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Biochemical and histological changes of grass carp (*Ctenopharyngodon idella* Val) induced by exposure to rice straw

Medhat H. Khalil[1], Mohsen S. Hussein[1], Salwa M. Abou El-Ella[2], Mostafa I. Badr[1] and Ibrahim E. Ebrahim[1]

1- Department of Animal Production, (Fish Production), Faculty of Agriculture, Al- Azhar Univ., Cairo, Egypt

2- National Water Research Center

ABSTRACT

The study was carried out by Delta Research Station, Canal Maintenance Research Institute, National Water Research Center. 300 grass carp (average body weight 20-30 g) were divided into three equal groups (100 fingerlings per group) in fiber glass basins of each 2000-liter basin, the first group was used as a control group (C), the second group was used 25 gm /m^2 of rice straw (B_1), the third group was used 50 g/m^2 of rice straw (B_2). The rice straw was used to control the growth of algae as a biological method. The study was conducted during the spring season for 10 weeks (mid-March to May 2011). This study examined some physiological and histological changes of the grass carp fish liver as a result of exposure to the compounds resulting from the decomposition of rice straw in water. Blood samples were withdrawn and transverse sections of the liver were performed two weeks after the beginning of the experiment.

Results indicated that there were no significant effect of using 25 and 50 g/m^2 rice straw on plasma total protein, liver glycogen and GST compared to the control group. Also, there were no significant differences between ALT recorded for the group 25 and 50 g/m^2 rice straw of rice straw as compared with the control group throughout the study except after 3 or 5 weeks from the start of the experiment. On the other hand, glucose showed significant difference between 25 50 g /m^2 of rice straw throughout the study except weeks 2, 3 and 7.

The general histological examination indicated that there was no significant damage in tissues of grass carp liver after exposure to 25 or 50 g/m^2 of rice straw concentration for 8 weeks.

It could be concluded from the previous results that rice straw (25 g/m^2) application can be used in the biological resistance of algae in water courses as it does not have any effects on the bio-efficiency of fish and thus on the general health of humans.

Key words: Grass carp, *Ctenopharyngodon idella*, rice straw, Phenol pollution, Physiology, Histology.

INTRODUCTION

In recent years, there has been an apparent increase in the occurrence of harmful algal blooms in potable waters worldwide (Ball *et al*., 2001; Abd El-Monem *et al*., 2008). The use of plant remnant as a control for algae growth has received considerable attention within the last years. It has been used in lakes, potable water reservoirs, canals, and streams (Caffrey and Monahan, 1999). Barley straw was applied to control algal bloom in Chesterfield canal (Welch *et al.*, 1990) in Derbyshire Reservoir (Everall and Lees, 1996), in coarsely filtered fresh Potomac River and brackish Patuxent River waters (Brown *et al*., 2003). In Egypt, it was used in some fishponds (Ghobrial *et al*., 2007).

A total of 28 water soluble compounds, decayed from rice straw were identified (Abd El-Monem *et al*., 2008). Olofsdotter *et al*. (1995) reported 16

potential allele-chemicals that have been found in rice. Most of the detected compounds analyzed in the present decaying barley straw have been reported as allelopathic. Three phenolic containing group compounds were released through the barley straw rotting and forming 21.94 % of the total decayed chemicals. Algal inhibition effects of plant producing-phenols similar with that reported by Nakai *et al*., (2000). The results given by Pillinger *et al*. (1994) indicated the presence of Methoxy- phenyl compounds that was to be highly inhibitory to algal growth. Otherwise, 9 decayed substances included siloxane, which is a compound containing hydroxyl phenyl group and has been detected and represented 25.16 % of the total decomposed chemicals. Phenolic acids (as benzoic acid) and its derivatives, 5 compounds composed about 6.04 % among the decaying chemicals from the rotted straw. Allelopathic activity, as phytotoxic, of the phenolic acids extracted from rice straw was investigated by Rimando *et al*. (2001) and Park *et al*. (2006).

The present study aimed to investigate the impact of phenol toxicity from rice straw in water on grass carp (*Ctenopharyngodon idella* Val) with special reference to the hematological, biochemical and histological changes.

MATERIALS AND METHODS

Rice straw doses, preparation form and position:

The previous studies referenced volumetric dosage barley ranging from 6 to 400 gm^{-2} (Brown *et al.*, 2003). However, others suggested using real dosages varied between 25 and 50 gm^{-2} of rice straw which were used in the present. Rice straw was broken up into cylindrical wrapping nylon mesh, 15 cm diameter and about 2 m long with a terminal fixing rope in both sides including some form of float (Fig. 1).

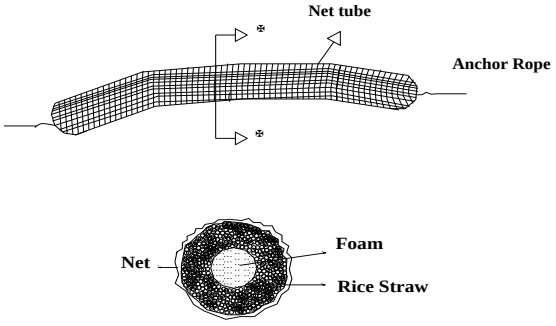

Fig. (1): Longitudinal and cross sections of rice straw barriers

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Chromatographic analysis of rice straw decomposing:

Table (1): Decomposing compounds identified in aqueous extracts of rice straw (PK: Peak number).

PK	Area%	Compound
1	56.91	Dimethylphosphinicazide
2	0.07	1,3 – dipheny1- cyclotrisiloxane
3	0.41	Hex methyl pyrido [2,3-d] pyrimidine
4	0.61	Hexamethy1 imethylsiloxane cyclic trimer
5	0.19	Hexamethy1 Arsenous acid
6	0.11	Hexamethy1 1,3- bis (trimethylsilyl) benzene
7	0.13	Tris (trimethylsilyl) ester
8	0.06	Methoxy- phenyl- tert- butyl
9	0.22	Oxime
10	21.81	Methoxy- phenyl- disiloxane
11	0.22	Trisiloxane
12	0.51	4' –(trimethylsiloxy)
13	0.13	Octamethyl-octamethylcyclotetrasiloxane
14	0.09	1,1,3,3,5,5,7,7- octamethylCyclooctasiloxane
15	1.95	Cyclotrisiloxane
16	2.72	Benzoic acid
17	0.16	Dibenz (b,d) cycloheptane
18	2.92	Decamethyl- 3,4 – dihydroxybenzyl alcohol
19	0.13	Decamethyl- Benzoic acid
20	0.61	Methyl 2,3 – bis (trimethylsilyloxy)
21	0.12	4- Amino -5- imidazole carboxamide
22	5.19	Dodecamethyl-2,3-bis (trimethylsilyloxy)
23	0.12	3,5 – diisopropoxy -1,1,1,7,7,7 – hexam ethyl – 3,5- bis (trimethylsiloxy) tetrasiloxane
24	0.15	7-hydroxy-7,8,9,10- tetramethyl
25	3.05	1,1,1,5,5,5- hexamethyl-3,3-bis [(trimethylsilyl)oxyl]
26	0.91	1- Monolinoleoylglycerol trimethylsilyl ether
27	0.34	Bistrimethylsilyl N-acetyl eicosasphinga-4
28	0.16	1,1,3,3,5,5,7,7,9,9, 11,11,13,13,15,15- hexadecamethyl- hexasiloxane

Experimental Fish:

A total number of 300 grass carp (*Ctenopharyngodon idella* val.) were used. The fish were reared in ponds till weighed 20-30 gm. They fed mainly on rotifers till 1.5 gm and or artificial pellets till the requested weight. Fish were adapted to laboratory conditions for at least 2 weeks prior to the experiment by holding them in filtered, running aerated Nile water in 2000 liter tanks. Fish were not fed for 48 hours prior to and during the experiments. Mortality was less than 2% during the adaptation period. Fish were individually examined. All fishes were healthy and clinically free of diseases.

Experimental design:

Grass carp fishes were randomly divided into 3 equal groups. Each group contained 100 fishes and divided as the following:

Group1: control group Grass carp fish with no straw.

Group 2: Grass carp fish exposed to straw ($25g/m^2$).

Group 3: Grass carp fish exposed to straw ($50g/m^2$).

Analytical Techniques:

Fiber glass basin (4 x 1 x 0.5 m) 2000 liter provided with air pumps for aeration was used. Water quality characteristics were measured by the methods described by (APHA, 1995) and the measured values are presented in Table (2).

Table (2): water characteristics of filtered Nile water.

Parameter	Value	Unit
Temperature	22 ± 2.0	^{o}C
PH	7.1 ± 0.4	-
Dissolved oxygen	6.5 ± 0.5	mg / L
Alkalinity	152.0	mg / L as $CaCO_3$
Hardness	194.03	mg / L as $CaCO_3$
Magnesium ion (Mg^{++})	9.84	mg / L
Potassium ion (k^{+})	5.7	mg / L
Sodium ion (Na^{+})	35.65	mg / L
Calcium ion Ca^{++}	29.9	mg / L
Bicarbonate ion (HCO^{-}_3)	140.91	mg / L
Carbonate ion (CO^{--}_3)	0.00	mg / L
Sulfate ion (SO^{--}_4)	120.96	mg / L
Ammonia (NH_3)	< 0.05	mg / L
Nitrite (NO^{-}_2)	Nil.	mg / L
Chloride ion (CL^{-})	0.01	mg / L
Electrical Conductivity	300 ± 11.5	μmho / Cm

Plasma samples:

The experiment was carried out from mid-March to May 2011. Nine blood samples were taken from grass carp after 2, 3,4,5,6,7,8,9 and 10 weeks from the start of the experimental treatment. Fish was anesthetized in 120 mg/L tricaine methane sulfonate (MS222) solution. Blood was drawn from the common cardinal vein using 1 ml plastic insulin syringe containing 0.2% EDTA as the anticoagulant. Plasma samples were separated by centrifugation at 3000 rpm for 3 minutes to obtain blood plasma which transferred to eppendorf tube and stored at -20°C until assayed.

Plasma parameters:

Plasma glucose was estimated by the method of (Sasaki *et. al.*, 1972).The plasma protein content was determined using the method of (Valery *et. al.*, 1980).The plasma Lactate Dehydrogenase was assayed according to the method of King (1965). The plasma Alanine aminotransferase (ALT) was assayed by the method of Mohun and Cook (1957).The plasma Aspartate aminotransferase (AST) was assayed by the method of (Mohun and Cook, 1957). The plasma Glutathione-S-transferase (GST) in different tissue was determined using the method of (Beutler, 1986). The muscle and liver glycogen was determined by thean throne method as described by (Valery *et al*. 1980).

Histological studies:

Liver samples of grass carp fish were collected after 2, 3,4,5,6,7,8,9 and 10 weeks from the start of the experiment. Fish were killed by pithing (damaging the brain and severing the spinal cord between the head and trunk region using a sharp needle) and the liver samples were taken from fish

body, wiped thoroughly, using blotting paper to remove blood and other body fluids. The tissues were then immediately fixed in 10 % neutral buffered formalin for 24 hours, and then washed in water, dehydrated in ascending grade of ethyl alcohol finally cleared by xylene and embedded in melted wax. The liver blocks were sectioned at six-micron thickness and were stained by eosin and heamatoxylin according to Pearse (1968).

Statistical Analysis:

Statistical analyses were carried out using SPSS program. One-way analysis of variance (Procedure ANOVA of SPSS 2006) followed by Duncan's multiple range test (Duncan, 1955) to test the effect of straw 25 and 50 g/m^2 after 2, 3,4,5,6,7,8,9 and 10 weeks from the start of the experiment.

RESULTS AND DISCUSSION

Plasma Parameters:

PlasmaGlucose:

Figure (2) shows that after 2, 3 and 7 weeks from the start of the experiment, using 25 or 50g/m^2 straw did not show any significant effect on plasma glucose of grass carp fish as compared with the control group. Meanwhile after 4, 5,6,8,9 and 10 weeks from the start of the experiment, using 50g/m^2 straw significantly increased plasma glucose of grass carp as compared with the control and 25g straw/m^2 treatment groups.

The plasma glucose concentration of control grass carp on exposure to 25 g straw /m^2 experiment was 67.333 ± 4.546 mg/dl. The concentration of serum glucose increased throughout the entire experimental period and the maximum recorded value (72.166± 0.980 mg/dl) was obtained compared to the control value in the beginning of experiment 67.333 ± 456 mg/ dl. Grass carp exposed to 50g straw/m^2 concentration showed a significant increase ($p< 0.05$) of serum glucose concentration during the exposure time, the maximum recorded concentration was 74.166 ± 1.170 mg/dl compared to the control value 72.166 ± 1.471 mg/dl. The minimum recorded value was 70.833 ± 4.215 mg/ dl at the beginning of exposure period (2 weeks).The increase in blood glucose of fish exposed to straw may reflect an increased need for energy to counteract the effects of stress caused by straw toxicity. Hyperglycemia or elevated blood glucose levels indicate impaired glucose and lipid metabolism and degradation of glycogen in liver, this result agrees with Acker and Nogueira (2012), Ponepal and Paunescu (2014).

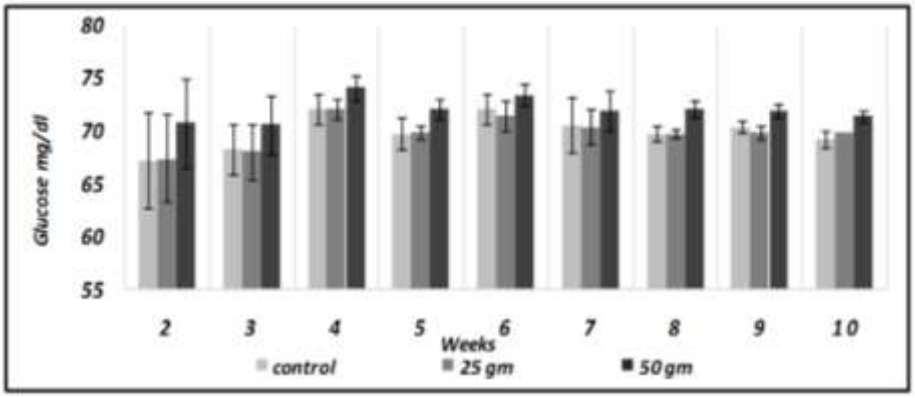

Fig: (2) Changes of plasma glucose (mg/dl) in grass carp after exposure to 25 and 50 g straw/m^2 for10 weeks.

Liver glycogen:

Treatment of grass carp with 25 or 50g straw/m^2 for 10 weeks did not show any significant effect on liver glycogen as compared with the control group (Fig. 3). The Liver glycogen concentration in control showed a value of 3.950 ± 0.634 g/ 100g Fresh weight). This level showed a significant decrease ($p< 0.05$) when Fish exposed to 25 g straw /m^2 concentration throughout the entire experimental period and reached a minimum value of 3.116± 0.300 g/100g Fresh weight after 4 weeks of exposure. At the end of exposure period (10 weeks), the value recorded 3.466 ± 0.233 g/100g fresh weight. Similar results were obtained for grass carp exposed to 50g straw/m^2 where a significant decrease ($p<0.05$) in liver glycogen concentration was obtained during the exposure time (10 weeks). The values recorded at the end of the experiment were decreased significantly compared to the control values. The decrease in the total carbohydrate content in liver and muscles of both the treated groups may be due to detoxification mechanisms which become active and the hepatic synthesis of detoxifying enzymes that requires high energy levels that might be derived from carbohydrate metabolism, for driving the various enzyme-mediated reactions. This result agrees with Varadarajan *et al*. (2014).

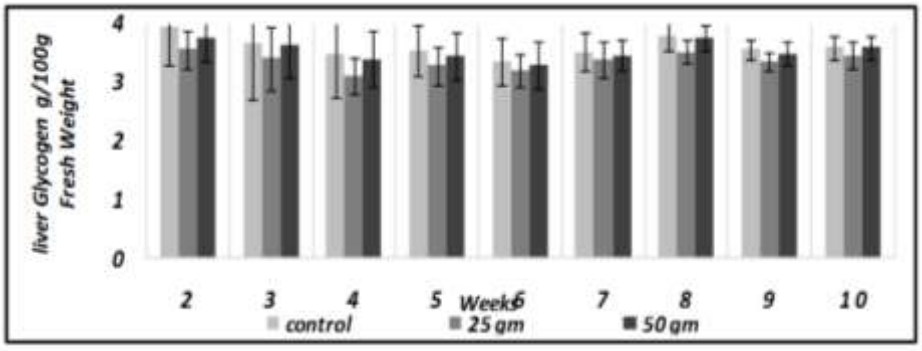

Fig. (3). Changes of liver glycogen (g/ 100g fresh weight) in grass carp after sub lethal exposure to 25and 50 gm straw/m^2 for10 weeks

Plasma total protein:

Figure (4) indicates that treatment of grass carp with 25 or 50gm straw/m2 for 10 weeks did not show any significant effect on plasma total protein as compared with the control group. The control of grass carp showed a plasma total protein value of 6.383 ± 0.133 g/ dl. This value showed a significant decrease ($p<0.05$) reaching a minimum value of 5.900± 0.210 g/ dl, after 10 weeks of exposure to 25 g straw /m^2 concentration. Grass Corp exposed to 50g straw /m^2 concentration showed increase ($p<0.05$) in serum total protein level throughout the experimental period up till 8 weeks of exposure. Then, plasma total protein decreased significantly to a value of 6.05± 0.084 g/dl ($p<0.05$) at 10 weeks of exposure compared to control value 5.950± 0.084 g /dl**.** The values recorded at the end of the experiments were significantly difference comparing to the control values.The Normal levels of protein in different plasma is essential for the metabolic harmony of the organism. Protein level may be altered if there is interference with either the synthetic or degradative pathway, this result agree with (Ram nayan

Singh *et al.*, 2015) Similar significant decrease in total serum protein, globulin and also albumin was reported by (Velisek *et al*., 2009) in *Cyprinus carpio* after metribuzin exposure

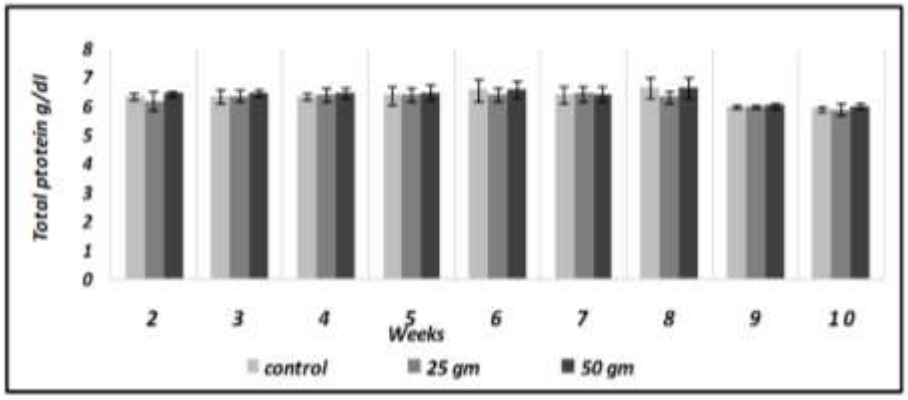

Fig: (4) Changes of plasma total protein (g/dL) in grass carp after sub lethal exposure to 25and 50 gm straw/m^2 for10 weeks.

Plasma Alanine amino Transferase (ALT):

It was obvious from Figure (5) that after 5, 6 and 7 weeks from the start of the experiment treatment of grass carp with 25 or 50gm straw/m^2 did not show any significant effect on plasma ALT as compared with the control group. Meanwhile after 2, 3, 4, 8, 9 and 10 weeks from the start of the experiment, treatment of grass carp with 25gm straw/m^2 significantly decreased plasma Alanine Amino Transferase as compared with the control groups.Plasma ALT showed gradual highly significant increased From the 2 weeks (109. 166±3.763 µ/L) till reaching the last week of the experiment (126.000±1.550 µ/L) when exposed to 25 g straw /m^2.The concentration of ALT in control grass carp was 116.66±6.055 µ/L. when fish exposed to 50 g straw /m^2, ALT values in creased gradually throughout the exposure period. The maximum recorded level of Plasma ALT For grass carp was 133.33±4.22 µ/L) after 9 week of exposure which was found to be statistically highly significant ($p<0.05$). The results show also treatment of grass carp with 50gm straw/m^2 for 10weeks significantly decreased plasma ALT as compared with the control group. The ALT is an enzyme frequently used in the diagnosis of damage caused by pollutants in plasma was decreased of fishes treated with 25 and 50gm straw/m^2. The results of the current study show that straw did not cause any significant increase on plasma ALT activity and this indicate that straw did not show any harmful effect on liver functions**,** this result agrees with those of De la Torre *et al*. (1999 and 2000).

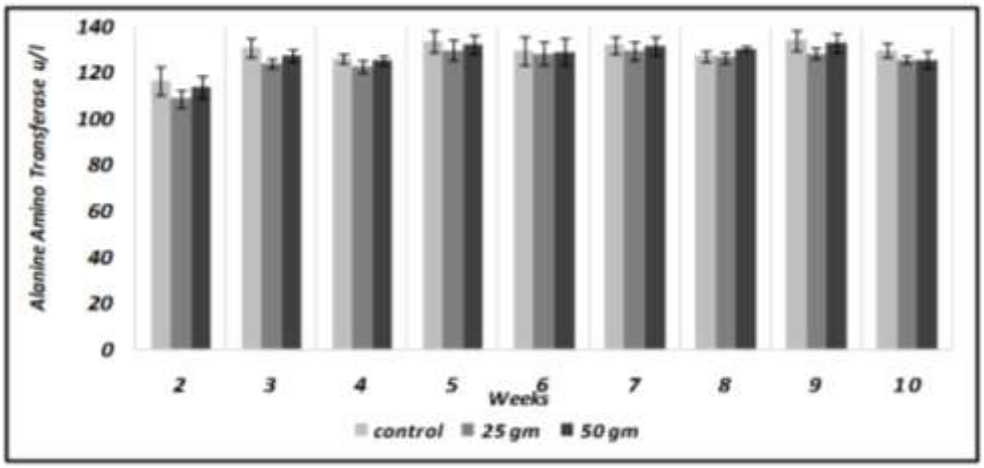

Fig. (5). Changes of plasma Alanine Amino Transferees (u/l) in grass carp after sub lethal exposure to 25and 50 gm straw/m^2 for10 weeks.

Plasma aspartate amino transferase (AST):

It was clear from Figure (6) that after 2, 4, 6, 7, 8, 9 and 10 weeks from the start of the experiment treatment of grass carp with 25 or 50gm straw/m^2 did not show any significant effect on plasma AST as compared with the control group. Except that after 3 and 5 weeks from the start of the experiment, treatment of grass carp with the 25gm straw/m^2 significantly decreased plasma AST as compared with the control groups. plasma AST showed gradual highly significant increased From the 2 weeks (109. 166±3.763 µ/L) till reaching the last week of the experiment (126.000±1.550 µ/L) when exposed to 25 g straw /m^2.The concentration of AST in control grass carp was 115.000±7.100 µ/L. when fish exposed to 50 g straw /m^2, AST values increased gradually throughout the exposure period. The maximum recorded level of plasma AST For grass carp was 128.166±1.471 µ/L) after 5week of exposure which was found to be statistically highly significant ($p<0.05$). The elevation in the levels of AST and ALT in different tissues of O. mossambicus can be considered as a response to the stress induced by phenolic compounds to generate keto acids like keto-glutarate and oxaloacetate for contributing to gluconeogenesis and energy production necessary to meet the excess energy demand. The increase in the levels of ALP and AST has been shown to reflect liver damage, whereas an elevation in the ALP activity may be indicative of renal and liver damage, this result agree with (Gill *et al*., 1990; Bhattacharya *et al.*, 2005; Karan *et al*., 1998).The results in the current study show that straw (25 or 50 gm straw/m^2) did not show any significant increase in plasma ALT and AST activities and these indicate results that straw (25 or 50 gm straw/m^2) did not show any side effect on liver functions.

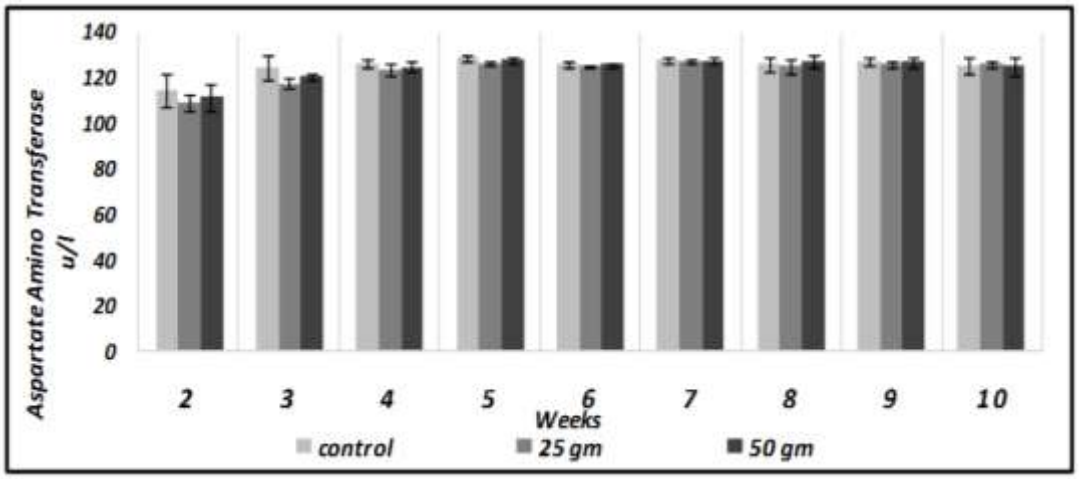

Fig. (6). Changes of plasmaAspartic Amino Transferee (u/l) in grass carp after sub lethal exposure to 25and 50 gm straw/m^2 for10 weeks.

Plasma Lactate Dehydrogenate (LDH):

Figure (7) shows that after 3, 4, 5, 6 and 8 weeks from the start of the experiment treatment of grass carp with 25 or 50gm straw/m^2 did not show any significant effect on plasma Lactate Dehydrogenate as compared with the control group. Meanwhile after 2, 7, 9 and 10 weeks from the start of the experiment, treatment of grass carp with 50gm straw/m^2 significantly increased plasma Lactate Dehydrogenate as compared with the control and 25gm straw/m^2 treatment groups. The above results indicate that during for 9 or 10 weeks our study treatment of grass carp with 50gm straw/m^{2}statistically significantly increased plasma Lactate Dehydrogenate (LDH) as compared with the control and treatment with 25gm straw/m^2 groups. The increase in LDH activity in juvenile Australian Bass and Macquaria novemaculeata in response to two different crude oil spills. The increase in LDH activity also suggests a significant increase in the conversion of pyruvate to lactic acid, thereby leading to the accumulation of lactic acid. Compared to control a significant decrease in LDH activity in liver and kidney of m-cresol treated fishes and in gills of fishes treated with phenol was observed. This may be due to increased tissue damage. Similar results were obtained when O. mossambicus were exposed to sub-lethal concentrations of organ phosphorus insecticide, this result agree with (Rao, 2006 ; Cohen *et al*., 2001).

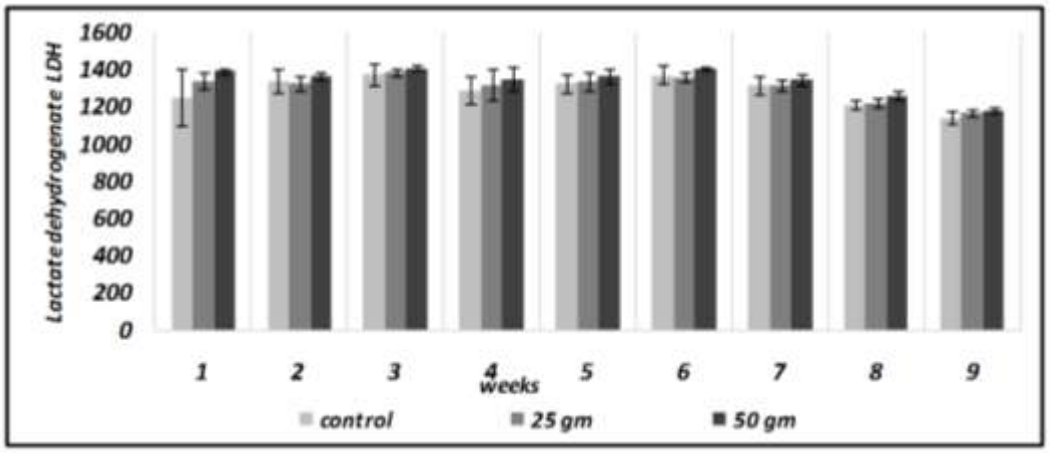

Fig. (7). Changes of plasma Lactate Dehydrogenate (LDH) (u /l) in grass carp after sub lethal exposure to 25and 50 gm straw/m^2 for10 weeks.

Plasma Glutathione-S-transferase (GST):

Treatment of grass carp with 25gm straw/m^2 after 2 and 3 weeks from the start of the experiment, significantly decreased plasma Glutathione-S-transferase (GST) as compared with the control and 50gm straw/m2 treatment groups (Fig.8). Meanwhile, after 4, 5, 6, 7, 8, 9 and 10 weeks from the star of the experiment treatment of grass carp with 25 or 50gm straw/m2 did not show any significant effect on plasma Glutathione-S-transferase (GST) as compared with the control group (Fig. 8). The above results indicated that during most of weeks under the present study treatment of grass carp with 25and 50gm straw/m^2 statistically did not show any significantly increased plasma Glutathione-S-transferase (GST) as compared with the control group in most weeks. Fish blood is often recommended as an environmental indicator of water pollution. The toxicants cause a disturbance in the physiological state of the fish, which affects the enzyme activity. Also, it can cause distortions in the cell organelles, which may lead to the elevation in the activity of various enzymes. Oxidative lesions in various organs of the common carp (Cyprinus carpio L.) have recently been related to liver tumor formation in fish from polluted environments, this result agree with (Velkova-Jorda Noska *et al*., 2008; Malins and Haimanot, 1991; Velkova-Jorda Noska, 2003). The increased GST assay was suggested as a useful tool for bio monitoring oxidative stress (Ding *et al*., 2000; Lin *et al*., 2001; Isani, Sarli *et al*., 2012). In the present study we show that use of straw (25 or50 gm straw/m2)did not cause any significant effect on plasma GST and these results mean that the phenol compound that were produced after straw decomposition did not consider as an environmental pollute. The use of straw in the control of algae growth did not have a harmful effect on the grass carp life.

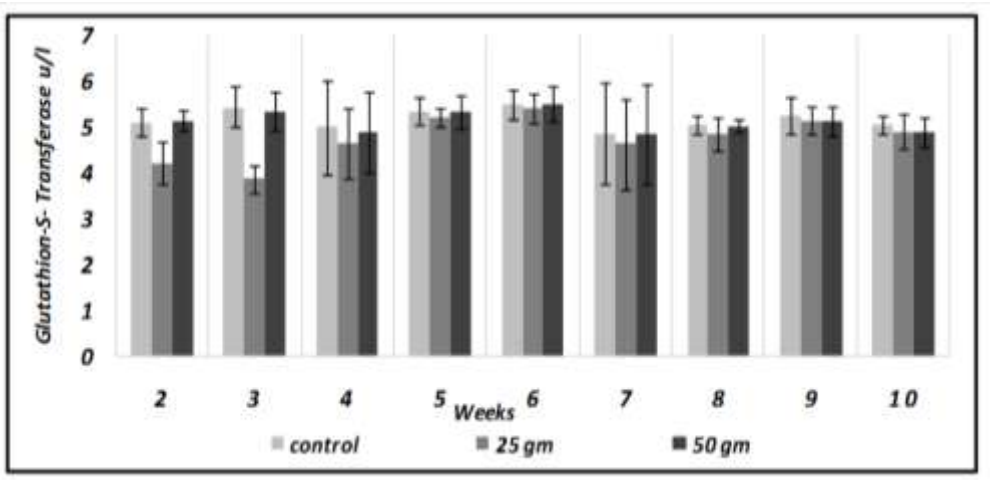

Fig. (8). Changes of plasma Glutathione-S-transferees (GST) (u/l) in grass carp after sub lethal exposure to 25and 50 gm straw/m^2 for10 weeks.

Effect of straw on histopathological changes in the liver:

The effect of 25 or 50 g. straw/m^2 on the histological structure of liver of grass carp was examined in comparison with that of the control group. Liver sections in the control group showed that the liver exhibited a normal architecture with hepatocytes presenting a homogenous cytoplasm and a large central or sub central spherical nucleus of normal structure (Fig. 9).

Liver section in the 25g straw/m^2 group revealed mild to moderate hydropic degeneration after 6 weeks (Fig. 10), while at eighth week, liver showed normal hepatic architecture (Fig. 11).

Liver section in the 50g straw/m^2 group after 2 and 4 weeks from the start of the experiment showed moderate hydropic degenerative changes in hepatocytes with slight congestion of hepatic sinusoids (Figs. 12, 13). While, the hepatocytes of the liver of carp fish showed normal structure after 6 and 8 weeks of exposure to 50g straw/m^2 (Figs. 14, 15).

The general histological examination indicated that there was no incidence of damage in tissues of grass carp (*Ctenopharyngodon idella* val.) after exposure to 25 and 50g straw/m^2 concentration for 8 weeks.

Nassr-Allah (2007) studied the impact of three sub-lethal concentrations of phenol (20%, 40% and 80% of LC50) on liver of on *Oreochromis aureus* juveniles for seven days. He found that the liver of fish subjected to the low, medium and high phenol levels showed histopathological sings. These signs include inflammation around portal vein, central necrosis and cell degeneration.

Remya (2010) found that the important histopathological changes observed in the phenol treated groups of studied *Oreochromis mossambicus* were pyknotic nuclei and clear cell foci. Acute toxic injury usually includes cloudy swelling

or hydropic degenerations and Pyknosis, karyorrhexis and karyolysis of nuclei (Hawkes, 1980; Hinton and Lauren, 1990; Hinton *et al*., 1992; Visoottiviseth *et al.*, 1999*;* Jiraungkoorskul *et al., 2003;* Cengiz and Unlu 2006).

Stehr *et al. (*2003) observed that on chemical contaminant exposure English sole (*Pleuronectes vetulus*) in Vancouver Harbour, Canada showed toxicopathic liver lesions such as neoplasms, preneoplasms, specific degeneration/necrosis and non-neoplastic proliferative lesions**.**

Basanta and Subhas (2000) exposed the Indian major carp (*Labeo rohita*) to 1/10 and 1/5 sub-lethal doses of hexachlorocyclohexane during a 45-day trial period. Swelling of the hepatocytes with diffuse necrosis and marked swelling of blood vessels were observed in the liver tissue.

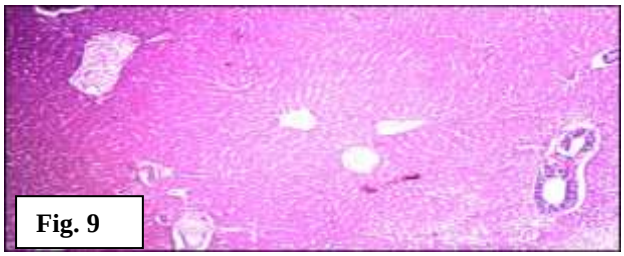
Fig. 9

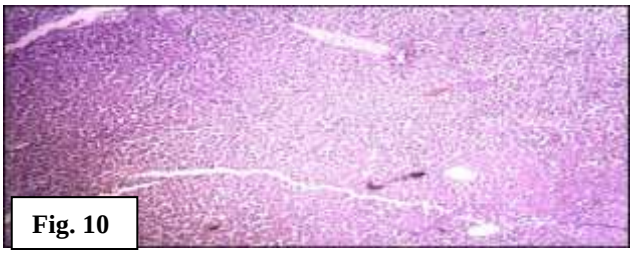
Fig. 10

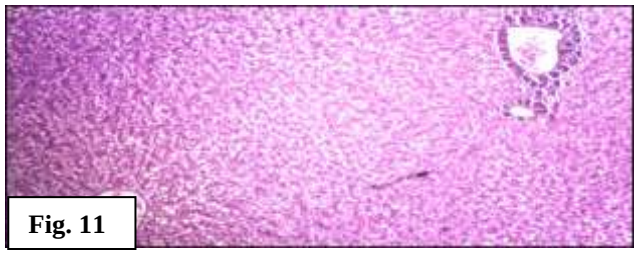
Fig. 11


Fig. 12

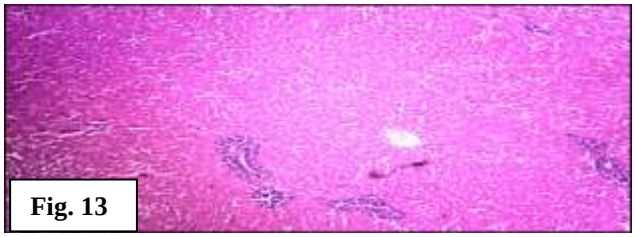
Fig. 13

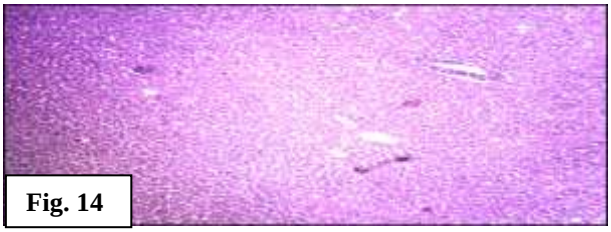
Fig. 14

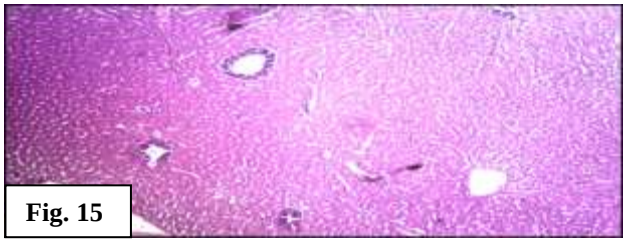
Fig. 15

Figures (9-15): Sections of liver grass carp fish stained with Hx-Eosin, Magn. X 100 showing the following:

Fig. 9: Liver structure revealed normal histology.

Fig. (10): Liver structure after six weeks from the start of the experiment in the 25g straw/m^2 revealed mild to moderate hydropic degeneration.

Fig. (11): Liver structure after eight weeks from the start of the experiment in the 25g straw/m^2 showed normal histology.

Fig. (12): Liver structure after two weeks from the start of the experiment in the 50g straw/m^2 showed preserved normal hepatic architecture, normal portal tract but the hepatocytes revealed hydropic degenerative changes with congestion of hepatic sinusoids.

Fig. (13): Liver structure after four weeks from the start of the experiment in the 50g straw/m^2 revealed hydropic histology.

Fig. (14): Liver structure after six weeks from the start of the experiment in the 50g straw/m^2 most of them revealed mild to moderate hydropic degenerative changes of hepatocytes

Fig. (15): Liver structure after eight weeks from the start of the experiment in the 50g straw/m^2 normal histology.

Conclusions and recommendations:

It could be concluded from the present results that there was no significant physiological and histological changes due to application of rice straw to control the growth of algae in water courses.

The study recommended using of 25 gm/m^2 straw in the biological resistance of algae to water courses because it has an effect on inhibiting the growth of algae and has no effect on the biological efficiency of fish.

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التغيرات البيوكميائية والهيستولوجية لسمكة مبروك الحشائش (كتينوفارينغودون إديلا فال) الناجمة عن التعرض لقش الأرز

مدحت حسين خليل[1] ، محسن صالح حسين [1] ، سلوى محمد أبو العلا [2] ، مصطفى إسماعيل بدر[1] ، إبراهيم إمام إبراهيم[2]
1 - قسم الإنتاج الحيواني – كلية زراعة – جامعة الأزهر بالقاهرة
2 - معهد بحوث صيانة القنوات المائية – المركز القومي لبحوث المياه

المستخلص

أجريت الدراسة بمحطة أبحاث قناطر الدلتا بمعهد بحوث صيانة القنوات المائية المركز القومي لبحوث المياه. تم تقسيم 300 سمكة مبروك حشائش (متوسط وزن الجسم 20-30 جرام) الي ثلاث مجاميع متساوية (100 إصبعية في كل مجموعة) في أحواض من الفيبر جلاس سعة كل حوض 2000 لتر: المجموعة الاولي أستخدمت كمجموعة مقارنة بدون قش الارز، المجموعة الثانية تم أستخدام 25 جم/م2 من قش الأرز، المجموعة الثالثة تم أستخدام 50 جم/م2 من قش الأرز. وقد تم استخدام قش الأرز المستخدم كوسيلة بيولوجية للتحكم في نمو الطحالب و لتحديد المواد الناتجة من تحلل ذلك القش في الماء علي بعض الوظائف الفسيولوجية للأسماك .تم إجراء الدراسة أثناء موسم الربيع لمدة شهرين ونصف (منتصف مارس وحتى مايو 2011) حيث درست بعض التغيرات الفسيولوجية والهستولوجية لكبدالاسماك نتيجة لتعرضها للمركبات الناتجة من تحلل قش الأرز، تم سحب عينات الدم وفصل بلازما الدم وحفظة على درجة -20^{O}م حتى إجراء التحليلات كما تم عمل قطاعات في الكبد بعد أسبوعين من بداية تحلل القش ثم بعد ذلك كل اسبوع لمدة عشرة اسابيع.

أتضح من خلال التحليل الكروما توجرافي للمركبات المتحللة من القش في الماء أنها مركبات فينولية وصنفت الى 28 مركب. كما وجد من خلال نتائخ القياسات الفسيولوجية للأسماك عدم وجود فروق معنوية بين مجموعة التأثير 25 جرام/م2 من القش ومجموعة 50 جرام/م2 من القش لكلا من البروتين الكلي والجليكوجين و GST وكذلك مع المجموعة الكنترول على مدار الدراسة. بينما تلاحظ من دراسة تركيز ALT عدم وجود فروق معنوية بين المجموعة 50 جرام/م2 من القش ومجموعة 25 جرام/م2 من القش و بمجموعة الكنترول على مدار الدراسة فيما عدا الأسبوع ين3 ،5. وفيما يتعلق بتركيز الجلوكوز فقد وجدت فروق معنوية بين مجموعة 25 جرام/م2 من القش ومجموعة الكنترول ومقارنتها بالمجموعة 50 جرام/م2 من القش على مدار الدراسة فيما عدا الأسابيع 2 ،3 ،7.

أتضح من فحص التركيب النسيجي للكبد انه لاتوجد فروق معنوية على مدار الدراسة لمجموعات التأثير(25 جرام/م2 و 50 جرام/م2) بمقارنتها بمجموعة المقارنة.

ومن نتائج هذه الدراسة أمكن استنتاج أنه يمكن أستخدام القش في المقاومة الحيوية للطحالب بالمجاري المائية حيث انه لا يحدث أي تأثيرات على الكفاءة الحيوية للأسماك وبالتالي على الصحة العامة للأنسان.