5.211a ± 0.03	0.373a ± 0.001

At P < 0.05, means in the same column with different letters are significantly different.



**Table 7:** Effect of using raw and boiled oak on some intestine indices of common carp *Cyprinus carpio* 60 days rearing

Treatments	Intestine weight Index	Intestine Length Index	Intestine Length (Fish Length) Index	Condition Factor
T1 Control	1.730b ± 0.002	19.696b ± 0.00	139.642c ± 0.012	1.528a ± 0.002
T2 10g raw oak/ kg diet	2.023a ± 0.004	23.906a ± 0.006	185.278a ± 0.025	1.746a ± 0.003
T3 20g raw oak/ kg diet	2.433a ± 0.002	20.294ab ± 0.005	155.556b ± 0.042	1.515a ± 0.001
T4 10g boiled oak/ kg diet	2.043a ± 0.002	23.541a ± 0.002	139.524c ± 0.012	1.412a ± 0.004
T5 20g boiled oak/ kg diet	2.339a ± 0.001	22.359ab ± 0.005	158.182b ± 0.058	1.610a ± 0.001

At P < 0.05, means in the same column with different letters are significantly different.

**Table 8:** Effect of using raw and boiled oak on proximate analyses of common carp *Cyprinus carpio* 60 days rearing

Treatments	Moisture %	Crude Protein %	Crude Lipid %	Ash %
T1 Control	68.56b ± 0.12	19.36ab ± 0.02	6.11a ± 0.021	1.05a ± 0.006
T2 10g raw oak/ kg diet	69.52b ± 0.24	20.12a ± 0.03	6.85a ± 0.015	1.32a ± 0.002
T3 20g raw oak/ kg diet	70.21a ± 0.15	20.68a ± 0.01	6.94a ± 0.032	1.41a ± 0.001
T4 10g boiled oak/ kg diet	72.52a ± 0.15	21.22a ± 0.05	6.12a ± 0.011	1.51a ± 0.002
T5 20g boiled oak/ kg diet	71.28a ± 0.11	22.58a ± 0.01	6.54a ± 0.016	1.27a ± 0.003

At P < 0.05, means in the same column with different letters are significantly different.

**Table 9:** Effect of using raw and boiled oak on some meat indices of common carp *Cyprinus carpio* 60 days rearing

Treatments	Wt. without Viscera Index	Wt. without Viscera and Head
T1 Control	80.505a ± 0.1	59.251a ± 0.05
T2 10g raw oak/ kg diet	82.677a ± 0.6	62.032a ± 0.06
T3 20g raw oak/ kg diet	82.055a ± 0.2	59.888a ± 0.02
T4 10g boiled oak/ kg diet	83.576a ± 0.3	62.683a ± 0.04
T5 20g boiled oak/ kg diet	78.974ab ± 0.8	59.452a ± 0.06

At P < 0.05, means in the same column with different letters are significantly different.

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