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EFFECT OF DIFFERENT PERCENTAGES OF SEWAGE WATER ON GROWTH PERFORMANCE, SURVIVAL RATE AND FOOD CONVERSION OF NILE TILAPIA *(OREOCHROMIS NILOTICUS)*

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SUMMARY

The effect of sewage water pollution on growth performance, survival rate and food conversion of *O. niloticus* (8.0 cm for total length and 12.0 gm for body weight) was studied for 91 days. The fish were stocked at a density of one fish / 5 liters in glass aquaria (150 liters each). It was observed that the maximum values of final weight, specific growth rate and normalized biomass index (15.4 gm, 3.2 and 6.14 respectively) were observed in aquarium 2 (75 % freshwater and 25 % pollutant water).

The survival rate of rearing fish was gradually decreased with the increasing of sewage water pollution, while the food conversion and condition factor increased. It was also noticed that the fish production reached its highest value (0.95 kg) in the second pollutant level.

INTRODUCTION

Due to the population explosion, the main objective of developing countries today is to improve and develop new sources of food materials. In Egypt fish production has been considered as one of the main goals of the food security. River Nile and its branches are considered among the most important resources of different fish species in Egypt. However, they are often exposed to human wastes, sewage water and various kinds of pollutants.

The sewage pollution effected directly on the growth rate of fish species (Draz et al., 1993) or indirectly on chemical composition of water (Nessim & Tadros, 1988) and natural food organisms for fishes (Ibrahim, 1987). This work was conducted to study the effect of sewage water pollution on the growth performance, survival rate and food conversion of *O. niloticus*.

MATERIAL AND METHODS

The experiment was carried out in 10 glass aquaria (80 x 50 x 50 cm) at a laboratory belonging to El-Kanater El-Khyeria Research Station. Aquaria Nos. 2.3 and 4 were filled with different percentages of fresh and sewage water as been presented in table (1). Aquarium No. 1 is control for the experimentcontain 100 % fresh water and No. 5 contain 100 % pollutant water. Each aquarium was duplicated with the same previous conditions.

The sampling was done weekly from April, first to the end of June, 1998 (91 days). The water temperature and pH value were measured daily before feeding. Dissolved oxygen, alkalinity, ammonia, nitrate, phosphate and silicate were determined using the standard methods described by Arnold et al. (1980).

The total length (Ln) and weight (wt) of *O. niloticus* (15 fish at least) in each aquarium were measured to the nearest cm and gm respectively. The specific growth rate (SGR) was estimated using the formula of Weatherly and Rogers (1978), while the normalized biomass index (NBI) was calculated according to Beck (1979) equation.

SGR=(Ln final wt - Ln initial wt) x 100 / Time (days).

NBI = (Final wt x final No. of fish - Initial wt x initial No.) / 100.

The survival rate, food conversion and condition factor were also determined biweekly for reared fish in each aquarium. The experimental results were analysed statistically using the student's T. test according to Berly and Lindgren (1990).

RESULTS AND DISCUSSION

As shown in table (1) the mean weight of *O. niloticus* fish in aquarium No. 2 (75 % fresh water and 25 % pollutant water) was increased from 12.0 gm to 51.4 gm at the end of experiment. .While in other aquaria the weight was decreased with increasing of sewage water percent. Stastical analysis of the data present in table (1) revealed a high significance increase in the mean weight of *O. niloticus* fish reared in aquarium No. 2 ($p < 0.01$) at the end of experiment. While the increase in the mean weight of fish in other aquaria was not significance ($P > 0.05$).

The results obtained from the previous study may be attributed to that in aquarium No. 2, the chemical compounds and organic matter were suitable to water fertility which lead to elevation of the growth rate of rearing fish than that in aquarium No. 1 (control group). While in aquaria Nos. 3, 4 and 5 the values of chemical compounds and organic matter were higher than

Table 1: Variation of mean body weight value (gm) of *O. niloticus* reared in different levels of sewage water pollution during a period of 13 weeks.

Month	Body wet / Week	Aqua. (1) Control (100 % F. W)	Aqua. (2) 75 % F. W 25 % P. W	Aqua. (3) 50 % F. W 50 % P. W	Aqua. (4) 25 % F. W 75 % P. W	Aqua. (5) 100 % P. W
		M ± SD	M ± SD	M ± SD	M ± SD	M ± SD
April	0	12.0 ± 1.2	12.0 ± 1.2	12.0 ± 1.2	12.0 ± 1.2	12.0 ± 1.2
	1	17.6 ± 2.5	21.0 ± 2.5	13.9 ± 2.4	12.3 ± 1.9	12.3 ± 1.4
	2	18.9 ± 2.7	26.9 ± 3.0	15.1 ± 2.1	14.1 ± 1.9	13.2 ± 1.5
	3	19.8 ± 3.0	29.6 ± 2.8	16.8 ± 1.8	15.9 ± 2.4	14.6 ± 1.3
	4	22.5 ± 3.2	31.8 ± 3.2	18.0± 2.2	18.5 ± 2.3	--
May	5	26.6 ± 3.6	34.5 ± 4.7	21.3 ± 3.1	20.0 ± 1.0	--
	6	28.6 ± 4.4	39.0 ± 2.1	25.8 ± 3.7	25.4 ± 3.0	--
	7	30.8 ± 3.9	41.8 ± 3.3	29.4 ± 3.2	28.2 ± 3.0	--
	8	35.9 ± 4.8	44.7 ± 3.4	31.4 ± 4.9	30.4 ± 1.6	--
	9	36.7 ± 2.4	45.7 ± 1.9	33.9 ± 4.6	33.8 ± 3.9	--
June	10	39.1 ± 1.6	46.7 ± 1.7	34.8 ± 3.0	35.6 ± 3.2	--
	11	40.0 ± 1.4	47.0 ± 0.8	37.0 ± 4.4	36.2 ± 2.3	--
	12	42.8 ± 3.8	50.1 ± 1.4	38.0 ± 2.7	37.3 ± 2.9	--
	13	43.0 ± 2.2	51.4 ± 1.2	39.0 ± 2.6	38.2 ± 2.3	--
Statistical analysis		--	***	*	*	*

F.W = Fresh water
P.W = Pollutant water.

*** high significance.
* non significance.

Table 2: Specific growth rate (SGR) and normalized biomass index (NBI) of *O. niloticus* reared in different levels of sewage water pollution.

Month	Body wet / Week	Aqua. (1) Control (100 % F. W)		Aqua. (2) 75 % F. W 25 % P. W		Aqua. (3) 50 % F. W 50 % P. W		Aqua. (4) 25 % F. W 75 % P. W		Aqua. (5) 100 % P. W	
		SGR	NBI	SGR	NBI	SGR	NBI	SGR	NBI	SGR	NBI
April	1	5.54	1.50	8.08	2.28	2.17	0.29	0.42	-0.40	0.42	-0.89
	2	3.28	1.69	5.80	3.66	1.68	0.18	1.17	-0.22	0.72	-2.02
	3	2.41	1.94	4.32	4.10	1.63	0.43	1.36	0.06	0.96	-3.45
	4	2.26	2.48	3.50	4.35	1.47	0.54	1.56	0.47	--	--
	5	2.29	3.58	3.01	5.03	1.65	1.09	1.50	0.64	--	--
May	6	2.08	4.12	2.82	6.15	1.83	2.08	1.80	1.48	-	--
	7	1.93	4.72	2.56	6.85	1.84	2.87	1.75	2.00	--	--
	8	1.97	6.09	2.36	7.59	1.73	3.31	1.67	2.48	--	--
	9	1..78	6.31	2.13	7.37	1.66	3.86	1.65	2.82	--	--
	10	1.69	6.96	1.95	7.61	1.53	4.06	1.56	3.16	--	--
June	11	1.57	7.20	1.78	7.68	1.89	4.17	1.44	2.92	--	--
	12	1.52	7.96	1.71	8.42	1.38	4.00	1.36	2.74	--	--
	13	1.41	8.01	1.60	8.74	1.30	4.20	1.28	2.51	--	--
Mean ± SD		2.29± 1.03	4.81± 2.43	3.20±* 1.88	6.14±* 2.05	1.67±* 0.23	2.39±* 1.67	1.42±* 0.35	1.56±* 1.36	--	--

F.W = Fresh water
P.W = Pollutant water.

* The differences in this results are non significance.

Table 3: Chemical analysis of aquaria water and growth performance of fish reared in different levels of sewage pollution.

Item	Aqua 1 Control (100% F. W)	Aqua 2 75% F.W 25% P.W	Aqua 3 50% F.W 50% P.W	Aqua 4 25% F.W 75% P.W	Aqua 5 100% P.W
Chemical analysis:					
Water temp. (C)	20.0	20.5	20.0	19.5	20.0
D. oxygen (mg/L)	5.0	4.0	3.0	2.5	1.5
Alkalinty (mg/L)	190.3	194.7	186.5	180	163.4
Ammonia (mg/L)	0.5	2.0	5.5	8.0	8.7
Nitrate (mg/L)	0.3	2.0	3.0	3.5	3.4
Phosphate (mg/L)	1.5	5.0	8.0	8.5	8.6
Silicate (mg/L)	16.0	20.5	21.6	22.5	22.4
PH value	6.4	7.0	7.3	8.0	8.5
Growth performance:					
Gain in weight/fish/day (gm)	0.40	0.51	0.35	0.34	--
Total food consumed (kg)	18.07	22.82	13.29	11.89	--
Food conversion	2.16	2.41	2.46	2.84	--
Fish production/aquarium (kg)	0.84	0.95	0.54	0.42	--
Condition factor	1.96	1.87	2.93	2.87	--
Number of fish/aquarium	30	30	30	30	30
Number of fish loss	3	6	10	14	30
Percent of survival	90	80	67	53	--

F.W= Fresh water
P.W= Pollutant water.

the optimum level and subsequently were harmful for fish. This explanation is similar to these of Stickney et al. (1979) who reared *O. niloticus* with different histories of organic fertilization and mentioned that, the purpose of suitable organic fertilization is to increase of pond productivity, especially that of phytoplankton and Seymour (1980) who reported that, the production of fish ponds can be increased by adding suitable fertilizer compounds which encourages growth of phytoplankton and in turn the amount of food available to the fish. On the other hand, zooplankton organisms which are considered th second food item for rearing fish also varied wi different levels of organic or inorganic fertiliz compounds as has been reported by (Groenew & Schluter, 1981 and Geiger, 1983).

Results presented in table (2) clearly indicate that the mean value of the specific growth rate o *O. niloticus* reached its maximum value (3.20± 1.88) in aquarium No. 2. The difference between the experimental values and contro group were non significance ($P > 0.01$). Simila results were also mentioned by *Ofojekwu &* Ejike (1984) for the Nile *tilapia and Lam*

Shephard (1988) for common carp. It was also noticed that, the highest mean value of normalized biomass index of *O. niloticus* (6.14± 2.05) was obtained also in aquarium No. 2, while the lowest one (1.56 ± 1.36) was recorded in aquarium No. 4. This may be attributed to increasing of weight gain of fish at this water pollution than others. The same results were also reported by Carlos (1988) at his study on growth of bighead carp in Saudi Arabia.

The survival rate was also decreased with increasing of sewage water in the aquaria (Table 3). The fish in aquarium No. 5 (100 % pollutant water) were totaly lossed after three weeks of rearing period. This may be due to increasing of pollutant compounds in aquarium water specially total ammonia which has a values of 8.0 and 8.7 mg / L in aquaria Nos. 4, 5. Also to decreasing of dissolved oxygen concentration (2.5 mg / L in aquarium No. 4 and 1.5 mg L in No. 5). These lead to falling of water quality and fertility in the previous rearing aquaria. Miltz & Giesy (1985) reported that, the increasing of mortality of catfish reared under effects of sewage water was due to excessive of toxic compounds in this pollutant water. Similarly Abou El-Gheit et al. (1995) mentioned that, the sewage pollution with high level of ammonia and organic matter has influence the fish life and the bacterial infection in fish.

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