EFFECT OF VARIOUS LEVEL OF THE DIETARY ALGAE (*SCENEDESEMUS SPP*) ON PHYSIOLOGICAL PERFORMANCE AND DIGESTIBILITY OF NILE TILAPIA (*OREOCHROMIS NILOTICUS*) FINGERLINGS

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Abstract

A 12-week feeding trial followed by a 2-week digestibility trial were conducted on the Nile tilapia fingerling (*Oreochromis niloticus*), to evaluate the microalgae (*Scenedesemus spp.*) as an alternative component to fish meal in complete diets. A control diet without microalgae served as a reference from which inclusion levels of 5, 10, 15 and 20% microalgae were investigated by the replacement of fish meal. All diets were formulated to be isonitrogenous and isocaloric in terms of crude protein (32%) and gross energy (400 kcal/100 GM diet). On the basis of digestibility trials and physiological performance, the microalgae (*Scenedesemus spp.*) were found to successfully replace up to 15% of the fish meal in the practical diet, which may be ascribed to the companion effects of microalgae and fish meal protein as will as to the feeding behavior of Nile tilapia (herbivorous). However, fish fed diet containing 15% increased significantly. The hepatosomatic index (3.04), while no significant differences due to the digestive tract index by different dietary algae levels that in ranged from 5.51 to 6.19. Fish fed 15% produced lower value of Creatinine (0.50 mg/dl) and triglycerides (48.0 mg/dl) and higher value of total protein (5.9 g/dl) and follicle stimulating hormone (0.25 pg/ml) while the control diet gave lower value of uric acid (2.6 mg/dl). The diet containing 10% algae gave best value of ASAT. (55.0 mg/dl), ALAT. (50.0 mg/dl) and lower value of cholesterol (100.0 mg/dl), Glucose (57.0 mg/dl) and low density lipoprotein (46.0 mg/dl) while, a diet containing 5% algae gave lower value of high density lipoprotein (35.0 mg/dl). Fish fed diet containing 15% algae increased significant by the digestibility coefficient of dry matter (92.5), crude protein (87.63), ether extract (88.45) and energy (81.41) and insignificantly the digestibility of N.F.E (72.07).

Apparently, inclution of 10 to 15% algae in diet of the Nile tilapia fingerlings improved the fish organs, blood characteristics and digestibility coefficient

Keywords: algae, fish, fish organs index, blood characteristics and digestibility coefficient

INTRODUTION

In many aquaculture operations today, feed accounts more than half of the variable operating cost NRC, (1993). Therefore, the potential use of unconventional food stuffs such as algae, for substitution the high cost food stuffs such as fish meal is very important.

Algae have attracted the attention as a possible alternative protein source for cultured fish, particularly in tropical and subtropical developing countries, where algae production rates are high and they have higher protein, vitamins and essential fatty acids contents. Broun (1980) reported that the algae have a high content of protein (50 – 58 %), low fiber (10%) and high content of threonine, lucien, phenylalanine, tyrosine and valine. The amino acid composition of *Scenedesmus* algae was compared well with the FAO amino acid pattern, and it was found that they have the same components except for methionine and isoleucine. Dawh *et al* (2002) found that five amino acids (aspartic acid, serine, alanine, leucine and glycine) were collectively responsible for 50% or more of the total dry matter content, and algae proteins like other single cell protein are deficient in sulfur-amino acids.

Becker (1978) found that algae are particularly rich in water-soluble vitamins compared with other foodstuffs of the high vitamin contents. Soeder (1980) reported that about 67% of the fatty acids in Scenedesmus algae are unsaturated. Broun and walz (1978) reported that Scenedesemus, algae contain 16.1 – 38.9 mg calcium, 5.5 – 26.8 mg phosphorus, 12.3 mg silica, 7.1 mg capper, 0.28 mg manganese and 0.3 mg iron of dry matter.

The successful incorporation of algae levels in fish diets are different according to algae and fish species. The rates of 5 – 30% of algae were used in most trials that found in the literature (Faskin *et al.*, 2000).

The quality and quantity of some blood constituents had been successfully used as indicators to health, reproductive, nutritional and physiological statues of the animal (Fletcher, 1984) Moreover, one of the most important aspects in evaluating the suitability of foodstuffs is digestibility. This measures the ability of the fish to digest and absorb the fed nutrient. Therefore, this study aimed to investigate the effect of different algae levels in the diet on the digestibility coefficient and physiological performance of the Nile tilapia under Egyptian conditions

MATERIALS AND METHODS

This experimental study was conducted in the Central Laboratory for Aquaculture Research (CLAR), Abbassa, Sharkia Governorate, Egypt.

Experimental Diet

Five practical diets were formulated based on the proximate composition of the feed ingredients. Control diet contained no algae. The diets were prepared using different proportions of herring fishmeal (72% C.P) and the algae Scenedesmus sp. (51%C.P) as the major ingredients. The four test diets contained 5, 10, 15 and 20% algae meal by replacement of fish meal on an equivalent protein basis to insure that all diets were isonitrogenous (32%C.P) Moreover, the energy was calculated using

5.64, 9.44 and 4.11 for crude protein, fat and carbohydrate, respectively according to NRC (1993), all diets were adjusted to be isocaloric (4000 Kcal / 1kg diets). Composition and proximate analysis of the experimental diets and algae are shown in Table (1). Moisture, crude protein, ether extract and ash contents in feed ingredient and experimental diets were calculated according to the standard AOAC methods (AOAC, 1990), while nitrogen free extract was calculated by difference.

Table1. Percentage composition of the experimental diets:

Ingredient	Dietary treatment (Algae %)				
	Control 0.0	5%	10%	15%	20%
Fish meal	22.19	17.19	12.19	7.19	2.19
Algae meal*	-	5.0	10.0	15.0	20.0
Soybean meal	35.69	38.05	40.41	42.77	45.12
Cornstarch	30.24	28.64	28.80	26.15	23.28
Fish oil	0.03	0.65	0.73	1.36	1.96
Plant oil	3.45	3.36	2.25	2.23	2.13
Min Vit Mix**	3.0	3.0	3.0	3.0	3.0
Methionen	0.24	0.26	0.28	0.30	0.32
Carboxy methyl cellulose	2.0	2.0	2.0	2.0	2.0
Cellulose powder	3.16	1.85	0.34	-	-
Total	100	100	100	100	100
Chemical analysis:					
Moisture	9.18 ± 0.34	8.99 ± 0.45	8.97 ± 0.38	8.72 ± 0.25	8.46 ± 0.19
Crude protein	32.0 ± 0.50	31.97 ± 0.46	32.01 ± 0.43	32.00 ± 0.40	32.01 ± 0.15
Ether extract	6.01 ± 0.19	6.50 ± 0.30	5.43 ± 0.15	6.01 ± 0.15	6.46 ± 0.20
Crude fiber	7.69 ± 0.19	6.94 ± 0.26	5.96 ± 0.26	6.21 ± 0.39	6.77 ± 0.51
Ash	5.51 ± 0.14	5.76 ± 0.17	6.39 ± 0.14	6.84 ± 0.10	7.28 ± 0.07
Nitrogen free extract	39.61 ± 1.01	39.84 ± 0.79	41.24 ± 0.32	40.22 ± 0.58	39.02 ± 0.78
Gross energy Kcal/100 g	400.01 ± 0.57	405.41 ± 1.85	401.29 ± 0.634	402.52 ± 1.17	401.89 ± 1.19

*Proximate analysis of micro-algae: Moist = 4.51; CP = 51.0; EE = 7.39;Cf = 7.83; Ash = 16.18; NFE = 13.09 and GE = 411.2.

**Each 100 gram of vitamin and mineral contained:

Mineral : Zn, 2.50 mg; Mn, 16.00 mg; Fe, 31.50 mg; Cu, 5.50; I, 0.55 mg; Ca, 1.15 gm and P, 450 mg.

Vitamins : A, 7500000 Iu; Bi, 100 mg; B3, 500 mg; B6, 150 mg; B12, 2.5 mg; E, 100 mg; K, 100 mg; Pantothnic acid, 275 mg; Folic acid, 100 mg and vit. D3, 7500 Iu.

Algae.

The green-microalgae *(Scenedesmus Sp.)* processed by drum-drying, produced in the National Research Center, Dokki, Cairo, Egypt, was used in this study. The algae used in this study were produced according to El-Fouly *et al.* (1980) during March and April 2001.

After centrifugation the obtained slurry was adjusted to about 12% solids then passed through a homogenizer and pumped on a roller for drying. The yield was coming out in a form of green dried powder that contains 4-6% moisture. The yield of

successive harvesting of algae culture were collected and kept in polyethylene case in a dark room.

Fish and feeding regime

Nile tilapia (*Oreochromis niloticus*) fingerlings with an average weight of 13.41 ± 0.22 g and length10.18 ± 0.06 cm were transferred from Abbassa Hatchery to the wet Lab of (CLAR) and acclimatized in fiberglass for three weeks before using in the experiment. Fish were randomly allocated on the aquaria (25/ aquarium). Each treatment was performed in three aquaria (3 replicates).

A feeding regime of 3% body weight per day was employed throughout the trial. The amount of food was calculated and readjusted after weekly weighing and distributed in three equal portions for 12 weeks.

Experimental system

The experimental facility consisted of 15 glass aquaria (75 – 60 – 45cm). Each aquarium was supplied with aerated and dechlorinated tap water, which was stored in tanks for 24 hours and aerated by air pump (Model-Rina 301) during the experimental period. The water level was maintained at a fixed level by the addition of new well-aerated fresh water.

Fish organs response

The fish liver and digestive tract were taken from 6 fish for each treatment to calculate the following.

Hepatosomatic index (HIS)

Hepatosomatic index was calculated as liver percentage to the whole fish weight according to Hidalgo *et al.* (1987) as the following.

HSI = Liver weight (g) / Fish weight (g) × 100

Digestive tract percentage (DTP)

Digestive tract percentage was calculated as digestive tract percentage to the whole body weight as the following equation:

DTP = Digestive tract weight (g) / Fish weight (g) × 100

Blood parameters

Blood samples for biochemical examination were obtained from the fish at the end of the experimental period. The samples were withdrawn from the caudal artery. The needle was run quite deep through the middle line just behind the anal fin in a dorso-crunial direction using anti-coagulant, heparin 0.75 units / ml (Schreck and Moyle 1990).

The following components were determined in the blood.

Plasma creatinine

Plasma creatinine was determined by Jaffe method as described by Henry (1974).

Plasma uric acid:

Uric acid concentration in plasma was measured by enzymatic calorimetric test (uricase – PAP) according to Trinder (1969).

ASAT and ALAT Enzymes Activity

Plasma aspirate aminotransferase (ASAT) and alanine aminotranserase (ALAT) activities were determined calorimetrically using kits (Diamond kits, USA) according to Reitman *et al.* (1975).

Plasma glucose

The concentration of plasma glucose was measured by enzymatic calorimetric test (GOD-PAP) method as described by Trinder (1969).

Plasma total protein

Plasma total protein concentration was determined by Josephson and Gyllensward (1975).

Plasma cholesterol

Plasma cholesterol concentration was measured.

Plasma triglycerides

Plasma triglyceride was measured according to Wahlefeld (1974).

High-density lipoprotein (H.D.l).

Plasma (H.D.L) was measured according to Grove (1979).

Low density lipoprotein (L.D.L).

Plasma (L.D.L) was calculated using Fiedewald formula:

L.D.L-C (mg/dl) =Total cholesterol – (H.D.L – C + V.L.D.L - C)

Where: V.L.D.L-C = Triglycerides / 5.

Plasma F.S.H Hormone

Plasma F.S.H hormone concentration as pg/ml was measured using immune technique by immune Tech. Kit (France) with the 1275 Mini-Gama counter (U.S.A).

Evaluation of the experimental diets

The digestion trial was carried out at the end of the feeding experiment in the same aquarium, 15 aquaria to determine the digestibility coefficient of the experimental diets and consequently their nutritive value. Fish were starved for 72 hr to ensure that alimentary tract is empty. The fish were fed on the same experimental diets mixed with chromic oxide at a concentration of 0.5% of the diet. The fish were fed at 1% of their total biomass at 9.00 and 14.00 o'clock. Feces were collected for 14 day by siphoning at one time daily before the next morning meal and filtered through

3 layers of nylon cloth, then kept in the refrigerator at 4 °C. The total collected of samples was oven dried at 65^{c} overnight and finally stored in containers for chemical analysis. The apparent digestibilities were determined by the following equation according to N.R.C (1993).

Apparent digestibility coefficient:

$$(A.D.C) = 100 - \left[100 \frac{\%\ \text{indicator in feed}}{\%\ \text{indicator in feces}} \times \frac{\%\ \text{nutrient in feces}}{\%\ \text{nutrient in feed}}\right]$$

Statistical analysis:

Statistical analysis was performed using the analysis of variance (ANOVA) and Duncan's multiple Range Test to determine differences between treatments, means at significance level of 0.05. The standard errors of treatment means were also estimated. All statistics were carried out using Statistical Analysis System (SAS) program (SAS, 2000).

RESULTS AND DISCUSSION

Fish organ responses

According to the obtained results in Tables 2 and 3, it is noticed that there is significant differences in hepatosomatic index and insignificant differences in digestive tract index due to the level of algae in the diet of Nile tilapia. Hepatosomatic index values were 2.07, 2.48, 3.0, 3.04 and 2.11%, for diets containing 0.0, 5, 10, 15 and 20% algae. These results are in agreement with those obtained by Fasakin *et al.* (1999), who noted that the H.S.I. were 1.2, 1.5, 1.4,1.4 and 1.4 for diets containing 0.0, 5, 10, 20, and 30% duck weed for Nile tilapia, respectively. On the other hand, Ibrahim (2001) found that the H.S.I. of hybrid tilapia did not significantly differ from artificial fish diets and a live micro alga fed fish and is ranged from 1.78 to 2.13%. However, results of digestive tract index are in agreement with those obtained by Ibrahim (2001), who reported that, the D.T.I. of hybrid tilapia were did not significantly differ from artificial fish diets and a live micro alga fed fish which ranged from 5.89 to 7.1%.

Table 2. Hepatic somatic index and Digestive tract index ($\bar{x} \div \pm$ S.E) % for the Nile tilapia *(Oreochromis niloticus)* as affected by different dietary algae *(Scenedesmus spp.)* levels.

Items	Dietary treatment (Algae %)				
	Control (0.0%)	5%	10%	15%	20%
H.S.I	2.07 ± 0.03^{b}	2.28 ± 0.14^{b}	3.00 ± 0.17^{a}	3.04 ± 0.25^{a}	2.11 ± 0.14^{b}
D.T.I	5.09 ± 0.11	5.41 ± 0.17	5.64 ± 0.13	5.89 ± 0.57	6.19 ± 0.38

Means with different superscript letters within a row are significantly different (P<0.05).

Table3. Liver and digestive tract weight (g/ fish) for the Nile tilapia *(Oreochromis niloticus)* as affected by different dietary algae (*Scenedesmus spp.*) levels at the end of experimental periods.

Organ	Treatments				
	Control (0.0%)	5%	10%	15%	20%
Liver	0.69 ± 0.03	0.81 ± 0.03	1.15 ± 0.02	1.21 ± 0.14	0.78 ± 0.07
Digestive tract	1.69 ± 0.06	1.92 ± 0.02	2.17 ± 0.12	2.35 ± 0.28	2.29 ± 0.11

Blood constituents

Results presented in Table 4 illustrate the effect of dietary algae on some blood constituents of Nile tilapia. The average values of creatinine decreased significantly ($P<0.05$) as the diets of fish contained 5 - 15% algae. However, the lowest value was obtained by 15% algae. These results are in agreement with those obtained by Nandeesha *et al.* (1998), Faskin *et al.* (1999) and Abu-Rezq *et al.* (2002).

The results indicated also that uric acid increased significantly ($P<0.05$) due to the inclusion of 5 to 20% algae. However, the highest values of uric acid were obtained by 15% algae followed by 20, 5, 10 and the control one. These results are in agreement with those obtained by D'Souza *et al.* (2000) and Uchida Murata (2002) who found that the uric acid increased by increasing algae in fish diets up to 10%. The average values of Glutamic oxalacetic transaminase (GOT) and Glutamic pyruvic transaminase (GPT) Table (4) increased significantly ($P<0.05$) as the diets of fish contained 5 - 15% algae. However 10% algae diet resulted in the significant higher value of GPT and GOT both enzymes.

These results are in agreement with those obtained by D'Souza *et al.* (2000) and Uchida Murata (2002) who found that the GPT and GOT increased significantly with increasing algae in fish diets less than 20%.

Concerning the total protein results in (Table 4) it is indicated that the total protein increased significantly by the inclusion of algae in the diet of fish. However, 5% algae resulted in higher value than other treatment groups.

Table 4. Some blood constituent ($\bar{x}$ ±S.E) of the Nile tilapia *(Oreochromis niloticus)* as affected by different dietary algae *(Scenedesmus spp.)* levels.

Items	Dietary treatment (Algae %)				
	Control (0.0%)	5%	10%	15%	20%
Creatinine (mg/dl)	1.10 ± 0.06^{a}	0.80 ± 0.10^{b}	0.80 ± 0.10^{b}	0.50 ± 0.00^{c}	1.10 ± 0.10^{a}
Uric acid (mg/dl)	2.6 ± 0.06^{b}	3.10 ± 0.10^{a}	2.8 ± 0.06^{b}	3.30 ± 0.12^{a}	3.20 ± 0.10^{a}
G.P.T (u/l)*	16.0 ± 0.58^{c}	20.0 ± 1.00^{b}	42.0 ± 1.53^{a}	18.0 ± 1.00^{bc}	12.0 ± 0.58^{d}
G.O.T (u/l)**	42.0 ± 1.15^{d}	79.0 ± 1.52^{c}	120.0 ± 2.08^{a}	110.0 ± 1.73^{b}	29.0 ± 1.0^{e}
Total protein (g/dl)	5.50 ± 0.06^{b}	6.0 ± 0.21^{a}	5.6 ± 0.06^{ab}	5.9 ± 0.15^{ab}	5.8 ± 0.10^{ab}
Glucose (mg/dl)	60.0 ± 0.58^{a}	57.0 ± 0.58^{b}	55.0 ± 1.0^{b}	57.0 ± 1.15^{b}	62.0 ± 1.0^{a}
Cholesterol (mg/dl)	132 ± 1.15^{a}	117.0 ± 2.65^{b}	100.0 ± 1.53^{d}	110.0 ± 1.15^{c}	127.0 ± 2.08^{a}
Triglycerides (mg/dl)	63.0 ± 1.53^{a}	54.0 ± 1.53^{b}	50.0± 0.58^{bc}	48.0 ± 2.08^{c}	52.00±1.53^{bc}
H.D.L (mg/dl)***	42.0 ± 1.15^{a}	35.0 ± 0.58^{b}	37.0 ± 1.53^{b}	36.0 ± 1.0^{b}	36.0 ± 1.00^{c}
L.D.L (mg/dl)****	88.0 ± 1.53^{a}	66.0 ± 2.08^{c}	46.0 ± 0.58^{d}	62.0 ± 1.0^{c}	74.0 ± 2.65^{b}
F.S.H(g/ml)*****	0.15 ± 0.01^{b}	0.18 ± 0.01^{b}	0.15 ± 0.01^{b}	0.25 ± 0.02^{a}	0.15 ± 0.01^{b}

Means with different superscript letters within a row are significantly different (P<0.05).
*Gltamic pyruvic transaminase., ** Gltamic oxalacetic transaminase.
High-density lipoprotein., * Low density lipoprotein.
****** Follicle stimulating hormone.

These results are in agreement with those obtained by Zaghloul (1997) who found that plasma protein of Nile tilapia ranged from 5.35 to 8.88 mg/dl. However, Ibrahim (2001) showed that plasma total protein was higher by addition of micro algae with urea than control diet. These results are in a partial agreement with those obtained by Nakagawa (1985) who found that inclusion of lower levels of algae increased fish plasma total protein.

Results presented in Table 4 indicated that inclusion fish diet with algae from 5 - 10 % decreased significantly the values of glucose, cholesterol, triglycerides, high-density lipoprotein HDL and low-density lipoprotein (LDL) than control one. However, follicle-stimulating hormone (FSH) increased significantly in 15% algae diet.

Results of plasma total glucose are in agreement with those obtained by Zaghloul (1997) who found that blood glucose of Nile tilapia ranged from 53 to 82 mg/dl. On the other hand, Shalaby (2000) reported that the normal blood glucose of Nile tilapia was 32 mg/dl. However, Ibrahim (2001) showed that levels of blood glucose of Nile tilapia were 60.45, 57.81 and 61.45 due to artificial diet, micro algae with urea and micro algae with super phosphate.

Results of plasma cholesterol are in agreement with those obtained by Khattab (1996) who found that normal cholesterol of Nile tilapia was 126.89 mg/dl. Farrell (1993) found that no differences in plasma triglycerides or high-density lipoprotein, while cholesterol and low-density lipoprotein was higher significantly due to containing fish oil in the diet instead of vegetable oil. Similar results were observed by Ibrahim

(2001) who found that plasma total lipid was highest in control than micro algae treated with super phosphate and micro algae with urea.

Results of FSH are in agreement with those obtained by Mecdowell *et al.* (1990) who found that egg production and fertility were higher due to algae diet than fish meal diet. From another side Pereira *et al.* (1998) showed that plasma levels of estradiol and total number of eggs per female (total fecundity) for brood-stock of Rainbow trout were significantly higher due to fish meal diet than soybean or corn meal diets.

Digestibility coefficient

The average values of digestibility coefficient of nutrients of Nile tilapia as affected by different dietary algae levels are presented in (Table 5). Results indicate that, inclusion of algae in the diets of fish improved significantly the digestibility coefficient of nitrogen free extract (NFE). Moreover, the digestibility coefficient of gross energy improved significantly by algae inclusion in the diets.

Table 5. Digestibility coefficiency ($\bar{x}$ ± S.E)of the Nile tilapia *(Oreochromis niloticus)* as affected by different dietary algae *(Scenedesmus spp.)* levels.

Items	Dietary treatment (Algae %)				
	Control (0.0%)	5%	10%	15%	20%
Dry matter	91.83 ± 0.30^{ab}	92.77 ± 0.29^{a}	92.16 ± 0.13^{ab}	92.49 ± 0.28^{a}	91.44 ± 0.38^{b}
Crude protein	80.44 ± 0.83^{c}	85.18 ± 0.64^{b}	85.67 ± 0.48^{b}	87.75 ± 0.33^{a}	85.23 ± 0.56^{b}
Ether extract	81.08 ± 0.78^{c}	85.37 ± 0.90^{b}	86.33± 0.87^{ab}	88.45 ± 0.38^{a}	87.27 ± 0.70^{ab}
***N.F.E**	68.97 ± 1.64	72.25 ± 1.01	71.91 ± 0.75	72.06 ± 0.73	69.46 ± 1.47
Gross energy	75.85 ± 1.07^{b}	80.01 ± 0.61^{a}	79.95 ± 0.46^{a}	81.40 ± 0.48^{a}	79.27 ± 0.61^{a}

*Nitrogen free extract

Means with different superscript letters within a row are significantly different (P<0.05).

However, 15% algae in the diets showed the best values of digestibility coefficients of CP (87.75), EE (88.45) and NFE (72.06), resulted in the higher digestibility coefficient of energy (81.40).

Results of the present study were similar with those obtained by Nandeesha *et al.* (1998) who reported that the protein digestibility of common carp ranged from 81.73 to 88.94, while the protein digestibility of algae did not differ and is better than control diet (fish meal). The digestibility of fat was highest with diets containing 25% algae. Also, Olvera *et al.* (1998) found that the lowest digestibility was recorded in diets containing 80 and 100% algae for Tilapia. The highest digestibility were recorded in fish diets containing 10, 20, 30, 40, 50 % algae and control fish meal diets. On the other hand, these results are in a partial agreement with those obtained by Appler and Jounce (1983) who found that the digestibility of diets containing different levels of algae was fairly high, while the diet containing 25% algae was low. They added also

that the digestibility was 86.6% for diets containing 20% algae, 94% for diet contained 5% algae. They reported also that the digestibility decreased by increasing algae in fish diets.

Generally, the results obtained indicated that inclusion of 10 to 15 % of microalga Scenedesmus sp. in the fish diets improved physiological performance and digestibility coefficient of Nile tilapia fingerlings

REFERENCES

1. A. O. A. C. 1990. Official Methods of Analysis. Association of Official Agricultural Chemists. 15th. Ed. Washington, D.C., U.S.A.
2. Abu-Rezq, T., K. Abdul – Elah, R. Duremdez, A. Al-Marzouk, C. M. James, H. Al-gharabally and J. Al-Shimmari. 2002. Studies on the effect of using the rotifer, *Brachionus plictilis*, treated with different nutritional enrichment media and antibiotics on the growth and survival of blue-fin sea bream, *Sparidentex hasta* (Valenciennes), larvae. Aquaculture Research, 33: 117-128.
3. Appler, H. N. and K. Jauncey. 1983. The utilization of filamentous green algae (*Claddophara glomerata* (1) kutzin) as a protein source in pelleted feeds for Tilapia, *Saratherodon niloticus* Fingerlings. Aquaculture, 30: 21-30.
4. Becker, E.W. 1978. The legislative back ground for utilization of micro algae and other types of single cell protein. Arch. Hydrobiol. Beih. Ergebn. Limnol. 56-64.
5. Brune, H. 1980. Micro algae for the nutrition of man and animals, results and problems; pric. 2nd. Egypt. Algae symp. Cairo; p.85-110
6. Brune, H. and O. P. Walz. 1978. Studies on some nutritive effects of the green algae, *Scenedesmus acutus*, with pigs and broilers Arch. Hydrobiol. Beih. Ergben. Limnal., 11:79-88.
7. D'Souza, F.M.L., D. Lecossis, M. P. Heasman, J. A. Diemar, C. J. Jackson and R. C. Pendrey. 2000. Evaluation of centrifuged micro algae concentrates as diets for *Penaeus monodon fabricius* larvae. Aquaculture Research, 31: 661-670.
8. Dawah M. A., A. N. Ibrahim H. M. and Eladel. 2002. Amino acids content of *Chlorella vulgaris* and *Scenedesmus bijuga* raised on domestic sewage and agricultural drainage water. 1st Scientific Conference of the Egyptian Aquaculture Society. El-Arish, North Sinai, Egypt.
9. El-Fouly, M. M., F. E. Abdessa, F. K. EL-Baz and A. F. A. Fawzi. 1980. Mass production of micro algae in the National Research Center. Pric. 2nd. Egypt. Algae symp, Cairo, pp. 111-134.

10. Farrell, D. J. 1993. Ones designer egg: recent advances. Recent advances in animal nutrition in Australia (edited by farress, C.J) 291-302, 39 ref. Armidale, Australia, University of New England.
11. Faskin, E. A., A. M. Baloigun and B. E. Fasuru. 1999. Use of duckweed, *Sprirodela polyrrhiz* L. Schleiden as a protein feedstuff in practical diets for tilapia, *Oreochromis niloticus* L. Aquaculture Research 30: 313-318.
12. Fletcher, D. J. 1984. Plasma glucose and plasma fatty acids levels of *Limonda limonda* (L) in relation to season, stress, glucose and nutritional state. Fish. Biol., 25 (6): 629-648
13. Grove, T. H. 1979. Effect of reagent PH on determination of high density lipoprotein cholesterol by precipitation with sodium phosphotungstate magnesium. Clin chem. 95, 23-29.
14. Henry, R. J. 1974. Clinical chemistry principles and techniques, 2nd edition. Harperrand Row, 525 pp.
15. Hidalgo, F., E. Alliot and H. Thebault. 1987. Influence of water temperature on food intake, food efficiency and gross composition of juvenile Sea bass, *Dicentrarchus Labrox*. Aquaculture, 64: 199-207.
16. Ibrahim, N. A. 2001. Effect of phytoplankton (*Chlorella vulgaris* and *Scenedesmus spp.*) Inoculation on water Quality for Tilapia culture by Urea and Super phosphate. Ph. D. thesis, Faculty of Agriculture, Cairo University.
17. Josephson, B. and A. Gyllensward. 1975. Determination of plasma total protein (T. protein Kit).Scand. Clin. Lab. Invst, 9 : 29.
18. Khattab, Y. A. 1996. Some studies on Fish growth. Ph.D Thesis, Fac. of Agric, Zagazig University, Egypt.
19. Mecdowell, L. R., L. C. Lizama, J. E. Marion and C. J. Wilcox. 1990. Utilization of Aquatic plants *Elodea canadensis* and *Hydrilla verticillata* in diets for laying Hens. 1. Performance and Egg-Yolk pigmentation. Poultry Science 69: 673- 678.
20. Nakagawa, H., H. Kumai, M. Nakamura and S. Kasahara. 1985. Effect of algae supplemented diet on serum and body constituents of cultured yellowtail. Bulletin - of - the – Japanese - society - of – scientific fisheries, 51(2) 279-286 pp.
21. Nandeesha, M. C., B. Gangadhar, T. J. Varghese and P. Keshavanath. 1998. Effect of feeding *Spirulina platensis* on the growth, proximate composition and organoleptic quality of common carp, *Cyprinus carpio* L. Aquac. Res. 29: 305-312.
22. National Research Council (NRC) 1993. Nutrition requirements of fish. National Academy Press, Washington C.U.S.A.
23. Olvera- Novoa, M. A., L. J. Daminguez-Cen, Olivera-Castillo, A. Carlos and Martinez- palacios. 1998. Effect of the use of the micro algae *Spirulina maxima* as

fish meal replacement in diets for tilapia, *Oreachromis mossambicus* (Peters) fry. Aquac. Res., 29: 709-715.

24. Pereira, T. O. B., M. A. Reis- Henriques, Z. T. L. Sanche and T. M. Costa. 1998. Effect of protein source on the reproductive performance of Rainbow trout, *Oncohynchus mykiss* (Walbaum). Aquac. Res., 29: 751-760.
25. Reitman, S. and S. Frankel 1975. Calorimetric method for determination of plasma ASAT and ALAT activity. Clinical Path. 28:56.
26. Schreck, C. B. and P. B. Moyle. 1990. Methods for fish biology. American fisheries society. Bethesda, Maryland, USA.
27. Shalaby, N. I. 2000. Chemical and environmental studies on farm fish. M.Sc. Thesis, Biochem. Dept, Fac. Agric, Zagazig Univ., Egypt.
28. Soeder, C. T. 1980. Chemical composition of micro algal biomass as compared to some other types of single cell protein; proc, 2nd .Egypt, Algae Symp. Cairo.
29. Statistical Analysis Systems (SAS) 2000. SAS program Ver. 6. 12, SAS institute incorporation. Cary. NC 27513 USA.
30. Trinder, P. 1969. Determination of plasma uric acid and glucose (uric acid and glucose Kits) Ann.Clin.Biochem., 6:24.
31. Uchida, M. and M. Murata. 2002. Fermentative preparation of single cell detritus from seaweed *Undaria pinnatifida*, suitable as a replacement hatchery diet for unicellular algae. Aquaculture. 207: 345-357.
32. Wahlefeld, A. W. 1974. IN Methods of Enzymatic Analysis, Vol 5, HU Bergmeyer, Ed. Academic Press, New York. Pp.1831-1835.
33. Zaghloul, K. H. 1997. Studies on the effect of water pollution along different studies of the river Nile on the survival and production of some fresh water fishes. Ph.D. Thesis, Fac. Science, Cairo Univ., Egypt.

تأثير التغذية بمستويات مختلفة من الطحلب الدقيق سينديسميس على الأداء الفسيولوجي والهضم فى إصبعيات اسماك البلطى النيلى

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٢. *المعمل المركزى لبحوث الثروة السمكية بالعباسة- شرقيه.*

تم إجراء هذه الدراسة لمدة ١٢ أسبوع تلاها تجربة هضم لمدة أسبوعين. أستخدم فى هذه الدراسة أصبعيات أسماك البلطى النيلى لتقييم إستبدال الطحلب الدقيق سينديسيمس بمسحوق الأسماك فى العلاقة الغذائية المتزنة.العليقه الضابضة كانت بدون طحالب للمقارنة مع المستويات الأخرى (٥، ١٠، ١٥، ٢٠% طحلب). كل العلائق كانت متساوية فى المحتوى البروتينى (٣٢%) والطاقة الكلية (٤٠٠ كيلو كالورى لكل ١٠٠جم عليقه).

الأسماك المغذاة بتركيز ١٥% طحلب أعطت زيادة فى دليل الكبد (٣,٠٤) بينما لم يوجد اختلافات بين المعاملات فى دليل القناة الهضمية والتى كانت فى المدى من ٥,٥١الى ٦,١٩ الأسماك المغذاة بتركيز ١٥% طحلب أعطت أقل قيم للكرياتينى 0.50 mg/dl ثلاثى الجليسريدات 48.0 mg/dl ، وأعلى قيم البروتين الكلى 5.9 g/dl ، والهرمون المشجع لنمو الحويصلات (F.S.H) 0.25 pg/ml فى بلازما دم الأسماك. بينما العليقه الضابضة أعطت أقل قيمه لحمض اليوريك 2.6 mg/dl. أيضاً العليقة المحتوية على تركيز ١٠% طحلب أعطى أعلى قيم لإنزيمات الترانسى أميني G.P.T. 55.0 mg/dl S.G.O.T 50.0 mg/dl. ،واقل قيم الكولسترول100.0 mg/dl ، الجلوكوز57.0 mg/dl والكثافات المنخفضة من الليبوبروتين 46.0 mg / dl. اما العليقه المحتوية ٥% طحلب أعطت اقل قيمة فى الكثافات المرتفعة من الليبوبروتين 35.0 mg / dl فى بلازما الأسماك. الأسماك المغذاة ١٥% طحلب أعطت زيادة فى معامل هضم المادة الجافة(92.5) ، البروتين الخام(87.63) ، مستخلص الدهن (88.45) والطاقة الكلي (81.41) بينما لم توجد فروق معنوية بين المعاملات فى هضم المستخلص الخالى من النيتروجين (72.07). يتضح أن :احتواء عليقه البلطى النيلى على ١٠ إلى ١٥% طحالب يحسن من دليل الأعضاء وصفات الدم و معاملات الهضم.