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BIOCHEMICAL ANALYSIS, HAEMATOLOGICAL PROPERTIES AND CARCASS COMPOSITION OF NILE TILAPIA (*Oreochromis niloticus*) REARED IN DIFFERENT LEVELS OF SEWAGE WATER

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SUMMARY

Biochemical analysis, haematological properties and carcass composition of *Oreochromis niloticus* were studied in relation to different levels of sewage water pollution for a period of 91 days. The fish were stocked in glass aquaria (150 liters each) and fed on artificial diet (28% protein). It was noticed that, the dissolved oxygen and total alkalinity of the water were decreased with the increasing of sewage pollution level. While ammonia, nitrate, phosphate, silicate and pH value were slightly increased.

The liver biochemical constituents, blood parameters, serum compositions and proximate analysis of rearing fish were increased from control group (100% freshwater) to the first level of sewage pollution (75% fresh water and 25% pollutant water). While above this level, the previous values were gradually decreased. On the other hand, the values of hepatosomatic index and serum glucose were increased with the increasing of sewage pollution concentration.

INTRODUCTION

Fish production has been considered as one of the main sources of animal protein in developing countries including Egypt. Fresh water with sewage pollution may be highly toxic to water organisms specially fish species (EPA, 1973). As a matter of fact, blood parameters and serum composition are the most indicator of the general condition of the animal body. Subsequently, the physiological changes are caused by environmental pollutants (Mazhar et al., 1987).

On the other hand, Saleh (1982) mentioned that the liver condition and hepatosomatic index of *Tilapia zillii* could be used as an indicator of aquat-

ic environmental pollution with heavy metals and insecticides. Influence of different pollutant compounds on biochemical and physiological properties of fish species has been performed by Panigrahi & Misra (1980), Kandil (1987) and Hilmy et al. (1987).

Thus this study was undertaken to know the influence of varying toxicity levels on biochemical and physiological properties of Nile tilapia, in order to protect the human beings from dangerous hazards of these pollutant substances

MATERIAL AND METHODS

The experiments were carried out on *O.niloticus* collected from the River Nile in area of El-kanater El-Khyeria at the end of March, 1998. The initial length of fish was about 8.0cm and body weight of 12.0gm. Treatments were conducted in 10glass aquaria (80 x 50 x 50cm) filled with different levels of sewage water pollution. Control aquarium (No.1) contain 100% fresh water, No.2 contain 75% fresh water with 25% pollutant water, No.3 contain 50% fresh water with 50% pollutant water, No.4 contain 25% fresh water with 75% pollutant water and No.5 contain 100% pollutant water. The water in each aquarium was continuously aerated by mean of an electric compressor, feces and other remains were removed daily by socking. The physical and chemical properties of aquaria water were determined according to Arnold et al. (1980) methods.

The blood samples (15 fish examined) were taken over a heparinized vials by severing the caudal peduncle of the fish (Dabrowska et al., 1989). The erythrocyte count was determined by a double haemocytometer using the method of Wintrobe (1934). Haemoglobin content was estimated by Van Kampen and Zijfstra (1981) method. Serum glucose was determined using Boehringer Mannheim kits as described by Trinder (1969), serum lipid was estimated by Zollner and Kirsch (1962) method. Protein in serum and liver was determined by Biuret methods using the Boehringer Mannheim Kits according to Gornall et al. (1949). Glycogen in liver was carried out using anthrone reagent (Handel, 1965), while the total lipid in liver was extracted with a mixture of chloroform and methanol (2:1) using Bligh and Dyer (1959) method.

The crude protein and fat in dry matter of rearing fish were determined suing Kjeldahl and Soxhlet apparatus. Water content was estimated by maintained the fish muscle at 105°C for 2hrs. The experimental results were statistically analysed using student's T.test as mentioned by Berlly and Lindgren (1990) with applied the formula; calculated value

$$= \bar{X}_1 - \bar{X}_2 \Big/ \frac{SD_1}{\sqrt{n_1}} + \frac{SD_2}{\sqrt{n_2}}$$

Table (1): Chemical analysis of aquaria water and carcass composition 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	19.0	20.0
D. oxygen (mg/L)	5.0	4.5	3.0	2.5	1.5
Alkalinity (mg/L)	190.3	194.7	186.5	180.0	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	6.5	7.0	7.3	8.0	8.5
Carcass composition:					
Crude protein (%)	60.2±1.2	60.6±1.0	66.7±1.0	55.8±1.1	-
Crude fat (%)	21.3±1.5	21.5±1.1	18.5±1.1	17.7±1.2	-
Ash content (%)	11.0±0.6	11.7±0.7	8.8±0.8	7.8±0.8	-
Water content (%)	64.8±1.8	66.6±1.1	59.9±1.4	58.0±1.4	-
GE (kcal/kg)	5411±198	5460±141	4950±136	4822±139	-
ME (kcal/Kg)	4049±156	4087±113	3688±148	3589±113	-
Energy protein ratio	67.7±1.4	67.4±1.4	56.1±2.0	64.4±1.7	-

F. W.= Fresh water
P.W = Pollutant water.
GE= Gross energy
ME = Metabolizable energy

RESULTS AND DISCUSSION

As shown in table (1), the water temperature was not varied in different levels of sewage pollutant. Dissolved oxygen (D.O) and total alkalinity (T.A) reached its maximum values (4.5, 194.7 mg/L) in the aquaria contain 75% fresh water with 25% pollutant water. While, the highest values of ammonia, nitrate, phosphate, silicate and pH (8.7, 3.4, 8.6, 22.4 mg/L and 8.5 respectively) were observed in aquarium contain 100% pollutant water. This may be due to the fact that the chemical compounds and organic matter in aquarium No.2 are suitable to fertility of phytoplankton organism (chlorophyta) which leads to increasing of D.O and T.A in this aquarium (Ibrahim, 1987 and Smith & Piedrahita, 1988). While the increasing of these chemical compounds in other aquaria leads to decreasing of D.O (1.5mg/L) and increasing of ammonia, nitrate, phosphate and silicate (Nessim &Tadros, 1988).

Table (2) cleared that, the protein, lipid, glycogen and water content in liver of control *O.niloticus* were 20.85, 3.53, 3.09 and 58.13 gm/100 gm fresh tissue respectively. These values showed a

marked unsignificant ($p > 0.05$) increase (21.14, 3.93, 3.53 and 60.83 gm/100gm tissue) in first level of sewage pollutant (75% fresh water and 25% pollutant water). While above this level, its values were gradually decreased this may be due to the decreasing of dissolved oxygen concentration and increasing of ammonia level. The same observations were also postulated by Kandil (1987) at his study on physiological properties of grass carp under different environmental pollutants. While the values of hepatosomatic index were high significantly ($p<0.01$) increased with the increasing of sewage pollutant, this may be attributed to increasing of size and weight of the liver due to concentrated of heavy metals, insecticides and other pollutant compounds in its tissues (Saleh, 1982).

It was also noticed that, the erythrocyte counts, haematocrit value and haemoglobin content in

Table (2): Blood parameter, serum analysis and liver metabolites of *O.niloticus* reared in different Levels of sewage water pollution after a period of 91 days.

Item	Aqua. 1	Aqua. 2	Aqua. 3	Aqua. 4	Aqua. 5
	Control (100%F.W)	75%F.W 25%P.W	50%F.W 50%P.W	25%F.W 75%P.W	100%P.W
Blood parameters:-					
Erythrocyte counts (M*/mm^3)	1.736±0.103	1.843±0.102	1.345±0.100	1.147±0.102	-
Haematocrit value (%)	36.76±2.78	38.29±1.62	31.34±1.60	28.28±1.61	-
Haemoglobin content (gm/100ml blood)	7.33±0.88	8.25±0.94	5.27±0.93	4.23±0.89	-
Serum analysis:-					
Protein (gm/100ml serum).	5.37±0.67	6.26±0.57	3.29±0.56	2.32±0.55	-
Lipid (gm/100ml serum).	3.68±0.40	4.05±0.13	2.05±0.14	3.68±0.40	-
Glucose (mg/100ml serum).	84.75±9.82	86.30±10.10	93.57±9.92	84.75±9.82	-
Liver metabolites:					
Protein (gm/100mg tissue).	20.85±1.96	21.14±1.37	18.04±1.35	20.85±1.96	-
Lipid (gm/100 tissue).	3.53±0.68	3.93±0.71	2.44±0.66	3.53±0.68	-
Glycogen (gm/100gm tissue).	3.09±0.26	3.53±0.31	2.05±0.30	3.09±0.26	-
Water content (gm/100gm tissue).	58.13±2.20	60.83±1.82	52.85±1.80	58.13±2.20	-
Hepatosomatic index	1.48±0.53	2.06±0.43	2.62±0.38	1.48±0.53	-

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

* M= Million

blood of Nile tilapia reached its highest values (1.843 million/mm^3, 38.29% and 8.25gm/100ml blood respectively) in aquarium no.2 (75% fresh water with 25% pollutant water). These values were unsignificant ($p>0.05$) decreased with increasing the concentration of sewage pollutant until reached a values downward the corresponding control level (100% freshwater). This may be attributed to the haemolysis of red blood cells caused by pollutant compounds (Mazhar et al., 1987). The serum protein and lipid in control *O.niloticus* were 5.37, 3.68gm/100ml serum. These values showed an increase (6.26, 4.05gm/100ml serum) in fishes reared in level of 75% freshwater and 25% pollutant water (the differences were unsignificant, $p>0.05$). While after this level its values were slightly decreased (Kandil, 1987). Glucose concentration was significantly ($p<0.05$) increased with the increasing of pollutant concentration. Similar observations were also found by Hilmy et al. (1987) in the work on variation in blood chemistry of *Clarias Lazera* exposure to environmental pollutants. This almost due to the highly activates of glycolesis process (conversion of liver glycogen to blood glucose) and thus raises the concentration of glucose in the blood.

The present investigation also indicated that, the carcass composition (crude protein, crude fat, ash content and water content) and energy content (gross energy, metabolizable energy and energy protein ratio) reached its highest values (60.6%, 21.5%, 11.7,66.6%, 5460, 4087 kcal/kg and 67.4) in *O.nitoticus* reared in aquarium contain 75%freshwater and 25% pollutant water. This may be due to the suitability of this level to fertility of natural food organism and water quality. Therefore, the carcass composition of fish flesh is often used as indicator of fish quality (Reintz, 1983). Similarly, Degani (1988) mentioned that, the percentage of crude protein and other body composition of African catfish increase with the elevation of healthy and growth rate of rearing fish.

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