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Effect of Arabic Gum and technomus as a prebiotic in some blood parameters of *Cyprinus carpio* L.

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Abstract

This study was conducted at the first agricultural research and experiment station, Agriculture college, Al-Muthanna university, for 85 days, including the localization period (for the period from 25/9/2022 to 20/12/2022), to determine the effect of adding Arabic Gum and technomus as a prebiotic on growth triats. 162 common carp were used, with an average weight of 75±5 gm per fish, in 27 small tanks (baskets) of 0.107 cubic meters, they were randomly distributed to nine treatments with three replicates (6 fish for each replicate), were as followed: T1: (control treatment; without adding). T2: add 0% technomus with 0.5% Arabic Gum to the diet. T3: add 0% technomus with 1.0% Arabic Gum to the diet. T4: add 0.5% technomus with 0% Arabic Gum to the diet. T5: add 0.5% technomus with 0.5% Arabic Gum to the diet. T6: add 0.5% technomus with 1.0% Arabic Gum to the diet. T7: add 1.0% technomus with 0% Arabic Gum to the diet. T8: add 1.0% technomus with 0.5% Arabic Gum to the diet. T9: add 1.0% technomus with 1.0% Arabic Gum to the diet. The results of examining RBC and WBC showed that T7 and T8 were significantly (P≤0.05) superior, T1 and T3 were significantly decreased (P≤0.05) compared with other treatments. significantly (P≤0.05) superior in T6, T7 and T8 on hematocrit (PCV) and hemoglobin (Hb) compare with others. A significant (P≤0.05) superiority for all treatments compare with T6 on albumin, while T3 decreased on glucose concentration compare others. As for globulin, all treatments showed significant superiority over T2.

Keywords: Arabic Gum, technomus, prebiotic, blood parameters,, common carp *Cyprinus carpio* L.

Introduction

Fisheries is one of the main pillars, plays a crucial role in global nutrition and food security.It is an important source for a diversified and healthy diet (FAO, 2018). The source of livelihood for the families in Southeast Asian countries (Gichuru *et al.*, 2019). Fisheries projects are also characterized by relatively good financial resources and fast capital turnover (Abdullah *et al.*, 2020). Fish farming has been of great economic importance in most countries of the world since ancient times because of its great economic and

social returns, as fish farming has become very important in providing healthy food to the consumer, especially in countries that have fresh water like Iraq (Mishra, 2020). Aquaculture accounts for about 48% of the world's total fish production and is about 87.5 million tonnes (FAO, 2022).

Fish is one of the most important sources of protein for human consumption, represents about 20% of the average per capita share of animal protein in the world. Fish meat provides 24% of human animal protein imports, while animal meat provides the remaining 40% only (Alagawany *et al*., 2021).

Antibiotics have been used as effective treatments to prevent disease outbreaks in aquatic animals (Reverter, 2020). Excessive use of antibiotics has become a traditional aquaculture practice in aquaculture health management, overuse of antibiotics increases the incidence of antibiotic resistance, by pathogenic bacteria in aquaculture sites and leakage into the food chain (Kari *et al*., 2022).

As antibiotics have been replaced with environmentally friendly additives, including antecedents, probiotics, and immunostimulants (Soliman *et al*., 2019). Feed additives are a very important tool in fish production that can be used to increase production efficiency by reducing waste and the need for treatments (Goncalves and Santos, 2017). Diet additives represent different types of compounds, molecules, or organisms that stimulate food intake and absorption (Watts *et al*., 2020).

Using a prebiotic as a nutritional supplement is one way, to overcome the misuse of antibiotics in aquaculture health management (Kari *et al*., 2021). They are indigestible food components that stimulate the growth of bacterial species that live in the digestive tract (Abdel-Latif *et al*., 2022). The widespread use of precursors in aquaculture has promoted growth, it also improves gut health (Rohani et al., 2022), boosts immune response (Selim and Reda, 2015), and disease resistance (Li *et al*., 2019).

The current study aims to evaluate the use of some important food additives, such as Mannan-oligosaccharide (MOS) and Arabic gum, as biological precedents to fish diets used, for feeding common carp (*Cyprinus carpio* L.) in pond culture, on some blood parameters of carp fish.

Materials and Methods

The fingerlings of common carp used in the experiment were brought from Babylon, Al-Mahaweel district, Al-Imam district, Al-Hajj Muhammad Abboud farm. Non-stressed fish of similar weight were selected. The fish were sterilized in a saline bath of 3% sodium chloride solution

for five minutes, which is the necessary period for the appearance of signs of stress on them for the purpose of purifying them from external parasites. The fish were weighed on the basis of live mass to the nearest 0.01 gm using an electronic balance after placing them in a container containing an amount of water. Fish were distributed among cages, 6 fish per cage, and three cages were allocated for each treatment, the number of fish used in the experiment was 162 fish, kept another number of fish in a storage recipe to compensate for the losses that might occur during the period of acclimatization or before the start of the experiment. The experiment lasted for 85 days. The experimental treatments were as follows:

T1: (control treatment; without adding).

T2: add 0% technomus with 0.5% Arabic Gum to the diet.

T3: add 0% technomus with 1.0% Arabic Gum to the diet.

T4: add 0.5% technomus with 0% Arabic Gum to the diet.

T5: add 0.5% technomus with 0.5% Arabic Gum to the diet.

T6: add 0.5% technomus with 1.0% Arabic Gum to the diet.

T7: add 1.0% technomus with 0% Arabic Gum to the diet.

T8: add 1.0% technomus with 0.5% Arabic Gum to the diet.

T9: add 1.0% technomus with 1.0% Arabic Gum to the diet.

Its components are shown in Table No. (1 and 2).

Table 1. The diets used in the experiment and according to the experimental parameters.

Items	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**
Soybean meal	40	40	40	40	40	40	40	40	40
Protein concentrate	20	20	20	20	20	20	20	20	20
Maize	15	15	15	15	15	15	15	15	15
Wheat bran	15	15	15	15	15	15	15	15	15
Barley	5	5	5	5	5	5	5	5	5
Wheat	3	3	3	3	3	3	3	3	3
Premix	1	1	1	1	1	1	1	1	1
Oil	1	1	1	1	1	1	1	1	1

Technomus	0	0	0	0.5	0.5	0.5	1.0	1.0	1.0
Arabic Gum	0	0.5	1.0	0	0.5	1.0	0	0.5	1.0
Total	100	100.5	101	100.5	101	101.5	101	101.5	102

Soybean meal type (EAGLE) of Argentine origin, maize (EAGLE) of Argentine origin. Protein Center (WAFI) of Dutch origin, the Arabic gum is of Sudanese origin. TechnoMos manufactured by Biochem

Table 2. Chemical analysis of materials included in the formation of experimental diets

Items	**Protein (%)**	**Ether extract (%)**	**Ash (%)**	**Fiber (%)**	**Carbohydrate (%)**
Wheat*	10.5	1.5	0.44	0.5	76.0
Wheat bran**	15.72	4.47	5.52	11.8	62.49
Barley**	11.83	1.53	4.11	7.0	75.81
Maize**	9.68	5.04	2.09	2.72	80.27
Soybean meal**	43.8	2.72	7.21	6.9	39.37
Protein concentrate*	40	5	23.45	2.81	28.74

* According to the card installed on the product by the producing company, ** As stated in NRC (1994)

Studied traits: White Blood Cell (WBC), Red Blood Cell (RBC), Haemoglobin (Hb), Packed Cell Volume (PCV), Globulin, Glucose and Albumin.

Results and Discussion:

Table (3) shows that the highest value on WBC in T8 (155.06 cells × 10/ml), it showed a significant ($P \leq 0.05$) superiority compare other treatments, then followed by T6 and T9 were 144.90 and 142.20 cells × 10^3/ml, respectively, while T7 recorded 138.50 cells × 10^3/ml and T4 (130.90 cells × 10^3/ml), outperformed, compare with T5 (126.80 cells × 10^3/ml), and T2 (122.30 cells × 10^3/ml). No significant differences were recorded between T1 and T3, which recorded 104.90 and 104.86 cells × 10/ml, respectively.

There was a significant superiority ($P \leq 0.05$), the highest value of RBC was recorded for T7 (1.40 cells × 10^6/ml), which surpassed compare with other treatments. The lowest value was T9 (0.94 cells × 10^6/ml), while no significant

differences were recorded among T6 (1.24 cells × 10^6/ml), T2 (1.23 cells × 10^6/ml), T5 (1.17 cells × 10^6/ml), T1 (1.15 cells × 10^6/ml), T3 (1.13 cells × 10^6/ml), T6 (1.12 cells × 10^6/ml) and T4 (1.10 cells × 10^6/ml), respectively.

There was a significant ($P \leq 0.05$) effect on Haemoglobin (Hb), T8 had a value of 28.60 gm/ 100 ml, was excelled. T7 (27.80 gm / 100 ml) was converged with T2 (27.50 gm / 100 ml), then followed by the convergence of T5 (26.83 gm / 100 ml), T6 (26.20 gm / 100 ml), significantly superior to the rest of the treatments, while no significant differences were recorded between T3 (24.90 gm / 100 ml) and T1 (27.50 gm/100 ml), the lowest value of hemoglobin concentration was recorded in T9, which was 18.83 gm/100 ml.

The results showed a significant effect on Packed Cell Volume (PCV), T6, T7 and T8 were significantly superior ($P \leq 0.05$) compare with other treatments, there was a convergence in the recorded values of 11.70, 11.50 and 11.33%, respectively, which was significantly close in value to T2 (11.10%), while no significant differences were recorded among T4 (11.00%), T1 (10.83%), T5 (10.80%) and T9 (10.63%), sequentially. T3 was record lowest value, which amounted to 9.63%.

Table (3) The effect of Arabic Gum and technomus as a prebiotic on the concentration of WBC, RBC, Hb and PCV in the blood serum of common carp *Cyprinus carpio* L. (mean ± standard error).

Treatments	**WBC (cells × 10^3/ml)**	**RBC (cells × 10^6/ml)**	**Hb (gm / 100 ml)**	**PCV (%)**
T1	3.63±104.86 e	0.05±1.15 b	1.18±24.63 ab	0.14±10.83 abc
T2	6.75±122.30 d	6.75±1.23 b	2.77±27.50 a	0.92±11.10 ab
T3	3.17±104.90 e	0.00±1.13 b	0.86±24.90 ab	0.14±9.63 c
T4	3.81±130.90 bcd	0.01±1.10 b	0.95±24.53 ab	0.28±11.00 abc
T5	1.67±126.80 cd	0.02±1.17 b	1.93±26.83 a	0.17±10.80 abc
T6	1.84±144.90	0.01±1.24	0.23±26.20	0.14±11.33

	ab	b	a	a
T7	7.85±138.50 bc	0.05±1.40 a	1.32±27.80 a	0.40±11.50 a
T8	6.54±155.06 a	0.07±1.12 b	2.71±28.60 a	0.11±11.70 a
T9	6.06±142.20 abc	0.04±0.94 c	1.41±18.83 c	0.83±10.63 abc

Blood tests provide essential information on the physiological aspects of assessing an animal's well-being, including neuroendocrine activity, the immune system and acute and long-term effects due to poor culture conditions, possible diseases, and genetic predisposition of fish, these responses can be identified as changes in the concentration of essential substances in the plasma, or in the concentration of hormones or a change in the size and numbers of blood cells (Seibel *et al*., 2021).

Prebiotic biofilmized food additives on fish diets are among the technologies, which have a role in improving the growth rates, productive and physiological characteristics of the final product as well as the health status, that the physiological characteristics of the living organism express the internal state of the body, it was one of the scientific criteria that reflects positively or negatively on growth indicators in fish, widely used in practice, to evaluate the quality of feed ingredients because they represent the end result upon which production depends (Gharaei *et al*., 2016).

The results of the current study showed that there were significant differences at the level of probability ($P \leq 0.05$) for all blood tests between fish at the beginning of the experiment, which recorded hemoglobin Hb (20.30 gm/ 100 ml), WBC (118.63 cells x 10/mL), RBC (0.84 cells × 10/ml), PCV (9.80%). After the experiment, it showed a wide range of physiological variation in the response to the biological antecedents (technomus MOS and Arabic Gum AG) compared to T1 (control), fed on a diet free of additives. Among the tests was the WBC, which plays the defensive role of the body against pathogens of all kinds, WBC were also made within the bone marrow and stored in the blood and lymphoid tissues, it also fights cancer cells (Witeska *et al*., 2022).

We notice by our results that all treatments outperformed the control treatment, these expresses the well-being and health status of the fish, the reason for this increase is due to the effect of the

prebiotic on the immune stimulation of fish. Modulating the immune system is one of the commonly proposed benefits of a prebiotic and its ability to induce systemic and autoimmunity in laboratory and commercial conditions. Various prebiotic supplements can eventually raise red blood cell and phagocytic cell rates (Gelibolu *et al*., 2018). The results of the current study agreed with those of Akrami *et al*. (2012) when goldfish *Carassius auratus gibelio* were fed 1, 2, and 3 g/kg of prebiotic MOS, it had a significant superiority ($P \leq 0.05$) by increasing blood parameters compared with the control treatment. The current results regarding white blood cells did not agree with the results of the study of Ding *et al*. (2017) when feeding yellow croaker fish on a diet containing 1, 2.5 and 4 g / kg feed. MOS did not show significant fluctuations in leukocytes compared with control treatment. The results of the current study agreed with the study of Yousefi *et al*. (2023). The addition of Arabic Gum to the diet of common carp fish led to a significant superiority in blood parameters. It also agreed with the results of Naiel *et al*. (2022) when feeding tilapia fish on a diet containing the prebiotic (Arabic Gum) by 0.25, 0.5 and 1%, significant superiority of blood parameters and immune response.

The results of the statistical analysis showed that there was a significant ($P \leq 0.05$) superiority of the experimental treatments over the control treatment. The results of the current study agree with the study of Akrami *et al*. (2012). Significant differences were recorded in the volume of packed blood cells (PCV) and hemoglobin (HCT), when feeding common carp fish on a diet supplemented with the prebiotic in proportions of 1, 2 and 3 gm/ kg, compared with the control treatment. The results of the study did not agree with what was reported by Gelibolu *et al*. (2018) when feeding golden-headed shank *Sparus aurata*, by adding different concentrations of the prebiotic 1, 2, 3 and 4 gm / kg feed, did not record any significant differences.

Table (4) shows that there was a significant effect ($P \leq 0.05$) on globulin concentration. T3, T4, T5 and T7, which recorded values of 2.50, 2.46, 2.43 and 2.35 mg/100 ml, respectively, outperformed the rest of the treatments, while no significant difference was recorded among T6 (2.00 mg / 100 ml), T8 (2.23 mg / 100 ml), T9 (2.25 mg/100 ml) compared to the control treatment (2.30 mg/100 ml). The lowest value in T2 (1.70 mg/100 ml).

There was a significant effect ($P \leq 0.05$) on glucose concentration, T2 was significantly superior ($P \leq 0.05$) compare to other

treatments, which recorded a value of 91.50 mg / 100 ml. The lowest value in T3 (57.00 mg/100 ml), while there were no significant differences among T5 (77.50 mg/100 ml), T7 (77.00 mg/100 ml), T6 (69.00 mg/100 ml), T4 (63.00 mg/100 ml), T9 (61.00 mg/100 ml) and T8 (60.33 mg/100 ml), respectively, compared with T1 (control), which recorded 70.50 mg/100 ml.

There was a significant ($P \leq 0.05$) effect on albumin concentration, the results showed the superiority of T2, T3, T4, T7, T8 and T9, which reached values of 1.15, 1.20, 1.16, 1.15, 1.16, and 1.15 mg/100 ml, respectively, compare to T1 (1.05 mg/100 ml) and T5 (1.10 mg/100 ml), which did not record a significant difference between them, while T6 recorded the lowest significant difference, which amounted to 0.95 mg/100 ml.

Table (4) The effect of Arabic Gum and technomus as a prebiotic on the concentration of globulin, RBC, Hb and PCV in the blood serum of common carp *Cyprinus carpio* L. (mean ± standard error).

Treatments	Globulin (mg/100 ml)	Glucose (mg/100 ml)	Albumin (mg / 100 ml)
T1	2.30±0.34 ab	70.50±0.86 bc	1.05±0.02 ab
T2	1.70±0.05 b	91.50±1.44 a	1.15±0.02 a
T3	2.46±0.18 a	57.00±8.14 c	1.20±0.05 a
T4	2.43±0.08 a	63.00±3.21 bc	1.16±0.03 a
T5	2.35±0.14 a	77.50±2.02 ab	1.10±0.05 ab
T6	2.00±0.05 ab	69.00±5.19 bc	0.95±0.02 b
T7	2.50±0.05 a	77.00±7.50 ab	1.15±0.08 a
T8	2.23±0.21	60.33±9.87	1.16±0.03

	ab	bc	a
T9	2.25±0.27 ab	61.00±5.19 bc	1.15±0.08 a

The liver is the main source of formation and secretion of more than 90% of serum proteins, which includes globulin and albumin and any defect in liver function or deficiency in the food consumed can lead to a change in the concentration of protein, it is important in the alkaline and acid balance and in maintaining the osmotic pressure of the blood, it also affects the solubility of carbohydrates, fats and other substances in plasma, transports some substances such as hormones, calcium and phosphorus, with the exception of gamma-clobulin, the measurement of globulin and albumin is one of the tests that indicates the ability of the liver to manufacture protein substances (Watts *et al*., 2008). Therefore, globulin and albumin are the major proteins that play an important role in immune responses, which means that its elevation in blood serum is an indicator of health and resistance to stress and disease (Bunglavan *et al*., 2014).

The positive results of the current study showed the superiority of the treatments with a biological precedent over the control treatment, the results of the current study agreed with the results of Gelibolu *et al*. (2018) study when adding MOS at concentrations of 1, 2, 3 and 4% to fish diets. As the glucose concentration of the prebiotic treatments did not differ significantly with the control treatment. It also agreed with the results of the study of Yousefi *et al*. (2023) when adding Arabic Gum to common carp diets, led to an improvement in globulin in the experimental treatments compared with the control treatment. The results of the current study also agreed with the results of Naiel *et al*. (2022), when feeding Nile tilapia *Oreochromis niloticus* on a diet to which the prebiotic Arabic Gum was added at rates of 0.25, 0.5, and 1%, the results showed high levels of globulin and albumin in the prebiotics treatments, compared with the control treatment.

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