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ADDING DIFFERENT LEVELS OF DRY ARTEMIA AND FROZEN ARTEMIA SUBSTITUTE FISH MEAL AND EFFECT OF PROTEIN STANDARDS AND PHYSIOLOGICAL TRAITS FOR COMMON CARP *CYPRINUS CARPIO*

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Abstract:
This study was conducted in the fish laboratory, Department of animal production, Dept of Agriculture, University of Baghdad from 23/10/2021 till 20/01/2022 to the purpose of adding different ratios of dried and frozen brine shrimp instead of fish powder with concentration level of 25%, 50%, 75% and 100% for both dry and frozen brine shrimp to be used as food for Common carp (Cyprinus Carpio L), to study its growth. In this study 18 glass tanks were used with the dimensions of 60X40X30cm with the capacity of 72 litre. I planted 126 fish with weights varying from 2 to ±14 gr as median weight for individual fish over nine experiments. In each experiment 7 fish were used in each tank, repeated over for each experiment. The fish was feed until they were satisfied and being weighed every 14 days. 9 food batches were created in the laboratory, with the diameter of 4mm, protein level varied between 32.19% and 35.76% of each batch, whilst the calories varied between 2758.6 to 3491.8. Dry brine shrimp was added for the first, second, third and fourth productions with the percentage of 25%, 50%, 75% and 100% consecutively, whilst wet/frozen brine shrimp was added to the fifth, sixth, seventh and eighth productions with percentage of 25%, 50%, 75% and 100% consecutively. I studied in this research the amount of fodder that was consumed, the efficiency of digestion, digestion median, the amount of protein consumed, the efficiency of the consumption of the protein, the percentage of efficiency of the fodder, the digested remains of the fodder in terms of (protein, carbohydrates, fats, fibers, amount of protein disposed, amount of protein utilised), stool digestion time, testing body parts, testing the blood whilst looking at white blood cells, Hemoglobin, Hematocrit, blood protein, testing Triglyceride, Cholesterol, Low-density lipoprotein, High-density lipoprotein. The amount of fodder consumed during experiment number 7 was far more superior than the other experiments as the amount of fodder consumed was between 0.83gr ± 65.57gr per fish, after that experiment number 6 with an average of 1.94 ± 62.92gr per fish, followed by experiment number two 0.15 ± 60.54 per fish.The Efficiency of food conversion was superior in the experiment number seven, and it was by far the best out of all experiments as digestion median was 0.49±64.98%, followed by experiment number two with an average of 0.38 ±62.48%, then experiment number six 1.70±58.78%. The average of Efficiency of food conversion was best in experiment number seven as it reached 0.05±1.19%, followed experiment number six, 0.05±153% followed by experiment number two as it reached 1.60±1.60%. The amount of protein consumed was during experiment number seven 0.49±21.49gr, the efficiency of the protein 0.14±1.96% whilst the value of the produced protein 4.67±158.11%. The visual aspect of the digestion was superior in the third

experiment which reached 0.360±88.82%. Experiment number two was very successful in terms of protein filtration over the other experiments, where it reached 0.06±2.65% followed by the seventh experiment where it reached 0.07± 1.92%. Apparent protein precipitation was best in experiment number 2 which reached 0.13±10.55% followed by experiment number 1 which reached 0.10±12.25% followed by experiment number 7 with an average of 0.08±16.06. Time it took for stool to come out was the last in experiment number 7 as it was 4.63±8.36 hours, the level of blood cells was 25.8 and Hematocrit 29.2±106/ mm3 whilst red blood cells 0.015±1.91 0.020±103/mm3 and triglycerides 0.500 ± 209.50 and cholesterol %0.100g/dl, hemoglobin 0.050 ± 9.73 0.500 ±96.50. Low-density fatty proteins 0.150 ±59.15 whilst high-density fatty protein 0.200 ±16.70 and blood protein 0.31 ±2.60.
Keywords: dry Artemia, frozen Artemia, Fish meal, Protein, physiological traits, Common Carp, *Cyprinus Carpio*

Introduction

It is the first recording of the presence of Artemia a thousand years ago in the Iranian Lake Urmia It is one of the largest perennial salty lakes in the Middle East and in the world. (Manaffar and others 2020) Artemia or salty shrimp belong to the animal kingdom, the Arthropoda Division of Arthropods. Shelled Crustacea was categorised under Branchiopod under the rank of non-armored family of Artemidae (Treece, 2000; Aghakhanian, other, 2009; Zarei, 2013), and it is from Zooplankton (paddlers) it is used as live fodder or dry to feed the fish and maggots. More than 50 geographical strains of artemia have been identified, and nearly 90% of the global commercial crop of artemia bags (eggs) comes from the Great Salt Lake in Utah, USA. (Sura, 2016).

Artemia makes up the bulk of organisms used as live food among the living foods used in aquatic hatcheries for their high nutritional value and conversion efficiency. (Le, others 2019). As well as it can produce good food suitable for fish and aquatic organisms and can be made dry powder and storable. (Bengtson, others 2018). All stages of artemia's life including shelled peelable eggs (after removing capsule) maggots young and old to feed the fish in all stages, starting from a maggot reaching older fish. Frozen older artemia is widely used by fish breeders and aquatic organisms. (Lim, others 2003). Artemia is a natural feed commonly used in fish feeding, because its size is suitable for the size of the mouth and has a high nutritional value and is easy to digest. (John, others 2004). Artemia contains 50.6% protein, 25.7% carbohydrates, 14.2% fat, 9.4% ash and energy 18.97 kJ g-1. Artemia has the attributes as a non-selective filter nutrient, which consumes anything that enters its mouth (Mohibe, others 2015). Artemia is one of the important food sources used in the nutrition of aquatic organisms, especially in recent times, where its use in many types of breeding has increased. (Bernado, 2003). This is because of its nutrients rich in proteins, fats and carbohydrates, as well as artemia adds to the feed essential nutrients in appropriate concentrations. (Watanabe, 1993). And because high-quality fish feed contains a percentage of fish powder. (Adekunle, 2014). For this reason, the study was conducted to find out the effect of the use of dried artemia powder and frozen artemia on the growth parameters of common carp feeds, and to study the possibility of replacing fish protein partially or completely.

Materials and ways of implementation:

Experimental Fish

The fingerlings of the common carp fish (Cyprinus carpio L) with a weight of (12-17) g was brought from the private sector fish hatchery in the area of Al-Mahaweel on 18/10/2021, the fish were transported by a car intended for the transport of fish containing the water of the hatchery basin itself and equipped with a pump to circulate and ventilate the water when transporting.When the fingerlings arrived at the fish laboratory at the University of Baghdad / Faculty of Agricultural Engineering Sciences for fish farming, part of the water in the fish transport car was discharged to a 500-liter stainless steel water basin, sorted and isolated the fish according to the close weights and placed in saline solution at a concentration of (5 g / l) of the experiment to get rid of ectoparasites if any before placing them in glass tanks.

Experiments Tanks

Glass tanks with dimensions (30 × 40 × 30) cm were prepared where the internal surfaces and walls of the tanks were cleaned and sterilized with water and coarse salt and left for a whole week and then washed with water to remove the salt completely and filled the tanks with chlorine-free water from the water's purification center with the amount of 30 liters per tank, as the water is replaced with water that has been left for 24 hours inside the laboratory to remove chlorination from it, as well as to obtain a temperature close to the temperature of the laboratory and the tanks were supplied with water by four Tanks with a capacity of 1000 liters per tank outside the laboratory made of polyethylene material and then pulls the water into the tanks inside the laboratory capacity of 500 liters made of Stainless Steel, exposed from the top. The tanks are equipped with oxygen pump Super Pump Chinese made. The water temperature inside the tanks during the experiments were maintained by using a water heater (100watts) Reco brand, Italian made and equipped with temperature regulator in case if the temperature drops, this is to sure that the temperature is maintained and it is suitable for fish growth, which is (2±25C) for experiment tanks. The tanks were cleaned daily by pulling out waste and leftover food from the bottom of the tanks. Environmental measurements of water in the tanks were carried out daily, including measurement of both water temperature and pH.

The experiment

The experiment started 23/10/2021 and lasted 90 days, 172 fish were prepared with similar weight with median initial weight of 2±14gr and median of the average living mass of 116 ±1 g/bis after sterilization with brine (5 g/L) to get rid of ectoparasites if any, was randomly and evenly distributed over 18 glass tanks, dividing the trial tanks into nine experiments and by two repeaters/experiment and seven fish per refiner. The fish were starved for a whole day after which the fish were fed experimental feeding parameters (T1, TC, T2, T3, T4, T5, T6, T7, T8) at 5% of the weight of the living mass in each tank and at the rate of three meals per day, and the fish weighed every 14 days with a Chinese-made electronic sensitive scale (the scale weighs for three digits after sorting).

Manufacturing experimental feeds

Feed materials (Table 3–1) were purchased from the domestic market and grounded objects by a Silver Crest type laboratory mill of Chinese made. The required proportions were calculated (Table 3-2) and then the feed materials were mixed homogeneously and in accordance with the required proportions. Nine experimental feeds were made with similar protein content and energy, with protein content between 33.07 and 35.76% and energy between 2758.6 and 4033.7 calories/kg, consecutively. Dried artemia was added to the T1, T2, T3 and T4 experiments with a fishmeal replacement rate of 25, 50, 75 and 100% consecutively. Frozen artemia was added to the T5, T6, T7 and T8 experiments with a meal replacement rate of 25, 50, 75 and 100% consecutively. The fodder ingredients were mixed by hand for the purpose of consistency of the mixture per fodder, water was added at the rate of 400 ml of water per kg of the mixture of fodder ingredients, then the ingredients of fodder were placed in a meat grinding machine (tray holes of 4 mm) and re-grinded twice to form firm threads, spread in containers and exposed to the air to dry at room temperature for 48 hours with constant turning of the fodder granules to ensure the elimination of excess moisture as well as avoid the growth of fungi on them. The fodder threads were cut after drying into small pieces proportionate with the size of the mouth of the experimental fish, and then the feeds were kept in nylon bags, where each fodder was placed in a marked bag with the experiment number to be placed in the freezer under a temperature of (-18 C) until it was given to the experimental fish. A sample of each fodder was taken for chemical analysis.

Statistical Analysis

The SAS – Statistical Analysis System (2012) was used to analyse the data for studying effectiveness of different experiments in the studied attributes over a Complete Randomised Design (CRD).

Mathematical Model of the experiment

$Yij = \mu + Ti + eij$

Whereas:

Yij: value of watching j returning to experiment i

μ: The General median of the studied attribute

Ti: Influence of the experiment i

Eij: random error which spreads naturally with a median of zero and divergent value of o2e

Results and discussion:

Protein Evaluation Criteria

The results of the statistical analysis of the protein intake showed table (1) observed in the final period the superiority of the seventh experiment followed by the second and then the first experiment, then the rate of protein intake was 21.49 ± 0.49 21.22 ± 0.13 and 21.16 ± 0.08 respectively, the protein efficiency rate was observed above the seventh experiment followed by the second and then the eighth experiment and then the protein efficiency rate was 1.96 ± 0.14, 1.87 ±0.16 and 1.76 ± 0.18 respectively, in the efficiency of the protein produced, the seventh

experiment will continue to be followed by the eighth and then the second treatment at a rate of 158.11 ± 4.67 and 146.10 ± 1.31 and 141.42 ± 1.71 respectively, and the reason may be attributed to the superiority of the transactions added to it Artemia has increased the amount of feed consumed as well as the fact that Artemia works to benefit from the feed more and thus increase the amount of protein consumed (García et al., 2004). Karamushko et al., (2006), have pointed out that adding artemia to Clupea herring feeds works to increase feed consumption and thus increase protein efficiency. As Chepkirui (2011) pointed out, when Artemia was used in the nutrition of African catfish Clarias gariepinus the small percentage of fiber found in artemia works to reduce the speed of passage of nutrients within the gastrointestinal tract which increases absorption and benefit more from feed and thus increase protein absorption, as well as the quality of artemia protein, which contains essential amino acids, which led to an increase in the value of the product when using wet artemia by (75%) and dry by (50%), (García et al., 2001). As researcher Mamcarz et al. (2011) pointed out, when feeding Tinca tinca nitch fish on artemia instead of fishmeal, the value of the protein produced is higher in fish fed artemia compared to fish fed on fishmeal, the second experiment of net exploited protein outperformed all experiments of 2.65 ± 0.06, followed by the seventh experiment at a rate of 1.92 ± 0.07, followed by the eighth experiment at a rate of 1.87 ± 0.09, and may be due to the superiority of the second experiment (50%) Dry is the percentage Dried artemia and its proportion that was the reason for the promotion of the net protein exploited by fish (McMahon et al. 2015).

Conceição et al. (1997) have pointed out that the lower the humidity, the higher the protein concentration and the longer the protein stays within the gut, which eats longer, which promotes absorption and utilisation more of protein and thus increases the net protein content. But the experiments fed wet artemia remain the best because growth rates and fodder evaluation criteria were better. It is noted from the results of the statistical analysis of the trait of the precipitated phenol protein that the fourth experiment outweighed, with an average of 19.73 ± 0.31, followed by the third experiment with a rate of 18.52 ± 0.52, followed by the eighth experiment with a rate of 16.48 ± 0.14, while the controlled experiment ranked last.

Table 1: Protein Evaluation Criteria for Experimental Fish (Average ± Standard Error)

Waste Appearance Time/Hour	Precipitate Visual protein (g)	Net protein utilised (g)	Apparent digestion experiments (%)	The value of the protein produced (%)	Protein efficiency rate (%)	Protein Consumed (g)	TRT
1.89 ± 4.56 a	7.04 h ± 0.06	1.40 d ± 0.1	64.94 g ± 0.055	92.22 e ± 0.54	1.42 c ± 0.12	19.15 bc ± 0.13	TC
1.60 ± 5.31 a	12.25 f ± 0.10	1.50 cd ± 0.05	77.15 e ± 0.235	117.95 d ± 2.30	1.56 c ± 0.02	21.16 a ± 0.08	T1
2.21 ± 6.40	10.55 g	2.65 a	52.50 h	141.42 abc	1.87 ab	21.22 a	T2

a	± 0.13	± 0.06	± 0.390	± 1.71	± 0.16	± 0.13	
3.66 ± 4.55 a	18.52 b ± 0.25	1.41 d ± 0.01	88.82 a ± 0.360	126.30 cd ± 3.13	1.49 c ± 0.21	16.94 d ± 0.44	T3
2.20 ± 5.42 a	19.73 a ± 0.31	1.35 d ± 0.08	88.29 a ± 0.040	115.05 d ± 11.92	1.74 b ± 0.11	19.84 abc ± 0.74	T4
1.85 ± 5.12 a	12.24 f ± 0.12	1.41 d ± 0.05	81.96 c ± 0.040	117.08 d ± 3.62	1.43 c ± 0.07	20.64 ab ± 0.79	T5
1.94 ± 7.45 a	16.25 f ± 0.19	1.57 c ± 0.06	87.84 b ± 0.165	140.16 bc ± 5.62	1.74 b ± 0.22	20.98 ab ± 0.87	T6
4.63 ± 8.36 a	16.06 e ± 0.08	1.92 b ± 0.07	83.60 b ± 0.305	158.11 a ± 4.67	1.96 a ± 0.14	21.49 a ± 0.49	T7
± 7.14 1.54a	16.48 c ± 0.14	1.87 b ± 0.09	75.95 f ± 0.090	146.10 ab ± 1.31	1.76 b ± 0.18	18.34 cd ± 0.64	T8

Vertically different letters indicate the existence of significant differences between the averages of the studied adjective while vertically similar letters indicate that there are no significant differences between the mediations of the same adjective. The first, second, third and fourth experiment is dry artemia (25, 50, 75 and 100%) respectively, and the fifth, sixth, seventh and eighth experiment is wet artemia (25, 50, 75 and 100%) respectively.

Fats:

The results of the statistical analysis showed that there were no significant differences for total protein T.P. in all experiments, since normal levels of common carp fish ranged, as very low levels of total protein in the blood lead to exposure to infectious diseases, kidney damage, nutritional imbalance and stressful condition in fish (Wedemeyer, 1981). It is clear from the results of the study the high percentage of high-density lipoprotein HDL and low-density lipoprotein LDL as well as cholesterol with the high percentage of artemia in the fodder and may be due to the high percentage of fat in frozen and dried artemia compared to fishmeal, or the reason may be attributed to the fact that artemia increases the efficiency of digestion and increases the benefit of the fats contained in the nutrients that make up the fodder, the increase of this fat in fish may be a good indicator, as Ekasari pointed out et all (2015) suggest that the increase in total fat and cholesterol in fish is a good indicator as it leads to improved reproductive performance and increased fertility in fish eggs, as cholesterol is a precursor of the steroid hormone, including those that work in reproduction such as testosterone, estrogen, and progesterone so its increase in fish plasma is a good indicator (Lubzens et al. 2010).

Table 2: Total Protein, High Density Protein, Low-Density Protein, Triglycerides and Cholesterol of Experimental Fish Blood (Average ± Standard Error)

CHOL (%)	TRI (%)	LDL (%)	HDL (%)	TP (%)	TRT
95.75 b ± 0.250	277.50 b ± 0.500	48.30 e ± 0.300	11.90 f ± 0.100	2.40 a ± 0.15	TC
93.30 c ± 51.700	247.50 d ± 0.500	49.80 e ± 0.200	15.50 d ± 0.500	2.45 a ± 0.25	T1
116.50 b ± 0.500	245.50 e ± 0.500	52.40 cd ± 0.400	16.50 e ± 0.500	2.29 a ± 0.18	T2
119.00 b ± 1.000	213.50 g ± 0.500	60.70 b ± 0.300	19.50 a ± 0.500	1.94 a ± 0.12	T3
189.00 a ± 1.000	232.50 f ± 0.500	58.90 c ± 0.100	21.65 fe ± 0.150	2.33 a ± 0.15	T4
80.00 bc ± 1.000	256.50 c ± 0.500	60.6 b ± 0.100	13.55 e ± 0.350	2.18 a ± 0.5	T5
105.50 bc ± 0.500	311.50 a ± 0.500	62.50 ab ± 0.500	16.40 dc ± 0.400	2.48 a ± 0.42	T6
96.50 bc ± 0.500	209.50 h ± 0.500	59.15 c ± 0.150	16.70 c ± 0.200	2.60 a ± 0.31	T7
192.50 bc ± 0.500	171.50 I ± 0.500	63.40 a ± 0.400	17.85 b ± 0.150	2.18 a ± 0.25	T8

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The first, second, third and fourth experiment is dry artemia (25, 50, 75 and 100%) respectively, and the fifth, sixth, seventh and eighth experiment is wet artemia (25, 50, 75 and 100%) respectively.

Fish blood circulation system:

It is noted from the results of the statistical analysis (Table 8) that the eighth experiment came after the seventh experiment and then the sixth experiment for the percentage of hemoglobin and Hematocrit, The ratio was 11.1 ± 0.300 g/dL, 9.73 ± 0.050 g/dL and 9.2 ± 0.150 g/dL respectively This indicates that the addition of wet artemia improves the ratio of hemoglobin to fish blood, and the ratio reached 33.3 ± 0.200% and 29.2 ± 0.100% and 27.6 ± 0.100% respectively for Hematocrit, continued to excel the eighth, seventh and then fourth experiment for erythrocytes,

which reached 2.12 ± 0.12, 1.91 ± 0.015 and 1.82 ± 0.010 respectively, the best percentage was for the second experiment followed by the controlled experiment and the first experiment for leukocytes, which reached 21.3 ± 0.020 and 23 ± 0.040 and 23.4 ± 0.020 respectively.

Table 3: experimental Fish blood circulation system (average ± standard error)

WBC $10^3/mm^3$	RBC $10^{6/}mm^3$	PCV %	HB g/dl	TRT
23 c ± 0.040	1.69 d ± 0.020	24.6 bc ± 0.300	8.2 b ± 0.100	TC
23.4 c ± 0.020	1.69 d ± 0.015	24.4 bc ± 0.200	8.13 b ± 0.250	T1
21.3 c ± 0.020	1.71 bc ± 0.020	25.75 bc ± 0.150	8.58 b ± 0.950	T2
25.7 b ± 0.065	1.73 bc ± 0.025	26.1 b ± 0.250	8.7 b ± 0.900	T3
25.8 b ± 0.030	1.82 ab ± 0.010	27.4 a ± 0.250	9.13 b ± 0.750	T4
24.1 bc ± 0.035	1.73 bc ± 0.035	26.4 b ± 0.200	8.8 b ± 0.600	T5
26.2 a ± 0.035	1.8 ab ± 0.025	27.6 b ± 0.100	9.2 b ± 0.150	T6
25.8 b ± 0.020	1.91 a ± 0.015	29.2 a ± 0.100	9.73 ab ± 0.050	T7
23.6 c ± 0.015	2.12 a ± 0.02	33.3 a ± 0.200	11.1 a ± 0.300	T8

The vertically different letters indicate the existence of significant differences between the averages of the studied adjective while vertically similar letters indicate that there are no significant differences between the mediations of the same adjective.
The first, second, third and fourth experiment is dry artemia (25, 50, 75 and 100%) respectively, and the fifth, sixth, seventh and eighth experiment is wet artemia (25, 50, 75 and 100%) respectively.

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