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EFFECTS OF BIOGENIC L-CARNITINE SUPPLEMENTATION ON GROWTH PERFORMANCE, SURVIVAL RATE AND FEED EFFICIENCY OF MONOSEX NILE TILAPIA (*Oreochromis niloticus* L.) FRY DURING THE NURSERY PERIOD

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SUMMARY

The effects of biogenic L- carnitine were evaluated using diets fed to monosex Nile tilapia (*O. niloticus* L.) fry (0.27 ± 0.001g) during a single- stage nursery- rearing system. The basal diet contained 36.7% crude protein. Four dietary treatments contained L- carnitine concentrations of either 0, 400, 700 or 1000 mg/kg diet. Dietary treatments were fed at a rate of 10% of the total biomass during (1st and 2nd months) then reduced to 5% of total biomass till end of the experiment (105- days) and fish were fed 6 days/ week (twice daily). Each experimental treatment was represented in two replicate groups.

At the end of 15th week of experimental period, body weight of fish fed 1000 mg L- carnitine /kg diet were significantly ($P< 0.001$) higher compared to the other groups for monosex Nile tilapia *O. niloticus* fry. However, there were no significant ($P> 0.05$) differences in body weight among fish fed 0 and 400 mg/kg diet.

Specific growth rate (SGR) was significantly increased in groups fed dietary L-carnitine at 700, 1000mg / kg diet levels compared to the control group. Weight gain was significantly increased in groups fed L- carnitine at 400, 700 and 1000 mg/kg diet levels compared to the control group. Feed conversion ratio was significantly improvement in all groups supplemented with biogenic L- carnitine. Fish fed diets with 1000 mg/kg diet (T_4) or 700 mg/kg diet (T_3) had a higher significant ($P<0.05$) condition factors and survival rate. No significant ($P>0.05$) differences in body composition between fish in all groups supplemented with L- carnitine, which were almost similar at the end of the rearing period.

Results of this study suggested that using biogenic L- carnitine at concentration of 700 and 1000 mg/kg diet could be a positive factor (improve growth and survival rate) for monosex Nile tilapia fry during a single-stage nursery-rearing system, that produce fingerlings in least time with lowest mortality in order to became more available healthy fingerlings at the beginning of the culture season for fish farmers. From the economic point of view, L- carnitine supplementation in fish diets at a dose of 700 or 1000 mg/ kg diet was the most cost- effective.

***Keywords**: Nile tilapia, L-carnitine, growth performance survival rate, feed efficiency*

INTRODUCTION

L-carnitine (γ-trimethylamino- β-hydroxybutyrate) is synthesized in vivo from lysine and methionine. L-carnitine as supplements is a vitamin- like nutrient, has attracted many researchers for decades because of its important function in fostering the oxidation of long- chain fatty acids by the mitochondria and stimulating protein- sparing action by increasing energy derived from lipids, (Emaus and Bieber, 1983). From early research in fish by Bilinski and Jonas (1970) to more recent years, L-carnitine related studies were carried out on more than 15 fish species. Although conflicting results were created, most of the studies demonstrated that L-carnitine administration ameliorates fish growth performance, stress tolerance and reproduction, also reduces body fat content and stimulates lipid metabolism (Santulli, *et al.* 1988; Harpaz, *et al.* 1999; Dzikowski, *et al.* 2001; Ozorio, *et al.* 2001, Zhang, *et al.* 2002).

In studies to date, one of the most common explanations for the mechanism to improve feed utilization is the more efficient utilization of energy from fatty acids. This has been confirmed in part in short-term trails with fish. More recent studies give rise to the theory that the bio- availability of endogenous L-carnitine may be reduced when thermal stress places increasing demands on the fishes metabolism (Schreiber, *et al.* 1997) or when pronounced differences occur in biochemical, physiological and physical activities as in the case of distinct fish life- cycle stages (Cake, *et al.*, 1998). On the other hand Schreiber, *et al.*, (1996, 1997) found that better survival of offspring and improved integrity of cell membranes against the ingress of xenobiotics in guppies, *Poecilia reticulate* supplemented with L-carnitine (1000 ppm L-carnitine fish). The effect of dietary L-carnitine on growth rate, survival and body composition has been reported in several species of fish with different results. Accordingly, this study aimed to evaluate the effect of dietary L-carnitine on growth performance survival and feed efficiency of monosex Nile tilapia (*O. niloticus* L.) fry during a single- stage nursery- rearing system.

MATERIALS AND METHODS

Location :

The present study was carried out at the hatchery of Arab Fisheries Company at Abbassa village, Abu-Hammad, Sharkia Governorate, Egypt to represent four treatments with two replicates each. Eight circular fiberglass tanks 180 liter volume each were used. The tanks were on a flow- through system at 100%/day water exchange to avoid any harmful effect of water quality parameters.

Experimental procedure :

Circular fiber glass tanks were stocked at the rate of 50 monosex Nile tilapia *(O. niloticus* L.*)* fry per tank. Composition and proximate analysis of the experimental diet is presented in Table (1).

Monosex Nile tilapia *(O. niloticus* L.*)* fry were grouped into control and three levels of dietary carnitine (Arab Company for Pharmaceuticals & Medical plants – MEPACO - Egypt) at concentrations of 400, 700, 1000 mg/kg diet during the experimental period (105-days).

Fish were given the mash prepared diet (36.7% CP) at a daily rate of 10% of total biomass (during the 1^{st} and 2^{nd} months) then it reduced to 5% of total biomass till end of the experiment (105-days). Fish were fed the experimental diets 6 day/week (twice daily at 9.00 am and 3.00 pm). The amount of feed was bi-weekly adjusted according to the changes in body weight throughout the experimental period (105-days).

Records of live body weight (BW) and body length (BL) of individual fish were measured at the start and the end of the experimental period for each tank.

Table (1): Formulation and chemical composition of experimental diet.

Feed ingredients, %	**Experimental diet**
Fish meal (72% CP)	18
Yellow corn (9% CP)	18
Soybean meal (44%	46
Wheat bran (15% CP)	12.5
Starch	2
Vegetable oil	1.5
Vit. & Min. mixture [1]	2.0
Total	100
Chemical composition (on DM basis)	
Dry matter (DM)	93.75
Crude protein (CP)	36.7
Ether extract (EE)	10.01
Crude fiber (CF)	6.7
Ash	8.04
NFE[2]	38.55
L- carnitine mg /kg	0 400 700 1000

[1]Vitamin & mineral mixture/ kg premix : Vitamin D_3, 0.8 million IU; A, 4.8 million IU; E, 4g; K, 0.8g; BI, 0.4g; Riboflavin, 1.6g; B6, 0.6g, B12, 4mg; Pantothenic acid, 4g; Nicotinic acid, 8g; Folic acid, 0.4g Biotin, 20 mg, Mn, 22g; Zn, 22g; Fe, 12g; Cu, 4g; I, 0.4g; Selenium, 0.4 g and Co, 4.8 mg.

[2] NFE= nitrogen free extract (calculated by difference).

Growth performance parameters were measured by using the following equations.

Specific growth rate (SGR) =

$$\frac{Ln W_2 - Ln W_1}{t} \times 100$$

Where: Ln = the natural log, W_1 = intial weight (g), W_2 = the final fish weight in "grams" and t= period in days.

Relative growth rate (RGR) =

$$\frac{W_2 - W_1}{W_1}$$

Where : W_1 = initial weight and W_2 = final weight in "grams"

Mass weight gain (WG)= final weight (g) - initial weight (g)

Condition factor (K) = weight $/(L)^3 \times 100$

Feed conversion ratio (FCR) = feed ingested (g)/ weight gain(g)

Protein efficiency ratio (PER)= weight gain (g)/ protein ingested (g)

Chemical analysis :

Dry matter (DM), ether extract (EE), crude protein (CP), ash contents of the diet and whole fish body were determined according to the methods described in AOAC (1998).

Statistical analysis :

The statistical analysis of data was carried out by applying the computer program, SAS (2000) by adopting the following model .

$$Y_{ijk} = \mu + R_i + \alpha_j + E_{ijk}$$

Where, Y_{ijk} = the observation on the ijkth fish eaten the jth diet for the ith replicate; μ = overall mean, R_i= the effect of ith replicate; α_j = the effect of jth diet and E_{ijk} = random error.

Differences among means were tested for significance according to Duncan's multiple range test (1955).

RESULTS AND DISCUSSION

Growth performance :

All fish had almost similar body mass at the start of the experiment (0.27 ± 0.001) as presented in Table (2). Live body weight increased significantly (P<0.001) in fish groups fed L-carnitine at 1000 mg/kg diet compared to control groups. While no significant differences (P>0.05) were detected between the fish on the 400 mg L-carnitine/kg diet and control. These results are in agreement with Twibell and Brown (2000) who found that dietary L-carnitine has also been shown to increase growth rates in juvenile hybrid striped bass.

Jayaprakas, *et al.*, (1996) also observed an enhancement in growth which was not due to an increase in feed uptake but results from better feed conversion when 150 mg L-carnitine/kg diet was fed to the other tilapia *(Oreochromis mossambicus)*. Moreover, Zhang, *et al.*, (2005) suggested that L-carnitine could be a positive factor to enhance reproduction and population growth on enriched rotifers directly and/or indirectly under the optimum concentration (100mg/L).

Also, the present results indicated that a positive effect on growth (41.48% higher than the control) was observed when 1000 mg L-carnitine/kg diet was added to the grow- out diet. Similarly, Azab, *et al.* (2002) observed that L-carnitine (900mg/kg diet) caused a significant increase in body weight of Nile tilapia.

Values of condition factor (k) as shown in Table (2) had ranged between 1.78 to 2.08 with insignificant differences (P>0.01) between 1000 mg/kg and 700 mg/kg. While fish of control showed the least value as compared to the other three treatments.

Survival rate (SR) during the whole experimental period (0-105 days) were

Table (2): Effects of biogenic L- carnitine on growth performance parameters (mean ± SE) on monosex Nile tilapia (*O. niloticus*) .

Stages	Treatments (mg L-carnitine/kg diet)				
	T_1 (0)	T_2 (400)	T_3 (700)	T_4 (1000)	Significance
Initial body weight/fish (g)	0.27 ±0.001	0.27 ±0.001	0.27 ±0.001	0.27 ±0.001	NS
Initial body length /fish(cm)	2.35 ±0.03	2.35 ±0.05	2.37 ±0.03	2.36 ±0.03	NS
15- day post stocking	0.53 $\pm0.11^{a}$	0.56 $\pm0.02^{a}$	0.47 $\pm0.012^{b}$	0.46 $\pm0.01^{b}$	*
30- day post stocking	0.90 $\pm0.018^{b}$	0.97 $\pm0.015^{b}$	0.98 $\pm 0.015^{b}$	1.57 $\pm0.048^{a}$	*
45- day post stocking	1.22 $\pm0.038^{d}$	1.49 $\pm0.05^{c}$	2.26 $\pm0.044^{b}$	3.05 $\pm0.08^{a}$	***
60- day post stocking	1.93 $\pm0.05^{c}$	2.01 $\pm0.06^{c}$	2.7 $\pm0.06^{b}$	4.2 $\pm 0.11^{a}$	***
75- day post stocking	3.26 $\pm0.05^{c}$	3.22 $\pm0.05^{c}$	3.62 $\pm0.07^{b}$	5.15 $\pm0.14^{a}$	***
90- day post stocking	5.08 $\pm0.08^{c}$	6.18 $\pm0.12^{c}$	6.52 $\pm0.1^{b}$	7.78 $\pm0.13^{a}$	***
105- day post stocking	7.49 $\pm0.07^{c}$	7.7 $\pm0.12^{c}$	9.49 $\pm0.13^{b}$	12.8 $\pm0.13^{a}$	***
Final body length /fish (cm)	7.50 $\pm0.04^{c}$	7.50 $\pm0.08^{c}$	7.81 $\pm0.11^{b}$	8.51 $\pm0.08^{a}$	***
Daily weight gain (g/day/fish)	0.069 $\pm0.0001^{c}$	0.071 $\pm0.0001^{c}$	0.088 $\pm0.0001^{b}$	0.119 $\pm0.0001^{a}$	**
S.G.R.	3.16 $\pm0.11^{b}$	2.90 $\pm0.12^{b}$	3.39 $\pm0.12^{ab}$	3.68 $\pm0.13^{a}$	*
R.G.R.	26.74 $\pm0.12^{c}$	27.52 $\pm0.12^{c}$	34.15 $\pm0.12^{b}$	46.41 $\pm0.13^{a}$	***
Final condition factor	1.78 $\pm0.009^{c}$	1.83 $\pm0.01^{b}$	1.99 $\pm0.009^{a}$	2.08 $\pm0.08^{a}$	**
Survival rate %	78.0 $\pm0.1^{c}$	82.0 $\pm0.09^{b}$	89.0 $\pm0.10^{a}$	93.0 $\pm0.10^{a}$	**

a, b, c, d means within each raw having different letters are significantly different at (P<0.05) otherwise they are not

NS= non significance * = P < 0.05 ** = P < 0.01 ***= P < 0.001

78.0%, 82.0%, 89.0% and 93.0% for control, 400 mg/kg diet, 700 mg/kg diet and 1000 mg L-carnitine/kg diet, respectively (Table 2). The best value (93.0%) was obtained by T_4 while the worst SR (78.0%) was observed for T_1 (control). Although the SR of T_4 was numerically better than that of T_1, with significant difference ($P \leq 0.05$). There were insignificant differences ($P \geq 0.05$) between SR of T_4 and T_3, and between SR of T_3 and that of T_2 (Table 2). These results are in agreement with those obtained by Schreiber, *et al.* (1996, 1997) who found that better survival of offspring and improved integrity of cell membranes against the ingress of xenobiotics in guppies, *Poecilia reticulata* fed diets supplemented with L-carnitine (1000 ppm L-carnitine fish).

Averages of daily gain in weight (DWG) during the experimental period were 0.069, 0.071, 0.088 and 0.119g for the T_1, T_2 , T_3 and T_4, respectively and the differences between these values where significant ($P<0.01$). These results gave evidence that the increased dose of L-carnitine significantly increased DWG of Nile tilapia. Also, the same trend was observed for the relative growth rate RGR during the experimental period. The same findings were reported by Azab, *et al.* (2002) who cleared that weight gain was significantly increased in groups fed L-carnitine 300, 600 and 900 mg/kg diet at 10 and 15 % dietary lipid levels. These results are not in agreement with those obtained by Harpaz, *et al.* (1999) who observed that L-carnitine at the level of 500 mg/kg diet caused a better growth rate in Ornamental Cichlid fish, while L-carnitine at the level of 1000 and 2000 mg/kg diet reduced growth performance.

Results of Table (2) also showed that, specific growth rate SGR of (*O. niloticus* L.) insignificantly changed until the dose of dietary L-carnitine reached 400 mg/kg diet, after this dose SGR was significantly ($P<0.05$) increased. These results may be due to the enhancement of feed conversion ratio of the diets when supplemented with L-carnitine. The same findings were reported by Azab, *et al.* (2002) who found that SGR was significantly increased in groups fed dietary L-carnitine 600, 900 mg/kg diet at 10 and 15% dietary lipid levels. In this connection, Becker, *et al.* (1999) observed that, L-carnitine increased tilapia growth.

Feed utilization :

Average of feed conversion ratio (FCR) (g of feed per g of live mass gain) during the whole experimental period had ranged from 1.79 to 2.15 (Table 3). The best rate was recorded with T_4 (1000 mg L-carnitine/kg diet) where only 1.79kg of feed was required to produce one kilogram of live fish weight gain. While the worse rate (2.15) was obtained when fish fed T_1 (0 mg/kg diet). FCR decreased (improved) gradually with increasing the level of dietary L-carnitine with significant ($P<0.001$) differences between fish groups fed the experimental tested diets. These results are in partial agreement with those of Zou, *et al.* (2005) who suggested that dietary L-carnitine may influence the process of lipid packaging and absorption by the enterocyte in Ovariectomized rats, and may explain in part the increased status of α- Tocopherol in L- carnitine fed animals. From our findings we can clearly demonstrate that supplementation with L-carnitine enables the fish farmer to save 0.36kg feed per kg body weight gain, i.e. 16.74% less than the feed needed for the control group (unsupplemented). This aspect is of practical importance for the fish farmer both from an ecological and economic point of view. Although L-carnitine is an expensive substance, the saving of

Table (3): Effects of different doses of L-carnitine on the growth performance and feed efficiency (mean±SE) of monosex Nile tilapia .

Traits	Treatments (mg L-carnitine/kg diet)				
	T_1 (0)	T_2 (400)	T_3 (700)	T_4 (1000)	Significance
Initial body weight/fish (g)	0.27±0.001	0.27±0.001	0.27±0.001	0.27±0.001^{a}	NS
Final body weight /fish (g)	7.49±0.07^{c}	7.7±0.12^{c}	9.49±0.13^{b}	12.80±0.13^{a}	***
Mass weight gain (g)	7.22±0.13^{c}	7.43±0.11^{c}	9.22±0.10^{b}	12.53±0.11^{a}	***
Total feed intake (g/fish)	15.49±0.13^{bc}	16.45±0.13^{b}	17.53±0.13^{b}	22.44±0.12^{a}	*
Feed conversion ratio	2.15±0.01^{a}	2.21±0.01^{a}	1.90±0.01^{b}	1.79±0.01^{c}	***
Protein efficiency ratio	1.27±0.01^{c}	1.23±0.01^{c}	1.43±0.01^{b}	1.52±0.01^{a}	***

a, b, c means within each raw having different letters were significantly different at (P<0.05) otherwise were not
NS= non significance * = P < 0.05 ** = P < 0.01 ***= P < 0.001

Table (4): Effects of different doses of biogenic L-carnitine on whole body composition (mean ± SE) Nile tilapia .

Traits	Treatments (mg L-carnitine/kg diet)				
	T_1 (0)	T_2 (400)	T_3 (700)	T_4 (1000)	Significance
Dry matter (%)	18.5±0.81^{a}	18.7±0.81^{a}	18.7±0.81^{a}	18.9±0.81^{a}	NS
Protein (%)	50.21±2.21^{ab}	50.51±2.21^{ab}	52.11±2.21^{a}	53.2±2.21^{a}	NS
Ether extract (%)	24.11±1.15^{a}	24.11±1.15^{a}	23.71±1.15^{a}	24.51±1.15^{a}	NS
Ash (%)	25.67±1.25^{a}	25.36±1.25^{a}	24.15±1.25^{a}	22.30±1.25^{a}	NS

a, b means within each raw having different letters were significantly different at (P < 0.05) otherwise they are not
NS = non significance

0.36kg feed is equivalent to 0.76 L.E. but the cost required to produce these savings (1000mg/kg × 1.79 kg feed) amount to only 0.107 L.E. These findings are in agreement with those reported by Azab, *et al.* (2002) who found that FCR was significantly decreased in all groups supplemented with L-carnitine. Also, Becker, *et al.* (1999) observed that L-carnitine significantly ($P<0.05$) improved FCR in fish groups fed (105 and 300 mg/kg diet) compared with control groups.

During the whole experimental period, protein efficiency ratios PER were 1.27, 1.23, 1.43 and 1.52 for T_1, T_2, T_3 and T_4 groups, respectively. PER increased gradually with increasing the dose of L-carnitine in tested diets with significant ($P<0.001$) differences between fish groups. In this concern Becker, *et al.* (1999) found that dietary L-carnitine increased tilapia growth ($P>0.005$) and PER ($P<0.05$)

Body composition :

Table (4) showed that L-carnitine caused no significant differences in moisture, protein, fat and ash percentage in groups fed L-carnitine 0, 400, 700 and 1000 mg/kg levels in the diet. In this aspect, several authors found that, dietary carnitine did not alter tissue composition of hybrid striped bass (Twibell and Brown, 2000) or hybrid tilapia (Becker, *et al.* 1999). In contrast, dietary carnitine reduced tissue lipid concentrations in robu (Keshavanath and Renuka, 1998) and tilapia (Jayaprakas, *et al.* 1996).

Economical efficiency :

The current investigation give high lights on the potential of using biogenic L-carnitine in Nile tilapia diets. Generally, results of the present study showed the possibility of adding L-carnitine by the dose of 700 or 1000 mg/kg diet to improve the growth performance and feed utilization for Nile tilapia fry during a single- stage rearing period. Feeding costs in fish production is about 50% of the total production costs (Collins and Delmondo, 1979). All other costs in the present study are constant, therefore, the feeding costs required to produce one kg gain in weight could be used to compare the different experimental treatments. The calculated figures (Table 5) showed that, the cost of one ton feed mixture was increase in all treatments by adding different doses of biogenic L-carnitine. Adding 400 mg L-carnitine/kg diet (T_2) could increase feeding costs by 1.14% while adding 1000 mg L-carnitine/kg diet increased feeding costs by 2.86%.

On the other hand, as shown in (Table 5) (feed costs required to produce 1 kg gain in weight) decreased by feeding L-carnitine- diets. In the control diet, one kg of Nile tilapia required 4.52 LE for feeding. While using L-carnitine in Nile tilapia diets caused a reduction of incidence cost by 90.04 and 85.62% of the control group for Nile tilapia fed 700 and 1000 mg L-carnitine/ kg diet, respectively (Table 5) while the highest incidence cost (4.69%) was obtained by T_2 (400 mg L-carnitine/kg diet).

These results may be due to the potential of L-carnitine in improvement of the digestibility's of protein, enhancement of growth and feed conversion (Azab *et al.* 2002).

Results of economic evaluation (Table 5) indicated that the highest total cost (37.38 L.E./m^3) was for T_4 followed in a descending order by T_3, (34.33 L.E/ m^3) and T_2 (33.61L.E./m^3). The lowest total cost (32.95L.E./m^3) was recorded through T_1 group due to the absence of L-carnitine in the diet (Table 5). Net returns on L.E./m^3 were 10.45, 11.99, 22.48 and 35.14 L.E. for T_1, T_2, T_3 and T_4 groups, respectively.

Table (5): Economical evaluation of the experimental treatments

Item	Treatments (mg L-carnitine/kg diet)			
	T_1 (0)	T_2 (400)	T_3 (700)	T_4 (1000)
Stocking rate (No/m^3)	278	278	278	278
Average size at stocking (g)	0.27	0.27	0.27	0.27
Average size at harvest (g)	7.49	7.70	9.49	12.80
Total weight gain (g/fish)	7.22	7.43	9.22	12.53
Survival rate (%)	78.0	82.0	89.0	93.0
Total No. at harvest/ m^3	217.0	228	247	259
A- operating costs				
Fish fry 50 LE/ 1000 fry	13.9	13.9	13.9	13.9
Cost of one ton (L.E)	2100	2124	2142	2160
Relative to control (%)	100	101.14	102.00	102.86
Increase in feed cost (L.E/ton%)	0.00	1.14	2.00	2.86
Feed intake (g feed/fish)	15.49	16.45	17.53	22.44
Total food (kg/m^3)	4.31	4.57	4.87	6.24
Cost of food/m^3 (L.E)	9.05	9.71	10.43	13.48
Screen, pump and labor L.E. /m^3	10.0	10.0	10.0	10.0
Total costs/m^3 (L.E)	32.95	33.61	34.33	37.38
Feed conversion ratio (FCR)	2.15	2.21	1.9	1.79
Feed cost to produce 1kg fish (L.E)	4.52	4.69	4.07	3.87
Relative to control (%)	100.0	103.76	90.04	85.62
B- Total returns/m^3 (L.E.)	43.4	45.6	56.81	72.52
Net returns/ m^3	10.45	11.99	22.48	35.14
C- Net returns to operating cost	31.71	35.67	65.48	94.01

Local market price of feed and fingerlings when the experiment was done
L-carnitine 60000 L.E./ton
Fingerling by weight of 7.0-7.5g 200 L.E./1000
by weight of 9.0 – 9.5 g 230 L.E./1000
by weight of 12.0 – 12.5 g 280 L.E./1000
feed cost to produce 1 kg fish = Feed price × FCR

Percentages of net returns to total costs for different treatments were 31.71, 35.67, 65.48 and 94.01% for T_1, T_2, T_3 and T_4, respectively. These results indicated that the highest returns were reached by fish of T_4 (1000mg L-carnitine/kg diet) followed in a descending order by those of T_3 (700 mg L-carnitine/kg diet) and T_2 (400 mg L-carnitine/ kg diet). The lowest net return was recorded by fish of T_1 (control) which may be due to the absence of L-carnitine added to the diet.

RECOMMENDATION

The obtained results showed L-carnitine at concentrations 700 and 1000 mg/kg diet would improve growth performance, feed efficiency and survival rate of Nile tilapia fry during the rearing (nursery) period. Biogenic L-carnitine could be used at a dose of either 700 or 1000 mg/kg diet for Nile tilapia fry during a single-stage nursery- rearing system, that produce fingerlings of Nile tilapia in least time with lowest mortality in order to became more available healthy fingerlings at the beginning of the culture season for fish farmers.

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تأثير إضافة الكارنتين علي أداء النمو ومعدل الاعاشة وكفاءة التحويل الغذائى في يرقات أسماك البلطي النيلي وحيد الجنس خلال فترة الرعاية

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في هذه الدراسة تم تقييم تأثير الكارنتين علي كفاءة النمو ومعدلات الإعاشة وكفاءة تحويل الغذاء في يرقات اسماك البلطي النيلي وحيد الجنس (بمتوسط وزن 0.27جم) خلال فترة الرعاية وقد تم إضافة الكارنتين إلي العليقة (36.7% بروتين خام) بثلاث جرعات 400 ، 700 ، 1000 ميللجرام /كجم عليقة بالإضافة إلي العليقة الضابطة (كنترول) تم تغذية اليرقات بمعدل 10% من وزن الجسم وذلك خلال الشهر الأول والثاني ، بعد ذلك تم اختزال هذا المعدل إلي 5% وذلك حتى نهاية فترة الدراسة (105يوم) . وتم تغذية الأسماك 6 أيام / أسبوع (مرتين في اليوم) . تمثلت كل معاملة في مكررين وفي نهاية فترة الدراسة أظهرت النتائج ما يلي :

- زاد وزن الجسم زيادة معنوية (P<0.001) في المجموعات المضاف إليها الكارنتين بنسبة 1000 ملليجرام / كجم عليقة مقارنة بباقي المجموعات بينما لا يوجد هناك أى اختلافات معنوية (P>0.05) بين المجموعتين صفر ، 400 ملليجرام كارنتين . كذلك زاد معدل النمو النوعي في المجموعات المضاف إليها الكارنتين بنسبة 700 ، 1000 ملليجرام / كجم عليقة
- زاد معدل النمو النوعي SGR زيادة معنوية في المجموعات المضاف إليها الكارنتين بنسبة 700 ، 1000 ميللجرام / كجم عليقة مقارنة بالمجموعة الضابطة (كنترول). تحسنت قيم معدل تحويل الغذاء FCR في كل المجموعات المضاف إليها الكارنتين بالمقارنة بالمجموعة الضابطة (كنترول) . كذلك تحسنت قيم كل من معامل الحالة ومعدلات الإعاشة (P≤)في المجموعات المضاف إليها الكارنتين بنسبة 700 ، 1000 ملليجرام / كجم عليقة مقارنة بالمجموعات الأخرى .
- أما بالنسبة لتأثير الكارنتين علي مكونات الجسم (بروتين ، دهن ، رماد) فكانت غير معنوية (P>0.05) .

ومن هذه النتائج يمكن استخلاص أن إضافة الكارنتين إلي علائق يرقات اسماك البلطي النيلي وحيد الجنس خلال فترة الرعاية بمعدل 700 ، 1000 ملليجرام / كجم عليقة قد يؤدي إلي زيادة في وزن الجسم ومعدل النمو وكذلك تحسن في معامل الحالة ومعدل تحويل الغذاء FCR وزيادة معدل الإعاشة وبذلك يمكن إنتاج إصبعيات البلطي النيلي وحيد الجنس بأقل وفيات وكذلك في اقل وقت ممكن (فترة الرعاية) وبذلك تصبح متوافرة أكثر في الوقت المناسب وبالكميات المناسبة (موسم الاستزراع) .

وأظهر التحليل الاقتصادي أنه علي الرغم من أن إضافة الكارنتين في علائق البلطي النيلي وحيد الجنس يزيد من التكلفة الغذائية إلا أنه يزيد من الربحية وأن أفضل المعاملات كانت المعاملة الثالثة والرابعة (700 ، 1000 مللجم/ كجم عليقة) لذا يوصى باستخدامها في علائق يرقات البلطي النيلي وحيد الجنس خلال فترة الرعاية وذلك لإنتاج إصبعيات في الوقت المناسب وبالعدد الكافي والذى يفي باحتياجات المزارعين في بداية موسم الاستزراع .