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Cultivation of Some Local Algae from Iraqi Environment and Study its Impact on the Growth of Fishes

Ibtisam Fareed Ali Karm*

Market researches and consumer protection center, Baghdad University, Baghdad, Iraq.

* Corresponding author: Ibtisam Fareed Ali Karm; e-mail: ifak_77@yahoo.com

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ABSTRACT

Three types of local algae (*Chlorella sp., Oscillatoria sp., Scenedesmus sp*.) were isolated from Iraqi aquatic environments and were cultivated and grown to produce biomass. The effect of these algae was studied as a natural vegetarian food source on the growth of fishy brown fish fingerlings and investigated the effect of these algae by mixing them in specific proportions with a sample of pre-prepared forage Stander Media(SM) that used in fish farming and production. Eight pools with ten fingerlings in every pool were prepared and each two were supplied with specific forage and considered to be a treatment, treatment A1 (25% algae+75%SM), treatment A2 (50% algae+50% SM) and treatment A3 (75% algae+ 25% SM). The BOD, pH and temperature were measured daily and the survival rate measured every week for each treatment. The experiment continued for ten weeks, during which changes were observed in the rate of weights, lengths and survival of the fish sample for each treatment. In this study it was found that A2 was the best treatment used for improving the growth of fishes. The aim of the study is to identify the importance of algae and their potential use as alternative natural forage and to invest it as promoters for the growth of important aquatic organisms such as fishes.

Keywords: Cultivation algae, Fish growth, Fingerlings, Alternative forage.

1. INTRODUCTION

The first use of microalgae by humans belongs to Chinese before 2000 years. Micro algal biotechnologies have begun to develop since 1950. Present days shows that microalgae can be used to enhance the nutritional value of food and animal feed because of their chemical composition and they are known to play a crucial role in aquaculture and hence are cultivated as a source of highly valuable molecules [1].

The use of algae as substitute to fishmeal provides additional benefits which include improvement on taste and consistency of flesh, increase in Omega 3 fatty acid content, and increase in the rate of growth of the aquatic species due to better digestibility. Microalgae feeds have been used for the culture of larvae and juvenile shell and finfish [2, 3]. Another benefit of using Algae for Aquaculture because it enable farmers to have "green water ponds" where algae removes CO2 from water, thus reducing the stress of the aquatic species being farmed and accelerating its growth rates [2].

The most frequently used species in aquaculture are Chlorella, *Tetraselmis, Isochrysis, Pavlova, Phaeodactylum, Chaetoceros, Nannochloropsis, Skeletonema* and *Thalassiosira*. Mainly the microalgae *Spirulina* and *Chlorella* are used for feeding animals, aquarium fish, ornamental birds, due to rich source of proteins [4]. Micro-algae are produced in different cultivation systems either outdoors or indoors. Such systems include open shallow ponds and closed photo bioreactors. The most widespread and used technique is the open system [5].

The growth in aquaculture has been based on availability of fishmeal or any other protein source. Fishmeal production has not increased throughout the last 20 years [6]. The sustainable management and use of aquatic resources and adoption of ecosystem approaches - can boost economic growth, increase food security, improve nutrition and reduce poverty [7]. Reductions in feeding costs can be obtained by optimizing feeding strategies by using vegetable sources as substitutes for fish oil and fishmeal. This aspect is also very important to improve the sustainability of aquaculture [8].

2. MATERIALS AND METHODS

1. Preparing Fish samples

Brown fish samples as fingerlings were brought and collected from fish farms in Iraq, then samples were put in clean boxes marked with informations about the date, place and number of fishes as well as the length and weight of each fish sample.

2. Preparing Algae samples

Algae samples were collected from Tigris river near University of Baghdad campus in Iraq, all samples were collected in clean collectors with informations put on it, all samples were cultivated with enrichment media overnight, for this purpose modified Chu-10 media was used [9]. All samples were centrifuged and the sediments were cultivated in broth Chu-10 media for (10-12) day. Dilution technique was used for isolate the algae [10], [11]. Three types of algae were isolated and cultivated for mass production.

3. Experimental Design

Three forages or treatments were prepared to feed the fingerlings fish, and the control was the stander media (SM) that used in the farms for fish nutrition, treatment A1 (25% algae+75%SM), treatment A2(50% algae+50% SM) and treatment A3 (75% algae+ 25% SM). Eight pools were prepared and each two were filled with specific media and considered to be a treatment, ten fingerlings were put in each pool, the diameter of the pool was (75cm*50cm*60cm) and media supplied every week.

4. Measuring Environmental parameters

The Experiment was for 10 weeks, the weight and the size or length of the fingerlings were taken each week along with the BOD, pH and temperature were measured every day, and also surviving rate\ percentage was taken every week after each treatment [12].

Surviving percentage = (number of fish at the end of experiment\ number of fish at the begin of experiment) * 100

5. Statistical analyses

The Statistical Analysis System- SAS (2012) program was used to valuate various factors in study parameters. Least significant difference – LSD test (ANOVA) was used to significantly compare between means. [13], [14]

3. REULTS AND DISCUSSION

3.1 Algae isolates

Three types of algae were successfully isolated using dilution technique and these algae were widely distributed in the Iraqi environmental conditions and can be easily cultivated in a laboratory with high growth range. These isolated algae were identified according to Prescott [15].

Table 1: Algae classification that has been isolated in the study.

Genus	Family	Order	Class	Division
Oscillatoria	Oscillatoriaceae	Oscillatoriales	Cyanophyceae	Cyanophyta
Scenedesmus	Scenedesmaceae	Sphaeropleales	Chlorophyceae	Chlorophyta
Chlorella	Chlorococcaceae	Chlorococcales	Chlorophyceae	Chlorophyta

3.2 Measuring the Growth Parameters of fish fingerlings of The Study

In this study the growth of fishes was noticed by the increase in the length and weight and all data recorded was presented in table (2) and table (3).

There is a significant differences among all treatments and the time of the study that was ten weeks as shown in table (2), and there was a significant difference among data among all weeks except in week (1, 2, 3, 4 and 5). The best results were found in A2 forage which can be used as alternative feed for fishes fingerlings, A2 represents 50% algae culture bio mass of the three kind of isolated algae +50% stander media that was used for fish fingerlings nutrition in fish farms.

In table (3) it was noticed that there is a significant differences among all data in different treatments or forages, also there was a significant difference among data at all weeks except in first and second week. It was clear that A2 was the best forage that can be used as alternative forage after the stander media (SM) or the control because of the convergence between the results of A2 and SM (control).

Table 2: The length of the fish fingerlings(cm) at different forage (treatments) used in the study for ten weeks.

LSD	A3	A2	A1	Control	Week
2.69 NS	6.6	7.6	7.2	7	1
1.92 NS	6.9	8.1	7.8	7.5	2
2.33 NS	7.0	8.5	8.2	8.2	3
2.19 NS	7.2	9.0	8.5	8.6	4
NS 2.41	7.5	9.4	9.0	9.4	5
2.61*	8.1	10.8	10.5	10.1	6
2.54*	8.6	11.6	11.2	10.8	7
2.63*	9.3	12.2	11.8	11.2	8
2.75*	10.0	14.0	12.2	11.7	9
3.09 *	10.6	15.5	13.0	12.0	10
---	3.17*	3.68*	2.96*	3.31 *	LSD

* (P<0.05)

Table 3: The weights of the fish fingerlings (gm) at different forage (treatments) used in the study for ten weeks.

LSD	A3	A2	A1	Control	Week
1.75 NS	7.0	7.3	7.5	7.5	1
1.66 NS	7.3	8.8	8.1	8.8	2
2.72*	7.7	10.8	10.3	11.6	3
2.66*	8.2	12.0	10.9	13.0	4
2.51*	9.2	14.6	11.5	15.5	5
4.17*	10.8	16.5	12.3	18.3	6
4.75 *	12.2	17.7	15.0	21.0	7
3.89*	13.6	20.0	16.3	24.3	8
5.12*	14.8	22.2	17.0	28.5	9
5.52*	16.5	23.2	20.2	30.0	10
---	4.36*	5.26*	4.09*	4.62*	LSD

* (P<0.05)

The results were increasing in lengths and weights and they both were refers to increasing in the growth of fingerlings. The increase in fingerlings lengths were (from 7 to 12, from 7.2 to 13, from 7.6 to 15.5, and from 6.6 to 10.6 cm) it was observed in Control, A1, A2 and A3 respectively and there was an increase in fingerlings weights from (7.6 to 30, from 7.5 to 20.2, from 7.3 to 23.2 and from 7 to 16.5) in treatments Control, A1, A2 and A3 respectively.

Environmental parameters were measured, because of their importance which can effect on the results of the study. pH, BOD and Temperature were the most important factors in this study, the lowest records were (7.5, 5.5, 25) and the highest records were (8.5, 8.2, 32) respectively Table (4).

The results were enhanced by measuring the surviving percentage of the fingerlings fish throw the time of the experiments that were done at the study, it was appeared that the surviving present was 80% at SM, 70% at A1, 80% at A2 and 50% at A3 respectively as in table (5).

Table 4: Environmental parameters taken in the study.

Parameters	pH	BOD	TEMP.
Lowest value	7.5	5.5	25
Highest value	8.5	8.2	32

Table 5: Surviving percentage (%)at different treatments or forages

Treatments	C	A1	A2	A3
Surviving percentage %	80 %	70 %	80 %	50 %

The results of this study was in agreement with study by [16, 17] confirming that the use of microalgae either as a full or partial enrichment media should be considered for improving the nutritional quality because they have essential nutrients that may be transferred through food chains of zooplankton, fish larva and fish fingerlings, especially Poly Saturated and Unsaturated Fatty Acids and Amino Acids [16, 18]. A

study by [17] inshore that Microalgae must have rapid growth rates, be amenable to mass culture, and also be stable in culture to any changing in temperature, light and nutrients and must have a good nutrient with an absence of toxins that might be transferred up the food chain [19, 16]. The main applications of microalgae for aquaculture are associated with nutrition, being used fresh for coloring the biological activities [20]. This study was in agreement with [21, 22] considering Algae may limit the use to the commercial production of high value fish.

4. CONCLUSION

The use of farmed algae reduces the cost of the fishmeal, Algae is rich in Omega 3 with essential protein amino acids (EPA), Algae management bonds can remove CO_2 from ponds, so fish fed with algae would be much better for health.

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