

Influence of Mahua Oil Cake on the Hepatic Lipid Content Histosomatic Index and Hydration Level of Tissues of *Channa punctatus* (Bloch)

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Abstract

Healthy lara fish, *Channa punctatus* of same size were exposed to three sub-lethal doses of mahua oil cake for a period of 10 days. After 5 and 10 days of exposure hepatic lipid content, histosomatic index and moisture content of liver and gill were measured from the exposed and control fishes using standard methods. A dose and time dependent impact of MOC on HSI and methods. Moisture hydration level of liver and gill was noticed. Moisture content of liver and hepatic lipid value showed inverse relation.

Key words : *Channa punctatus*, Mahua oil cake, Lipid, Histosomatic index, Hydration level.

It is known that preparation and management of ponds in scientific way influence the final outcome in all pisciculture practices. The steps include not only sun drying and manuring of pond bottom but also removal of predatory and unwanted weed fishes other than the target fishes of economic importance. The unwanted fishes not only compete with food and space, but also the predatory fishes prey on the desired cultivable group. To remove the undesired ones, several chemicals and insecticides with residual toxicity were used earlier (1, 2). To avoid hazardous effects of these chemicals, use of less toxic plant derivatives are being practised for a long time. One such plant product mahua oil cake has become quite popular for its double role—its effectivity as manure (3) and toxicity at certain strength (4). It is known to kill common predatory and weed fishes at 75 ppm (5). Chatterjee and Ganguli (6) have studied its toxic influence on blood of *Clarias batrachus*. The present investigation was designed to study the dose dependent and time dependent effects on the histosomatic index (HSI) and hydration level of liver and gill of the fish *Channa punctatus* exposed to sublethal concentrations of mahua oil cake. Relation of hepatic lipid content and hepatic moisture content was also studied.

Methods

Healthy fresh water fish *Channa punctatus*

(Bloch) of almost same size (12—14 cm) each weighing about 25 ± 5 g were procured from a local pond. Sixty such fish were washed in 3.5% saline and acclimatized in the laboratory for a period of five days. The fish were divided into four batches and kept in four separate glass aquaria each containing 20 liters of tapwater (pH 7.1). Three aquaria, each having 15 fish were marked as experimentals (Exp. I, II, III) and the rest in the fourth aquarium marked as control. In the experimental aquaria I, II and III, mahua Oil Cake (MOC) suspension was added to make the final concentrations as 58 ppm (half LC_{50}), 38.6 ppm (one-third LC_{50}) and 29 ppm (one-fourth LC_{50}) respectively. Nothing was added to the control aquarium. Water of all the aquaria was changed on every alternate day when MOC suspension of appropriate strength was added to the experimental sets so that a steady toxicity level was maintained. During the entire period of study, the fish were supplied with *Tubifex* worms *ad libitum* as food.

Starting from the beginning of MOC exposure (day 0), the fish were sacrificed after 5 and 10 days from both the experimental and control groups. Fresh weight of each of the fish was taken and recorded separately before they were sacrificed. Organs like liver and gill were dissected out, weighed and fresh weights were recorded. A portion of the liver from fish of each set was subjected to extraction and quantitative estimation of total lipid after Barnes and Blackstock (7). Rest of the tissues were kept in

Table 1. Values of HSI, moisture content and total lipid in the fish *Channa punctatus* under experimental (E) and control condition (C) along with percent deviation in parentheses. Values are mean of five readings \pm SE. Statistical significance is shown at $P < 0.01^{**}$ and $P < 0.05^*$ levels.

Parameters		Exposure period (days)					
		5 days			10 days		
		58 ppm	Strength of MOC 38.6 ppm	29 ppm	58 ppm	Strength of MOC 38.6 ppm	29 ppm
HSI of liver	C	1.04 \pm 0.005	1.04 \pm 0.005	1.04 \pm 0.005	1.07 \pm 0.005	1.07 \pm 0.005	1.07 \pm 0.005
	E	0.724 \pm 0.004* (-30.4%)	0.764 \pm 0.0046* (-26.54%)	0.89 \pm 0.009* (-14.43%)	0.62 \pm 0.006* (-42.05%)	0.724 \pm 0.0056* (-32.33%)	0.86 \pm 0.009* (-19.63%)
Moisture content of liver (mg%)	C	69.7 \pm 0.33	69.7 \pm 0.33	69.7 \pm 0.33	74.4 \pm 0.12	74.4 \pm 0.12	74.4 \pm 0.12
	E	64.4 \pm 0.15* (-7.03%)	66.9 \pm 0.09* (-4.02%)	67.4 \pm 0.09* (-3.3%)	68 \pm 0.35* (-11.56%)	68.8 \pm 0.1* (-7.52%)	70.2 \pm 0.13* (-5.65%)
Total lipid of liver as mg%	C	1.97 \pm 0.013	1.97 \pm 0.013	1.97 \pm 0.013	2.13 \pm 0.02	2.13 \pm 0.02	2.13 \pm 0.02
	E	3.12 \pm 0.03* (+58%)	2.55 \pm 0.011* (+29%)	2.3 \pm 0.008* (+16.75%)	3.45 \pm 0.011* (+61.9%)	2.98 \pm 0.013* (+39.9%)	2.56 \pm 0.009* (+20%)
HSI of gill	C	1.84 \pm 0.014	1.84 \pm 0.014	1.84 \pm 0.014	1.96 \pm 0.14	1.96 \pm 0.14	1.96 \pm 0.14
	E	1.58 \pm 0.018* (-14.13%)	1.67 \pm 0.013* (-9.2%)	1.75 \pm 0.01** (-4.89%)	1.64 \pm 0.009* (-16.32%)	1.69 \pm 0.009* (-13.77%)	1.82 \pm 0.0068** (-7.14%)
Moisture content of gill (mg %)	C	71.8 \pm 0.13	71.8 \pm 0.13	71.8 \pm 0.13	73 \pm 0.17	73 \pm 0.17	73 \pm 0.17
	E	73.2 \pm 0.16** (+1.95%)	74.4 \pm 0.06* (+3.62%)	75 \pm 0.06* (+4.45%)	74.6 \pm 0.09* (+2.19%)	75.6 \pm 0.09* (+3.56%)	76.9 \pm 0.09* (+5.34%)

dessicator.

After completion of every 24 hours, the tissues were taken out of the dessicator and weighed separately till a constant weight is reached. Difference between the initial fresh weight and final constant weight accounts for the moisture/water content of the tissue and also its hydration level. Determination of histosomatic index (HSI) was done after Rao et al. (8) by application of the following formula

$$\text{HSI} = \frac{\text{Weight of the fresh tissue in g}}{\text{Weight of the concerned fish in g}} \times 100$$

Values presented are mean of five readings. Statistical significance of the recorded data was tested by application of student *t* test.

Results and Discussion

Values of hepatic lipid, HSI and mg% of moisture in liver and gill of experimental and control fish are presented in Table 1. Percent deviation of each parameter of experimental fish over control are given parentheses. A steady dose and time dependent impact of MOC on HSI and hydration level of liver and

gill (declining trend) was noticed. Moisture content of liver and hepatic lipid value presented inverse relation.

The declining trend in the HSI values of both liver and gill of the experimental fish indicate that the toxic stress might have resulted in necrosis of the tissues. Such possibilities have been reported earlier when fish were exposed to phosphamidon (8), methyl parathion (9) and heavy metals like mercuric chloride (10). It is likely that as liver is the main organ for detoxification, more percent deviation in HSI of this organ is noticed. Loss of weight of any organ indicate some sort of necrotic changes leading to histological disorders. Similar findings were recorded by Patil and Saidapur (11) in fishes exposed to heavy metals and Jyothi and Narayan (12) in *Clarias batrachus* exposed to carbaryl.

Hydration levels (as reflected by moisture content) of liver and gill present opposite trend, i.e. decline over control in liver and increment in gills. Identical trend was recorded by Chatterjee and Das (9) and Chatterjee et al. (13) when the fish was exposed to methyl parathion and cypermethrin respectively. Changes in the hydration level during insecticidal and starvation stress have been recorded by Rao et al (8) and Ahsan et al (14). The variations in the hydration

level may be due to failure of ionic and osmotic regulation with loss of ions as is evidenced in organophosphorous poisoning (15) or may suggest alterations in the permeability property of biological membrane systems (8). A seasonal variation of lipid-water ratio in the liver of *Channa punctatus* has been recorded to be inversely proportional (16). A similar results were recorded here also (Table 1). It is difficult to explain the exact cause and relation between the two parameters in regard to their increment and decline. But it is true that nature of the chemical/toxicant used may determine the extent of relationship. Direct exposure of the gills with water for a longer period may account for the higher hydration level than the liver.

It is evident from the finding that there is a dose and time dependent activity of the toxic component of MOC. It is necessary to determine the LC_{50} dose of MOC for any cultivable fish and also its residual effect under water before it is applied as a manure in fish ponds.

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