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Effects of Some Dietary Additives on Growth and Health Status of the Young Common Carp *Cyprinus carpio*

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ABSTRACT

The synbiotic mixture prepared with the local Iraqi probiotic, the commercial imported probiotic, and the commercial imported synbiotic mixture were used as a feed additive in the diets of common carp (*Cyprinus carpio*) in growth and health performance for a period of 70 days. 75 fingerlings were cultured in a recirculating aquaculture system with an average starting weight of 11.15 ± 1 g and an average length of 9.1 ± 1.5 cm. The fish were randomly distributed among five treatments, with three replicates for each treatment and five fish for each replicate. A standard diet was prepared to which 0.1% each of the Iraqi probiotic (T2), the commercially imported probiotic (T3), the commercially imported synbiotic mixture (T4), and the synbiotic mixture prepared (T5) from lactic acid bacteria (*Streptococcus themophilus, Lactococcus bulgaricus*) were added to it. The fish were fed experimental diets at 3% of the body weight, and the fish were weighed every 14 days. The results showed that the fifth treatment, T5, was superior to the studied traits. The results indicated that there was a significant difference ($P<0.05$) between it and the experimental coefficients in terms of growth criteria, which included the average final weight 130.48 gm, and weight gain 73.65 gm. The specific growth rate was 1.19 %.g/day, the condition factor was 1.69, the feed conversion ratio was 2.28 and there was an improvement in the immunological health parameters, as the synbiotic mixture treatment prepared was significantly superior ($P<0.05$) in total protein, albumin and globulin (2.05, 4.14, 2.09) g/dl, respectively, and an increase in glucose 83.31 mg/dl, as well as an improvement in the liver enzymes (AST, ALP, ALT) of the fish treated with the prepared synbiotic mixture (4.74, 54.13, 97.61) IU/L, respectively.

INTRODUCTION

Aquaculture has become one of the most important sectors of food production and has experienced rapid growth in recent years due to population growth (**FAO, 2020**). An increasing number of diseases, especially under intensive culture systems. In the spread of pathogens and causing significant economic losses in aquaculture (**Mishra *et al.*, 2017**). Due to the ban on antibiotics as a growth promoter as well as their adverse effects on the host, the use of natural feed additives such as probiotics, precursors and synbiotic mixtures in aquaculture has an important role through pathogen control, growth promotion, and immune stimulation of aquatic organisms **(Marimuthu *et al*., 2022**). Probiotics are live microorganisms administered via feed or directly into the culture water **(Carnevali *et al*., 2014**). Probiotics enhance intestinal bacteria and enzymatic contributions to improve digestion and food absorption **(Raja *et al*., 2015**). A variety of Gram-positive and Gram-negative bacteria were used as a probiotic. *Lactobacillus, Streptococcus* and *Bifidobacterium* are the most common strains of microorganisms **(Guardiola *et al*., 2016**) and also the work of probiotics to raise antibody activity and phagocytosis against pathogenic microorganisms (**Brown *et al*., 2021**). Prebiotics are used to improve the immune system of animals, as non-digestible food additives, and as energy sources for beneficial bacterial species that produce extracellular digestive enzymes in the colon **(Song *et al*., 2014**). A synbiotic mixture is a mixture of enhancers and prebiotics in some form of probiotic (**Ziemer and Gibson, 1998**). A synbiotic mixture can have more benefits compared to the activity of the probiotics or probiotics alone (**Newman and Arshad, 2020**).

The synbiotic mixture can enhance the assimilation and utilization of nutrients, enzymatic activities, as well as hematological and biochemical parameters (**Hoseinifar *et al*., 2017**). Also prebiotics can protect against infectious pathogens (**Ringø and Song, 2016**). Studies have revealed that the synbiotic mixture improves fish growth performance and survival rate by enhancing the activities of digestive enzymes, antioxidant status, and immunity (**Nekoubin *et al*., 2012; Dehaghani *et al*., 2015**). Antioxidants regulate levels of free radicals, prevent cell damage, and are a health indicator (**Devi *et al*., 2019**). The innate immune system is composed of many distinct and interrelated immune components. It shows the effect of nutritional treatments on the immune status of fish **(Nawaz *et al*., 2018**). Supplementation can elevate non-specific immune mechanisms and enhance performance and disease resistance in fish (**El Basuini *et al*., 2020**). Fermented plant foods are gaining widespread attention worldwide as health foods due to their unique sensory properties and health-promoting potential, many fermented foods are a rich source of nutrients, phytochemicals, bioactive compounds, and probiotics (**Shahbazi *et al*.,2021**).Functional food is characterized by high biological activities, such as anti-inflammatory and immunomodulatory functions, due to its high content of antioxidants and lactic acid-producing bacteria **(Siciliano *et al*., 2021**).Lactic acid bacteria contribute to maintaining a healthy gut microbiota composition and improving immunity **(Chizhayeva *et al*., 2022**).

Antioxidant compounds share many of the functional properties of fermented plant products by neutralizing free radicals, regulating antioxidant enzyme activities, reducing oxidative stress, improving inflammatory responses, and enhancing immune system functioning **(Mounir *et al*., 2022**). The aim of this study was to evaluate the effects of the prepared synbiotic mixture and compare it with the promoters and the commercial synbiotic mixture on growth and some blood parameters such as immune responses and liver enzymes in common carp by culturing them in the closed rotary culture system.

MATERIALS AND METHODS

1. Experiment aquarium

Four units of a recirculating aquaculture system were established, each unit containing four basins, the capacity of one basin is 30 liters. As each unit was linked to a special glass aquarium for filtration and placed in a stand of shelves divided into three sections, With backup power supply These are the basic needs of a Recirculating aquaculture system, which indicated (**Yamamoto, 2017)**.

2. Experiment fish

Small fish of common carp were brought from the ponds of the Aquaculture Unit of the College of Agriculture, University of Basrah, in Al-Hartha. Transported using 25-liter plastic bags containing water. Upon arrival to the laboratory, the fish were sterilized with saturated saline solution to get rid of pathogens. The fish were randomly placed in 30-liter plastic aquarium for the purpose of acclimatization for a period of 14 days. The experimental fish were fed a laboratory-made control diet. Experimental fish were distributed in 15 plastic aquariums, with an average initial weight of 11.15 ± 1 g, an average live mass of 55.94 ± 1.5 g, and an average length of 9.1 ± 1.5 cm for each aquarium. The fish were fed five experimental diets (5 treatments), with three replicates for each treatment and five fish for each replicate. Table 1 measured the rate of environmental factors for monitoring water quality. Feed was introduced gradually until it reached 3% of the weight of the fish, at the rate of two meals per day. The experiment lasted for 70 days, starting from 3/5/2022.

Table 1. Water characteristics average of the experiment aquarium in (R A S).

Temperature (C^0)	dissolved oxygen mg/l		NH3 mg/l		NO_2 µg/l		NO_3 µg/l		pH		Salinity (‰)	
	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	outlet	Inlet	Outlet	Inlet	outlet	Inlet
23.5	8.20	8.26	0.15	0.10	0.19	0.13	0.47	0.29	7.9	8.1	2.41	2.40

3. Diets experiment

- Preparation of the synbiotic mixture:

  Barley grains were purchased from the markets, cleaned of impurities, washed and dried well. After it is completely dry, it is ground with a well-made Chinese mill, and the barley flour is sifted with a very fine sieve to obtain 500 gm of barley flour, after which it is mixed well with 3.5 liters of distilled water according to the method **(Xiao *et al.*, 2020**), after which lactic acid bacteria are added. (*S. themophilus*, *L. bulgaricus*) manufactured by the Italian company SACCO, with a weight of 0.01 g to the mixture, it was incubated at 30 °C for 24 hours, after which the total bacterial number of the mixture was measured (6.03×10^{7} CFU /g) and the bacterial count of lactic acid(0.83×10^{7} CFU /g). 750 ml of the synbiotic mixture prepared for each kg of standard ration mixture prepared for the T5.

- Adding the Iraqi probiotic to the treatment T2 produced by Dr. Saad Abdul-Hussein, University of Baghdad/ College of Agriculture, contains *L. acidophilus*, *Bifidobacter*, *Bacillus subtilus*, *Saccharomyces cervisia* (1×10^{8} CFU/g).
- Adding the commercial probiotic Suntypo Bio-gulf to the treatment T3 made in China with distinction from the French Golf company containing (*B. subtilis* and fermentation metation) 5×10^{9} CFU/g.
- Adding the synbiotic mixture from the Biomin company to the Australian treatment T4 containing (*Enterococcuss* sp., *Bifidobacterium* sp., *Pediococcus* sp., *Lactobacillus* spp. and Fructo-oligosaccharides (inulin) 2×10^{11} CFU/kg.

After preparing the feed additives and adding them to the standard diet Table 2 for the purpose of preparing the feed provided to fish

Table (2) The components of the diet and the chemical analysis of the diet (%)

Feed material		T1	T2	T3	T4	T5
Fishmeal		30	30	30	30	30
Soybean meal		27	27	27	27	27
Yellow corn		13	13	13	13	13
Wheat		14	14	14	14	14
Barley		14	14	14	14	14
Oil		0.5	0.5	0.5	0.5	0.5
Vitamins and mineral		1	1	1	1	1
Salt		0.5	0.5	0.5	0.5	0.5
Total		100	100	100	100	100
Addition		0	0.1	0.1	0.1	0.1
Chemical analysis of experiment standard diet (%)						
Protein	Fat	Fiber	*Carbohydrates (NFE)	Ash	Humidity	*Gross energy Kcal/ 100 g
30.31	8.40	4.79	44.50	7.76	4.25	400.00

*NFE, nitrogen-free extract (100 − (protein + lipid + ash + fiber)) (**Wee. and Shu, 1989**).

*Gross energy (Kcal/g)= (4.56 * protein + 9.45 * fat + 4.1 * carbohydrate) (**A.O.A.C. , 2000**).

4. Studied Parameters

- Weight Gain (WG) (g)/ fish
  Final Weight (FW) (g)- Initial Weight (IW) (g)
- Specific Growth Rate (SGR) (%.g) **(Jobling and Koskela, 1996)**
  (LN Final Weight (FW) (g)- LN Initial Weight (IW) (g))/(number for days)
- Feed Conversion Rate (FCR) **(Utne, 1978)**
  (Weight Gain (g))/ (Food Intake (g)
- The condition factor (K)
  ((Weight)/ (body length) $^{\wedge 3}$)×100

5. Serum analyses

Collect 2 ml of fish blood for each treatment. Blood was drawn from the myocardium and the blood was placed in a 5 ml tube free of anticoagulant (EDTA). The serum was obtained after centrifugation 3000 Cycle/minute for 15 minutes, and the serum was placed in sterile tubes for biochemical analyzes. The serum analyzes included the following analyzes: Total protein, albumin, globulin, glucose and liver enzymes, including Aspartate aminotransferase, Alanine aminotransferase and alkaline phosphatase. Tests were conducted using several a special laboratory for each examination from the Mindray company and a device (BS-230 Mindray) of Chinese origin.

6. Statistical Analysis

The data were analyzed statistically using the **Statistical Analysis System-SAS (2012)** program to show the effect of adding some biological enhancers and the prepared synbiotic mixture, and the significant differences between the averages were compared using the Duncan test.

RESULTS

Results

1.1 Environmental factors

The results of the experimental water test showed **(Table 1)** the provision of optimal environmental conditions for the growth of common carp fish, including temperature, dissolved oxygen, ammonia, nitrate, nitrite, pH and salinity, which common carp fish need for growth and living.

1.2 Growth and Diet criteria

The results showed in **Fig. 1** for growth criteria, that there were significant differences ($P<0.05$) for the treatments of the prepared synbiotic mixture (T5), the Iraqi probiotic (T2) and the imported synbiotic mixture (T4) for each of the final weight and weight gain of the experimental treatments. If the treatment of the prepared synbiotic mixture (T5) was significantly superior ($P<0.05$) to the rest of the treatments, the values were (130.48,73.65), respectively. As the results showed, there was a significant ($P<0.05$) superiority of the treatments of each of the Iraqi probiotic (T2) and the imported synbiotic mixture (T4) over each of the commercial imported probiotic treatment (T3) and the control treatment (T1). While there were no significant differences between the treatment of the imported commercial probiotic and the control treatment. The survival rate was 100% in the experimental treatments.

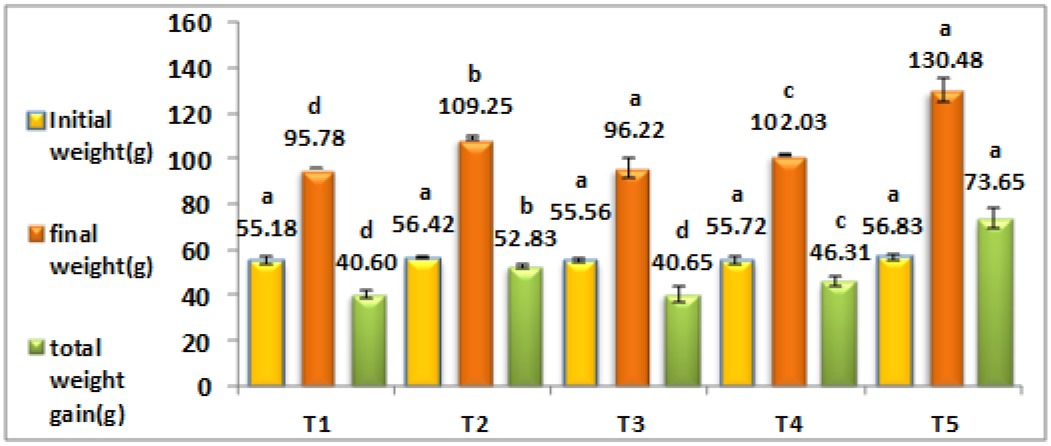

Fig. 1. The initial, final weight and the total weight gain of the experimental treatments for a period of 70 days (mean ± S.D). T1: control ration free of any additives; T2: Iraqi probiotic ration 0.1%; T3: commercial importer probiotic ration 0.1%; T4: commercial imported synbiotic ration0.1%; T5: prepared synbiotic ration 0.1%.

The results showed in **Fig. 2** the specific growth rate, that there were significant differences ($P<0.05$) between the treatments, as the treatment of the prepared synbiotic mixture (T5) excelled over the rest of the treatments and recorded 1.19 %.g/day. Then came the two treatments of the Iraqi biological probiotic (T2) and the treatment of the commercially imported synbiotic mixture (T4), while there were no significant differences between the two treatments of the imported commercial probiotic (T3) and the control (T1).

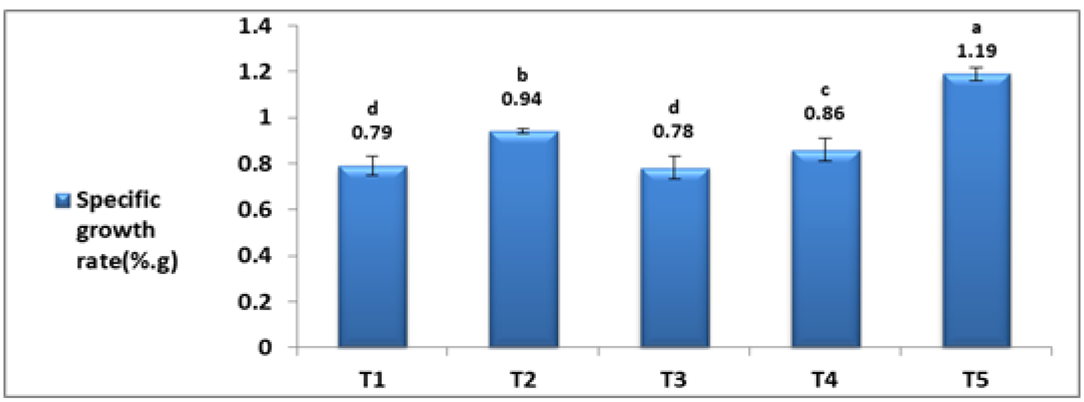

Fig. 2. The Specific growth rate of the experimental treatments for a period of 70 days (mean ± S.D). T1: control ration free of any additives; T2: Iraqi probiotic ration 0.1%; T3: commercial importer probiotic ration 0.1%; T4: commercial imported synbiotic ration0.1%; T5: prepared synbiotic ration 0.1%.

The results of **Fig. 3** showed that the condition factor indicated that there were significant differences ($P<0.05$) at the end of the experiment, in (T5) (1.69) outperformed the rest of the treatments, and there was no significant difference between it and (T2).

Then (T4), while there were no significant differences between the two treatments (T3) and the control treatment (T1).

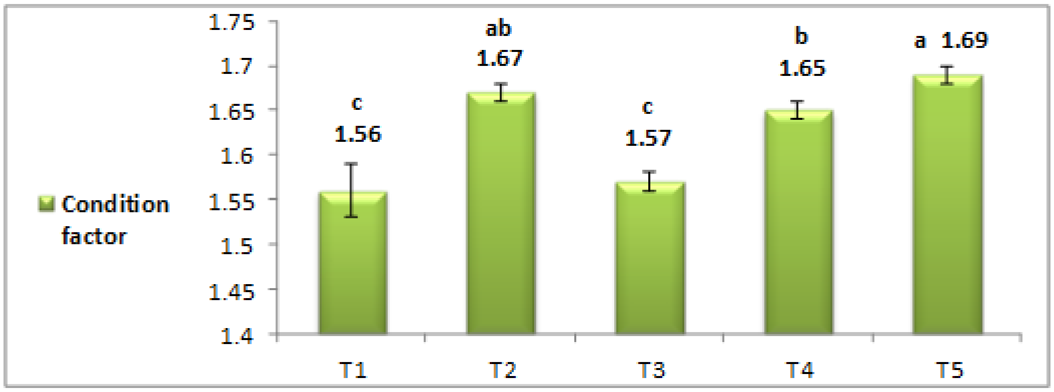

Fig. 3. The Condition factor of the experimental treatments for a period of 70 days (mean ± S.D). T1: control ration free of any additives; T2: Iraqi probiotic ration 0.1%; T3: commercial importer probiotic ration 0.1%; T4: commercial imported synbiotic ration0.1%; T5: prepared synbiotic ration 0.1%.

The results of **Fig. 4** showed an improvement in the feed conversion ratio of (T5), which amounted to 2.28 which better than the rest of the treatments. Then (T2), while the feed conversion ratio was close between treatments of (T4), (T3) and control (T1).

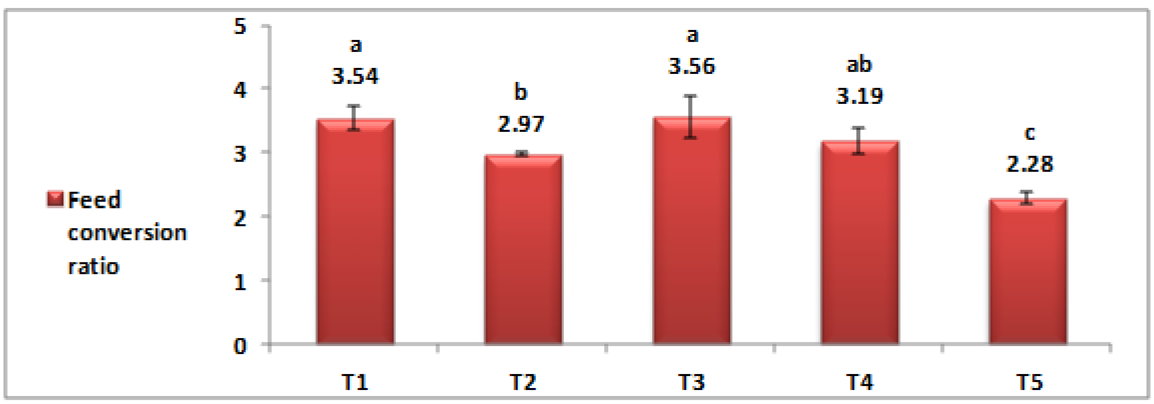

Fig. 4. The Feed conversion ratio of the experimental treatments for a period of 70 days (mean ± S.D). T1: control ration free of any additives; T2: Iraqi probiotic ration 0.1%; T3: commercial importer probiotic ration 0.1%; T4: commercial imported synbiotic ration0.1%; T5: prepared synbiotic ration 0.1%.

1.3 Blood criteria

The results showed in **Fig. 5** total protein, albumin, and globulin in the serum of fish, indicating that there differences between the treatments. The treatment of (T5) was significantly superior in terms of total protein, albumin and globulin, and recorded (4.14, 2.05, 2.09) g/dl respectively, Then came the two treatments of the (T2) and (T4) in total protein and albumin, while there were no significant differences between the two treatments of the (T3) and the control (T1), as well as there was no significant difference between the two treatments of the (T2) and (T4) in globulin.

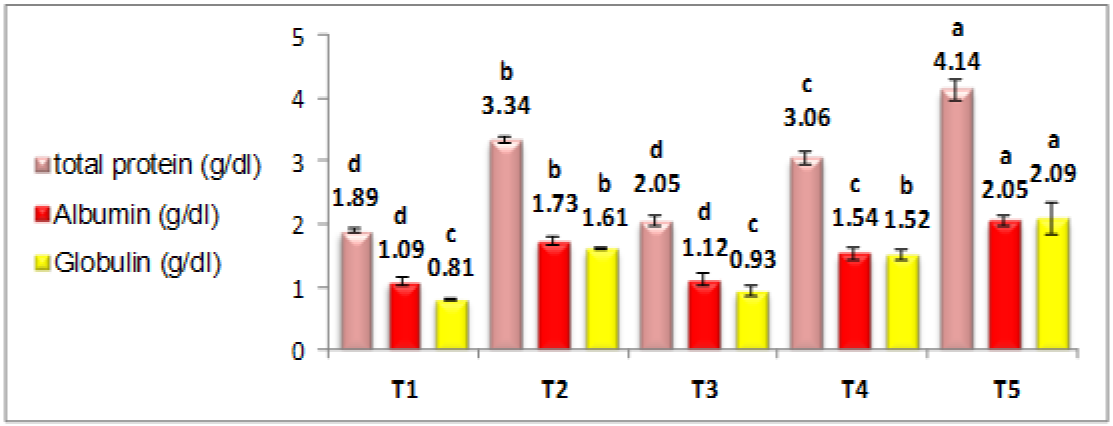

Fig. 5. The total protein, Albumin and Globulin in the serum of experimental treatments fish for a period of 70 days (mean ± S.D). T1: control ration free of any additives; T2: Iraqi probiotic ration 0.1%; T3: commercial importer probiotic ration 0.1%; T4: commercial imported synbiotic ration0.1%; T5: prepared synbiotic ration 0.1%.

The results of **Fig. 6** glucose in the blood serum of the treated fish indicated that there were significant differences ($P<0.05$) at the end of the experiment, as the treatment of the prepared synbiotic mixture (T5) (83.31 mg/dL) was significantly superior to the rest of the experimental treatments, and the rest of the treatments came after it (T2,T4,T3,and T1).

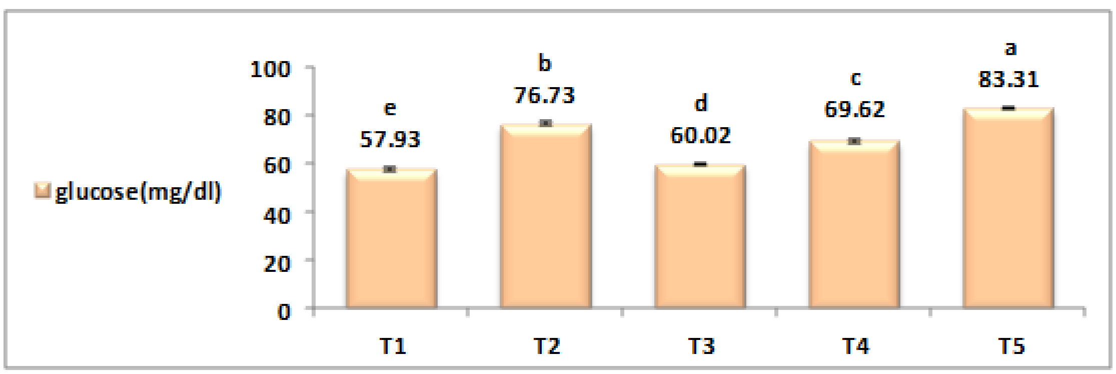

Fig. 6. The glucose in the serum of experimental treatments fish for a period of 70 days (mean ± S.D). T1: control ration free of any additives; T2: Iraqi probiotic ration 0.1%; T3: commercial importer probiotic ration 0.1%; T4: commercial imported synbiotic ration0.1%; T5: prepared synbiotic ration 0.1%.

The results of **Figs. 7, 8, 9** for the analysis of the liver enzymes (AST, ALP, ALT) for the experimental treatments showed an improvement in (T5) in the analysis of the liver enzymes as it was the lowest of the rest of the treatments, while it was the highest in the control treatment (T1) and the value of the treatment was recorded (T5) 97.61, 54.13, 4.74 IU/L respectively, Then came the Iraqi probiotic treatment (T2), the commercial imported synbiotic mixture (T4), the commercial imported probiotic (T3) and the control treatment (T1).

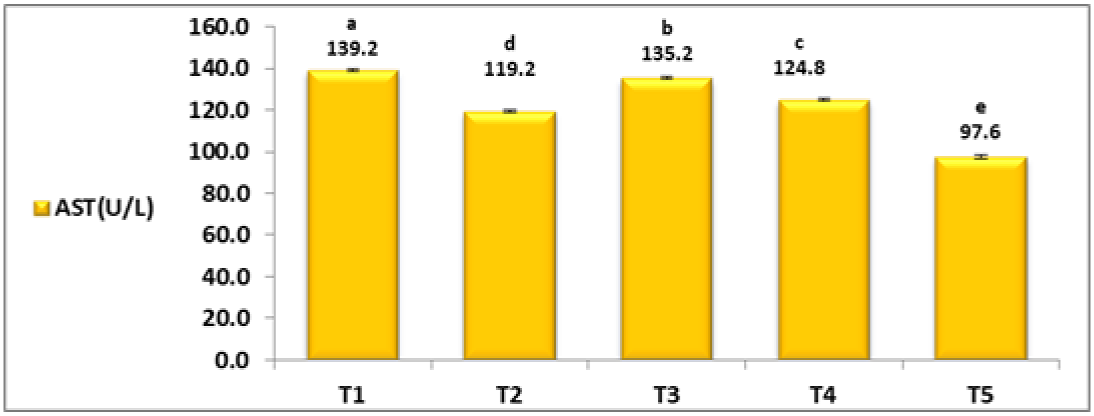

Fig. 7. The Amino Transferase Aspartate (AST) in the serum of experimental treatments fish for a period of 70 days (mean ± S.D). T1: control ration free of any additives; T2: Iraqi probiotic ration 0.1%; T3: commercial importer probiotic ration 0.1%; T4: commercial imported synbiotic ration0.1%; T5: prepared synbiotic ration 0.1%.

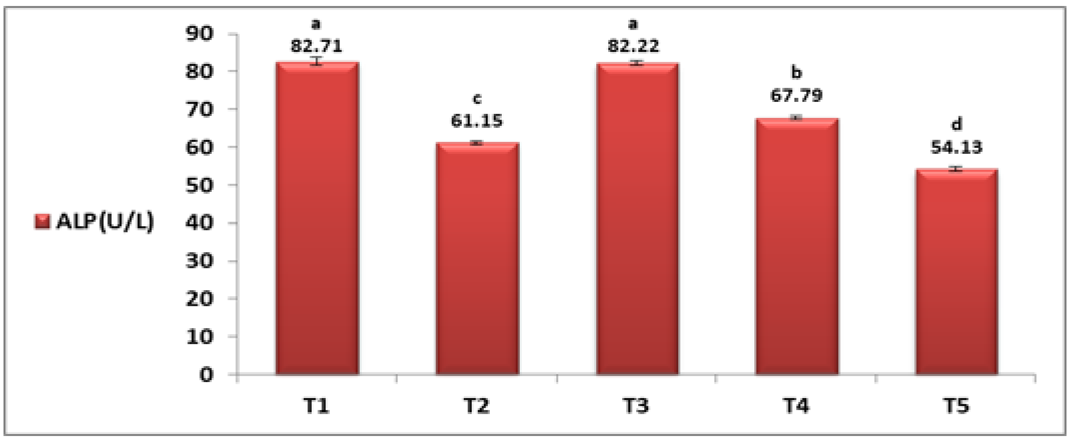

Fig. 8. The Alkaline phosphatase (ALP) in the serum of experimental treatments fish for a period of 70 days (mean ± S.D). T1: control ration free of any additives; T2: Iraqi probiotic ration 0.1%; T3: commercial importer probiotic ration 0.1%; T4: commercial imported synbiotic ration 0.1%; T5: prepared synbiotic ration 0.1%.

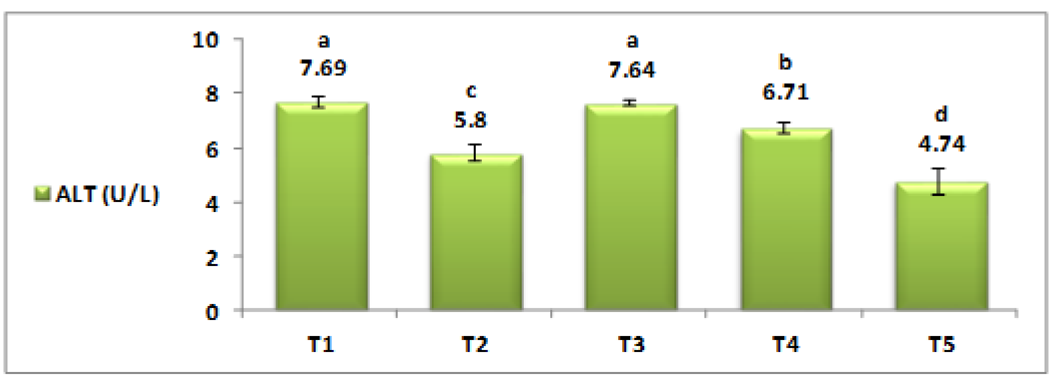

Fig. 9. The Alanine Amino Transferase (ALT) in the serum of experimental treatments fish for a period of 70 days (mean ± S.D). T1: control ration free of any additives; T2: Iraqi probiotic ration 0.1%; T3: commercial importer probiotic ration 0.1%; T4: commercial imported synbiotic ration0.1%; T5: prepared synbiotic ration 0.1%.

DISCUSSION

Fish are highly vulnerable to environmental changes because of their constant contact with the aquatic environment. Fish face fluctuations in environmental factors throughout their lives. Fish farming relies heavily on controlling environmental factors. Successful and sustainable breeding works to enhance the environment for fish farming to grow and live under ideal control conditions. Including some of the major environmental parameters that are critical in supporting physiological processes in fish under cultured conditions, these changes have wide-ranging effects on the general welfare status of fish, survival and resistance to disease **(Cabillon and Lazado, 2019).** The results showing the optimal environmental conditions for the growth of carp fish, and this indicates that the closed system and the biological filter work well, which are the appropriate environmental factors needed by common carp fish, which were explained by **(Rahman, 2015)** These results were also suitable for carp fish in the closed system, which are among them **(Mojer *et al*., 2021)**, which did not affect the feeding activity of fish. The aquaculture sector plays an increasingly important role in improving the sustainability of global fish production and the development of this sector. With the advent of new farming practices and the development of new technology, some natural nutritional supplements used as feed additives in aquaculture such as prebiotics and synbiotic mixtures are believed to be common nutritional supplements. It has the potential to improve the growth performance of fish **(Rohani *et al*., 2021)**. Synbiotic means is a combination of two Greek words "συν" and "βίος", which means "joint or together" and "life", it is a dietary supplement that includes both a probiotic and a prebiotic in a synbiotic relationship, help promote the growth and survival of microflora in the gastrointestinal tract of host species by altering the beneficial bacterial community in the gut **(Butt *et al*., 2021)**. The results of the final weight and the total weight gain showed that there were significant differences ($P<0.05$) between the treatment of the prepared Synbiotic mixture, the Iraqi probiotic treatments, the commercial imported probiotic, the Synbiotic mixture, and the control treatment for the final weight rates. So, the use of the method of fermentation with lactic acid bacteria and the composition of the Synbiotic mixture added to the diet at a rate of 0.1%, which contains 6.03×10^6 CFU/g of the total bacterial count, led to obtaining the highest final weight of 130.48 g and an increase in the total weight of 73.65 g. Then came each of the treatment of the Iraqi probiotic 109.25 g and the commercially imported Synbiotic mixture was 102.03 gm compared to the control treatment. While there were significant differences ($P < 0.05$) for the specific growth rate,as the treatment of the prepared Synbiotic mixture (T5) was significantly superior and recorded 1.19 g/day over the rest of the treatments, and there were significant differences ($P<0.05$) for the condition factor.

The treatment of the prepared Synbiotic mixture (T5) was significantly superior and recorded 1.69 compared to other treatments, so that the use of the Synbiotic mixture prepared from lactic acid bacteria led to an improvement in the condition factor of the fish, which indicates the health and physiological status of the fish. Many studies have shown the use of lactic acid bacteria as a probiotic, prebiotic, and Synbiotic mixture to positive effects for fish growth, including a study **(Eleraky and Reda, 2014)**. When adding the prebiotic (Mannan, Beta-glucans) at a rate of 0.15% and at a rate of 0.25%, and adding the prebiotic (Biogreen, which consists of 10^{10} CFU/g, at a rate of 0.05% and 0.1%), it led to an improvement in growth parameters, condition factor, and survival rates. As well as a study **Al-Dubakel *et al*. (2015)** when using 0.02% of the Iraqi probiotic in increasing the final weight, weight gain, and the specific and relative growth rate. The study **(Ali and Amal, 2016)** showed that the use of each of the probiotic The Chinese, Iraqi and Korean fish in the diet of common carp cultured in the Recirculating aquaculture system showed a significant increase in growth parameters when using the Chinese and Iraqi probiotic by 0.2%.

A study **Taher *et al*. (2018)** demonstrated the effect of the prebiotic extracted from *Laurus nobilis* leaves at three concentrations (1, 2, 3) % on the growth, feed conversion and survival of cultured common carp, as it gave a weight gain of 7.63 g and a specific growth rate. 0.975% /day due to the use of 2% of the extracted prebiotic. study of **Akter *et al*. (2019)** when using lactic acid bacteria *L*. *acidophilus* 10^5 and 7^{10} CFU/g as a probiotic in the diet of catfish (*Pangasianodon hypophthalmus*) confirmed an increase in growth parameters when the two concentrations of lactic acid bacteria were used.

As it worked as a catalyst for fish growth, as well as a study of **Hoseinifar *et al*. (2019)** when using the bacterium Pediococcus acidilactici as a probiotic and a prebiotic and mixing them as a synbiotic mixture and adding them to the diets of carp fish led to a significant improvement in the final weight, weight gain and daily growth rate The treatment of the Synbiotic mixture was higher than the use of the probiotic and the prebiotic alone, while the effect of the use of the prebiotic thepax and the synbiotic mixture labazyme on young carp fish, and these food additives had a significant effect on weight gain and specific growth rate, The best results were when adding 1 g/kg of the prebiotic feed thepax to enhance the growth of fish (**Al-Mhanawi *et al*., 2021)**, and the study of **Sutriana *et al*. (2021)** showed when the prebiotic were added individually or in combination with yeast and galacto oligosaccharide, mannan oligosaccharide and β-glucan on the growth performance of catfish. The treatment of 1% GOS and the treatment 1% yeast + 0.1% β-glucan. The use of these treatments led to an improvement in growth performance as the weight gain was 31.57 and 30.90 g. A specific growth rate 1.30 % /day for both treatments, a feed conversion rate 1.44, 1.42 and a survival rate of 100%. Also, when using lactic acid bacteria *Lactococcus* spp. 5×10^8 CFU/gm in the diet of common carp fish, it led to an increase in growth parameters such as final weight, total weight gain, specific growth rate, and condition coefficient **(Feng *et al*., 2022)**. The prebiotic, and the mixture work Synbiots as growth stimuli for fish **(Kazuń and Kazuń, 2019; Mugwanya *et al*., 2021; Huynh *et al*., 2021)**. The results of the diet evaluation criteria showed an improvement in the rate of feed conversion for the treatment of the prepared synbiotic mixture (T5) over the rest of the treatments, followed by two treatments of the Iraqi prebiotic (T2) and the treatment of the imported commercial mixture (T4), The addition of the prepared synbiotic mixture led to an increase in the amount of feed intake and its palatability by the experimental fish and an improvement in the feed conversion ratio. This indicates an improvement in diet digestion and utilization of nutrients significantly, which led to an increase in fish growth standards. Several studies showed an improvement in the parameters of the diet eaten by fish, including the study of **Skrede, (2002)** of the effect of fermentation of lactic acid bacteria *Lactobacillus* and its growth on wheat flour and barley in diets of Atlantic salmon. Bacteria were added to the funnel flour and barley, and they were fermented at a temperature of 30 °C for 16 hours before mixing with the components of the diet. This process led to an improvement in the digestion of the diet.

Through lower total starch contents and polysaccharide affinities and improved protein, carbohydrate and fat digestibility in fermented diets with Synbiotic mixture compared to non-fermented diets, also, another study showed the effect of fermentation and the formation of a Synbiotic mixture on the effect of fermentation of white soybean meal with lactic acid bacteria Lactobacillus brevis 10^9 CFU/g at a temperature of 30 °C for 36 hours before mixing with the feed ingredients and forming the diet added to the white soybean meal when fed. On Atlantic salmon (*Salmo salar*), an improvement in the digestion of the diet led to the elimination of sucrose and a decrease in the level of raffinose. and reduced trypsin inhibitor activity and increased fat digestibility and energy when fed on fermented synbiotic mix diets **(Refstie, 2005)**.

Several studies have shown an improvement in the criteria for evaluating the diet, which is represented by the ratio of the feed conversion factor ingested when using prebiotics, and synbiotic mixtures to improve the nutritional value of the feed intake and provided to fish **(Eleraky and Reda, 2014; Al-Dubakel *et al*., 2015; Taher *et al*., 2018; Akter *et al*., 2019; Hoseinifar *et al*., 2019; Al-Mhanawi *et al*., 2021; Sutriana *et al*., 2021; Feng *et al*., 2022)**. The addition of the synbiotic mixture prepared in common carp fish diets led to its significant ($P<0.05$) superiority in total protein, albumin, globulin, and glucose over the rest of the treatments, and an increase was recorded for each of total protein, albumin, globulin, and glucose in the fish serum. And it outperformed the rest of the treatments, and the values in each of the total protein, albumin and globulin were (4.14, 2.05, 2.09) g/dL, respectively and glucose and 83.31 mg/dL. The level of glucose in the blood serum of fish varies not only between fish species, but even within one species in different stages of life or under certain nutritional systems, glucose plays a major role in muscle metabolism and increased glucose utilization during peak muscle activity (**Hemre *et al*., 2002)**.

This indicates an improvement in the body of the fish fed on the synbiotic mixture prepared by increasing the immune response, improving the health of the fish and increasing growth due to the availability of amino acids after the addition of the fermented synbiotic mixture to the diet and the decrease in anti-nutritional factors, including phytic acid. Which indicates an increase in the process of protein synthesis and a decrease in the process of protein catabolism in the body (**Macfarlane, 2012)**. A study of **Valiallahi *et al*. (2018)** showed that when adding lactic acid bacteria Lactobacillus plantarum at three concentrations (1.5, 3, 4.5) × 10^6 CFU/mg, it increased total protein, albumin, and globulin, with a decrease in blood glucose concentration. The use of a synbiotic mixture of fructoligosaccharides, *Bifidobacterium animalis*, *Lactobacillus* ssp., and *Lactococcus lactis* at a rate of 2% in carp fish diets leads to an increase in total protein, albumin, and globulin and there are no significant differences in the level of glucose in the fish serum (**Zapryanova *et al*., 2021)**. A study of **Ajdari *et al*. (2022)** when using the synbiotic mixture from Biomin Imbo consisting of fructooligosaccharide and *Entercoccus faecium* at a rate of 0.1% added to an increase in total protein, albumin and globulin, a decrease in glucose level and an improvement in fish health compared to the booster (PrimaLac) and the previous (inulin) biosynthesis and control treatment. The results of figures (7, 8, 9) for using the prepared synbiotic mixture showed a decrease in the level of liver enzymes in common carp fish, and they include AST, ALP and ALT enzymes (97.61, 54.13, 4.74) IU/liter on respectively compared with the other treatments, after which came the treatment of the Iraqi probiotic, the imported commercial synbiotic mixture, the imported commercial biological probiotic, and the control treatment. A study of **Al-Niaeem *et al*. (2019)** showed a decrease in liver enzymes when using the Biogen probiotic consisting of *Bacillus subtilis* 6×10^7 cfu/g in common carp diets. Liver enzymes are among the indicators for evaluating the condition of the liver. A higher than normal liver enzyme value indicates damage to liver cells **(Abdel-Daim *et al*., 2020)**. Studies show improved enzymes in liver enzymes when using a synbiotic mixture of fructoligosaccharide, *Bifidobacterium animalis, Lactobacillus* ssp., *Bifidobacterium*, *Lactococcus lactis* by 2% and *Entercoccus faecium* at a rate of 0.1% added in common carp diets and feeding, an effect on liver enzymes **(Zapryanova *et al*., 2021; Ajdari *et al*. 2022)**.

CONCLUSION

The use of the synbiotic mixture consisting of lactic acid bacteria *Streptococcus themophilus*, *Lactococcus bulgaricus* and barley flour added to the fish diet led to stimulation and improvement of growth by improving the nutritional value of the diet and improving the health status of the fish by increasing the immune response. And improvement in liver enzymes in experimental fish.

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