ROTective ROLE OF CAFFEINE (1, 3, 7-TRIMETHYLEXANTHINE) ON LEAD INDUCED ALTERATIONS IN LIPID CONTENT OF DIFFERENT TISSUES OF FRESH WATER BIVALVE, LEMELLIDENS CORRIANUS (LEA)

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ABSTRACT
The present communication deals with effectiveness of caffeine (1,3,7-Trimethylexanthine) in lead induced toxicity in an experimental model, the freshwater bivalve, Lamellidens corrianus. The effect on bivalve was studied under five groups. Group A bivalves were maintained as control, B group bivalves were exposed to chronic dose (LC50) of lead nitrate (6.81 ppm) for 20 days. Group C bivalves were exposed to respective chronic concentration of lead nitrate along with caffeine (5mg/l). Lipid contents in selected tissues from each group were estimated after 10 and 20 days. Bivalves from group B were divided for recovery into two groups D and E after 20 day exposure to lead. D group bivalves were allowed to cure in normal water, E group bivalves were exposed to caffeine (5mg/l) up to the 9 days. From each of recovery groups, some bivalves were removed and lipid contents in selected tissues of bivalves were estimated after 3, 6 and 9 days. The lipid level was significantly decreased on exposure to lead while the decrease in presence of caffeine was less when exposed simultaneously than when exposed individually. During recovery lipid contents recovered and the rate of recovery was faster in caffeine exposed bivalves as compared to those recovered in normal water. The probable role of the caffeine is discussed in the paper.

KEY WORDS: caffeine, lead, lipid, Lamellidens corrianus.

INTRODUCTION
Advance in industrialization and human exploitation of world mineral resources has resulted in high levels of heavy metals in the environment. The aquatic bodies near the industrial and urban area are more prone to the accumulation of such metals. There are number of toxic heavy metals, whose increasing levels in the environment are of serious concern today. Water pollution is the biggest menace of urbanization, and modern agricultural practices. Heavy meals are one of the more serious pollutants in our natural environment due to their toxicity, persistence and bioaccumulation problem (Tam and Wong, 2000). The heavy metals such as cadmium, lead and mercury have no known beneficial effect and their accumulation over the time in animals can cause illness (Hawkes, 1997). The most important heavy metals from the water pollution point of view are Zn, Cu, Pb, Cd, Hg, Ni and Cr and become toxic at higher concentrations (Agrahari, 2009). Lead is a persistent metal, however, and is still present in the environment in water, brass plumbing fixtures, soil, dust, and imported products manufactured with lead. Lead is a highly toxic substance. There are many ways in which humans are exposed to lead: through deteriorating paint, household dust, bare soil, air, drinking water, food, ceramics, home remedies, hair dyes and other cosmetics. Lead is of microscopic size, invisible to the naked eye. When a pregnant woman has an elevated blood lead level, that lead can easily be transferred to the fetus, as lead crosses the placenta.

Lipids are molecules that contain hydrocarbons and make up the building blocks of the structure and function of living cells. Lipid is the most efficient organic reserves of most of the bivalves and other animals (Anderson and Webber, 1977) along with major structural components of the body tissues. It is therefore essential to study the effect of variables on the lipid content. It has been observed that heavy metals can cause biochemical effect, such as inhibition of enzymes, metabolic disorders, genetic damage, hypertension and cancer (Underwood, 1971; Zemansky, 1974; Lucky and Venugopal, 1977). Caffeine is a naturally found in the leaves, seeds and fruits of at least 63 plant species worldwide. Caffeine is one of the most frequently consumed alkaloid compounds The most commonly known sources of caffeine are coffee, cocoa beans, kola nuts and tea leaves (Barone et al., 1996; Frary et al., 2005). Detoxification has also become a prominent treatment as people have become more aware of environmental pollution. Calcium EDTA, penicillamine etc. are used in metal intoxication as chelators to remove As, Hg, Pb, and Cd poisoning. There are number of chelators used for the remediation of metal toxicity. Chelators are particular substances that bind to heavy metal and speed their elimination (Hammand, 1971; Graziano et al., 1985). Antioxidant plays a protective role in the treatment of lead poisoning (Gurer et al., 2001). Caffeine is found to have antioxidant activity. Caffeine being water soluble and common cheaper beverage, caffeine will be cheapest preventive and curative medicine. The protective action of caffeine from damage of tissues biomolecules and genetic material due to heavy metal generated free oxygen radicals might be because of its antioxidant property (Mahajan, 2005). The present work was carried out to study the...
Caffeine occurs naturally in more than 60 plants including coffee beans, tea leaves, kola nuts used to flavor soft drink colas, and cacao pods used to make chocolate products. Dorea et al., (2005) showed that epidemiological and experimental studies have shown positive effects of regular coffee drinking on various aspects of health, such as psychoactive responses (alertness, mood change), neurological condition (infant hyperactivity, Parkinson’s disease) and gonad and liver function. The protective action of caffeine against a variety of chemical carcinogens was established by several studies, carried out by Abraham (1989; 1991). Dissolved heavy metal ions are positively charged and caffeine contains uncharged and negatively charged molecules. Metal ions might bind to negatively charged groups. This reduces the charged active heavy metal ions which indicates that caffeine have capacity to remove the heavy metal from the living organism. Lipids are also one of the most important energy reservoirs and these are stored and transported in the form of di and tri glycerol’s and esters. Coppuzzo and Lancaster (1981) reported a significant decrease in the lipid of post larval lobster, Homarus americanus when exposed to pollutants. The various factors like age, sex, food supply, seasonal variations etc. influence the lipid content of the organisms. It was observed that the lipid contents increased when the animals came across the stressed conditions. There was increase in lipid content after dimilin intoxication in larvae of Porthreia dispar Salama et al., (1976). One of the reasons for lipid increase as inhibition of lipase activity after organophosphate treatment, Coley, R. M. and Jensen, R. G. (1973). The transformation of glycochen into lipid through trios’ phosphate pathway as one of the causes for lipid elevation Gabbott (1976). The same reason for lipid enhancement in heavy metal salts with caffeine-exposed bivalves as compared to those exposed to only lead nitrate. The bivalves show fast recovery in tissue lipid level in presence of caffeine than those allowed to cure naturally. When the bivalves exposed for 20 days to lead nitrate was allowed to recover, lipid recovery was at a very slow rate in naturally curing bivalves. Lipid contents recovered faster during nine days in all tissues in caffeine. Rate of recovery was better in caffeine than in normal water recovery. The decrease in lipid content in the fresh water bivalve, after lead nitrate treatment may be due to reduced synthesis of lipid or increased activity of lipase involved in oxidation of lipids (Hollands, 1978).
Table 1. Lipid content in Hepatopancreas of *Lamellidens corrianus* (Lea) after chronic exposure to Lead nitrate without and with caffeine during recovery. (Values are in percent of dry weigh)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>10 days</th>
<th>20 days</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 Days</td>
<td>6 days</td>
<td>9 days</td>
</tr>
<tr>
<td>Control</td>
<td>13.33 ±1.6673</td>
<td>13.83±1.6673</td>
<td></td>
</tr>
<tr>
<td>Lead nitrate (6.81ppm)</td>
<td>8.3±1.0559NS (-37.73)</td>
<td>6.6±1.2922NS (-52.27)</td>
<td></td>
</tr>
<tr>
<td>6.81ppm Lead nitrate+ 5mg/l Caffeine</td>
<td>12.49±1.29NS (-8.32)</td>
<td>11.83±1.494NS (-14.46)</td>
<td></td>
</tr>
<tr>
<td>After 20 days exposure to 6.81 ppm Lead nitrate</td>
<td>Normal Water</td>
<td>7.49±1.2922NS [+13.48]</td>
<td>8.3±1.0559NS [+25.75]</td>
</tr>
<tr>
<td></td>
<td>Normal Water+ 5mg/l Caffeine</td>
<td>9.9±1.6248NS [+50.00]</td>
<td>11.66±1.292NS [+76.66]</td>
</tr>
</tbody>
</table>

Table No. 2: Lipid content in Testis of *Lamellidens corrianus* (Lea) after chronic exposure to Lead nitrate without and with caffeine during recovery. (Values are in percent of dry weigh)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>10 days</th>
<th>20 days</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 Days</td>
<td>6 days</td>
<td>9 days</td>
</tr>
<tr>
<td>Control</td>
<td>8.33±1.0559</td>
<td>7.49±1.0559</td>
<td></td>
</tr>
<tr>
<td>Lead nitrate (6.81ppm)</td>
<td>5.83±1.2980NS (-30.01)</td>
<td>4.16±1.2922NS (-38.58)</td>
<td></td>
</tr>
<tr>
<td>6.81ppm Lead nitrate+ 5mg/l Caffeine</td>
<td>12.49±1.29NS (-8.32)</td>
<td>11.83±1.494NS (-14.46)</td>
<td></td>
</tr>
<tr>
<td>After 20 days exposure to 6.81 ppm Lead nitrate</td>
<td>Normal Water</td>
<td>4.99±1.2922NS [+19.95]</td>
<td>6.16±1.2848 * [+58.89]</td>
</tr>
<tr>
<td></td>
<td>Normal Water+ 5mg/l Caffeine</td>
<td>5.49±1.2922NS [+31.97]</td>
<td>6.39±1.2922NS [+53.60]</td>
</tr>
</tbody>
</table>

Values in ( ) indicate percent change over control
Values in [ ] indicates percent change over respective metal treated of 20 days
NS - Non significant, *-compared with control, ** compared with respective metal treated of 20 days
*/=- P< 0.005, ***/-P< 0.001, ***/-**- P<0.01

REFERENCES