Note

Effect of tannery effluent on some haematological profiles of a teleost fish *Cyprinus carpio* var. *communis*

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ABSTRACT

The present paper deals with the toxicity of tannery effluent on some blood biochemical parameters of a freshwater fish *Cyprinus carpio* when the fish was exposed to 10 and 25 % effluent concentrations. A significant increase in the level of glucose, protein and cholesterol was observed. Glucose and protein levels were maximum in 25 %, whereas cholesterol level was found to be high in 10 % effluent concentration.

Tannery effluents are considered to be more dangerous than all the other industrial wastes as pointed out by Arora (1981). They contain chiefly chromium salts, as well as chlorides of calcium and potassium which when discharged into rivers, greatly affect the aquatic life thereby posing a threat to the aquatic ecosystem (Eye and Lawrence, 1971). According to Christensen (1972) any kind of stress not resulting in gross changes and mortality, produces certain changes in fish blood characteristics. Early detection of specific physiological abnormalities provide an indication of exposure to solutions prior to manifestation of any gross damage (Gill and Pant, 1981 b). The above authors used the biochemical changes in tissues and blood offish to assess the chronic effects of toxicants.

The impact of industrial effluents on the physiology and biochemistry of fishes has been well documented (Varadaraj and Subramanian, 1991). Pollution may induce certain biochemical changes in fishes. Before the drastic cellular and systematic dysfunction manifest themselves, appropriate biochemical parameters could be used effectively as sensitive indicators (Aldridge, 1983). Therefore it appears useful to examine changes in the blood biochemistry of *Cyprinus carpio* intoxicated with tannery effluent to evaluate its toxicity.

Specimens of *Cyprinus carpio* were collected from the fish farm of Tamil Nadu Fisheries Development Corporation Limited, Aliyar, Tamil Nadu and acclimatised to the laboratory conditions for fifteen days. Water was changed daily and fish were fed *ad-libitum* with rice bran and groundnut oil cake twice a day. For the experimental studies, fish ranging from 6-7 cm length and weighing from 4-5 g were selected. The
physico-chemical parameters of the effluent was estimated according to APHA (1976) and are as follows: colour: brown, odour: pungent, pH: 3.5, temperature: 28°C, dissolved oxygen: 2.5 mg/l, total hardness: 3.0 mg/l and salinity: nil).

Six groups of ten healthy fish were selected and introduced into the plastic tubs containing 100, 75, 50, 25, 10 and 5% tannery effluent. The manifestation time and survival time of fish were observed following the method of Wurhman (1950). Based on the above studies 10 and 25% effluent concentrations were selected for experimental purpose. Fish were exposed to the above said concentration along with common control. At the end of one hour live fish from control and experimental groups were sacrificed and blood was drawn from the heart region by cardiac puncture with heparin as anticoagulant and centrifuged at 9000 rpm for 20 min. and clear plasma was collected for the analysis of glucose (0 Toludine method of Cooper and McDaniel, 1970), protein (Lowry et al., 1951) and cholesterol (Wybenga and Pileeggi, 1970). All the above values were analysed statistically.

In the present study when fish were exposed to 25% tannery effluent concentration, they survived for 2 hours and in 10% concentration, they survived for 3 hours, whereas in concentrations of 50, 75, and 100% tannery effluent the fish survived for 30-50 minutes only. Based on this observation 10 and 25% were selected for experimental purpose.

Table 1 shows the changes in the plasma glucose, protein and cholesterol levels of Cyprinus carpio exposed to different concentrations of tannery ef-
fluent. When the fish were exposed to 25 % tannery effluent, a significant increase in glucose, protein and cholesterol levels was noticed showing a percent increase of 142.68, 64.52 and 9.6 at the end of one hour when compared to that of control fish. Similarly in 10 % tannery effluent concentration also the biochemical components were increased. The cholesterol content was maximum showing a percent increase of 75.07 when compared to that of 25 % concentration. The glucose and protein level was comparatively minimum in 10 % treated fish showing a percent increase of 34.15 and 26.91 when compared to 25 % concentration. All the values are significant at 5 % level.

Changes in plasma glucose level has been suggested as a useful general indicator of stress in teleost and it was found to be elevated when the animals were subjected to stressful conditions. A hyperglycemic response was observed in fish *Leetatalurus nebulosus* when exposed to titanium dioxide industrial effluent (Larsson et al., 1980). McLeay and Brown (1979) reported that the hyperglycemic condition in cohosalmon *Oncorhynchus kisutch* exposed to kraft pulp mill effluent may be in response to increased energy demand by the fish under toxic conditions. Ghazaly (1992b) observed that hyperglycemia in *Tilapia zilli* exposed to cadmium may be due to an increase in the protein synthesis as a general adaptation syndrome in order to bind the excess of cadmium in the plasma. According to Florkin and Scheer (1970) under conditions of stress many organisms will mobilise proteins as an energy source via the oxidation of aminoacids. Ghazaly (1992 a) suggested that increase in protein content in *Tilapia zilli* under cadmium intoxication could be attributed to the relative changes in the mobilization of blood proteins. Another possible explanation for hyperproteinemia may be due to the binding affinity between the metal and plasma proteins (Bremner and Marshall, 1974). In the present study the increase in protein content during acute exposure may be due to the presence of chromium leading to the mobilization of blood proteins or binding affinity between the metal and plasma proteins.

Lafon (1967) reported that lipids are vital to embryogenesis, providing two third of energy by oxidation. Agarwal (1992) observed that an elevated level of serum cholesterol in *Channa punctatus* via the intermediate glucose-1-phosphate getting and entering the circulation. The hyperglycemic condition recorded in the present study may be due to the induced activation of adrenal pituitary glucocorticoid hormones which stimulate the hepatic glucose production thereby elevating the blood glucose level or it may be a physical response to meet the critical need of energy under effluent stress as suggested by the others.
exposed to mercuric chloride effluent might be an indication of liver damage which normally esterifies cholesterol and excrete a part of it with the bile. Janderko and Kossmann (1965) demonstrated that blood cholesterol elevation might be due to the inhibition of the activity of enzymes of lipid metabolism such as lipoprotein lipase by toxic effluents leading to a retarded clearance of lipids from blood. The increased level of plasma cholesterol in the present study may also be due to liver dysfunction or mobilization of glycerol or inhibition of oxidative phosphorylation.

Acknowledgment

M. Ramesh thanks the CSIR, New Delhi for the financial support received.

References


