can be cultivated on the synthetic compost like *Agaricus bisporus*.

The fresh sporophores were fed to white albino rat in the laboratory for one week. No abnormality could be detected in them.

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SIGNIFICANCE OF LIPID PEROXIDATION IN LIVER INJURY AFTER HEAVY METAL POISONING IN RATS

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FORMATION of lipo-peroxides at selective subcellular sites due to an alteration in the antioxidant activity of the cell has been considered to play a significant role in a number of pathological processes that involve the liver. The product thus formed is malonaldehyde or malonaldehyde like substance[1]. Malonaldehyde occurring in living tissues or in biological specimens undergoes metabolic transformation and can be determined by thiobarbituric acid. Many heavy metal salts severely effect the liver as they are metabolised by the hepatic microsomal system. Excessive intake of iron salts is known to stimulate lipid peroxidation[2], whereas zinc inhibits this process[3]. Recently a few observations have been made on malonaldehyde in brain and other tissues[4–6], however, the effects of other and environmentally important metals like mercury, lead, cadmium, molybdenum, copper, chromium and manganese on lipid peroxidation in liver have not been studied. The role of these metal ions on aggravation of liver lipids was reported[7]. Since, peroxidative damage to membranes also encourage triglyceride accumulation[8], role of lipo-peroxides was determined in the liver of rats (*Rattus rattus* albino) fed on few heavy metals *viz* mercury, lead, cadmium, molybdenum, copper, chromium, manganese and zinc.

Ninty laboratory bred male albino rats (*Rattus rattus* albino), 90 days old, weighing 100 ± 10 g were randomly allocated into 9 groups, each of 10 rats. Each rat was housed separately, fed on standard laboratory diet (Hindustan Lever Ltd., Bombay), tap water *ad libitum* and maintained under standard laboratory conditions. Rats of groups A, B, C, D, E, F, G and H received a sublethal dose of 0.005, 0.005, 0.5, 1.0, 0.1, 0.05, 0.25 and 5.0 g/kg body weight of Hg, Pb, Cd, Mo, Cu, Cr, Mn and Zn respectively daily by gavage, for a period of 30 days in addition to laboratory diet whereas the animals of control group I received the laboratory diet alone and tap water *ad libitum*. The dose levels were applied after making primary toxicological tests[9] like oral LD_{50}.

On expiry of treatments, all the rats were starved for 24 hr and then killed by decapitation. Pieces of liver from each rat were quickly excised and immediately frozen at -4°C. 10% (w/v) homogenates of the liver were prepared in 0.9% sodium chloride solution. Temperature near 0°C was maintained throughout the period of homogenisation. The homogenates were centrifuged for 120 min at $1500 \times g$ and the clear supernatant fluids were processed for the estimation of malonaldehyde[10]. The student *t* test[11] was applied to calculate the statistical significance between control and experimental values.

Present results indicate that lead, cadmium and zinc failed to promote the formation of lipid peroxides in the liver of rats whereas mercury, molybdenum, copper, chromium and manganese affected membrane fluidity and induced formation of aldehydes (table 1).

Free metal ions of mercury, lead, cadmium etc

Table 1 *Malonaldehyde in the liver of rats fed on different metals.*

Treatment	Malonaldehyde (nanomoles/g of liver) Nanomoles	Significance level
Control	0 140 ± 0 012	
Mercury	0 528 ± 0 036	P < 0.001
Lead	0.099 ± 0.008	P < 0 05
Cadmium	0.062 ± 0 009	P < 0.01
Molybdenum	0.727 ± 0.040	P < 0.001
Copper	0.192 ± 0.010	P < 0 05
Chromium	0.820 ± 0.092	P < 0.001
Manganese	0.428 ± 0 020	P < 0.001
Zinc	0 038 ± 0.006	P < 0.001

Each value expressed as mean ± S.E. (5 observations).

possess enzyme inhibitory properties. They produce substantial depletion of cytochrome P_{450} in rat liver without a concomitant change in NADPH-cytochrome C reductase. *In vivo* studies have demonstrated decrease in cytochrome P_{450} levels after lead, mercury, copper, cadmium and cobalt poisoning[12]. The mechanisms responsible for the decrease in cytochrome P_{450} content of endoplasmic reticulum in the liver are though varied, however, occurrence of lipid peroxidation has also been suspected[13].

Heavy metals induced lipid peroxidation might also involve chain mechanisms proposed for other xenobiotics. Two types of lipid radicals may be formed initially, one formed by hydrogen abstraction and the other formed by addition of an OH radical to a double bond. The OH is formed directly following the autooxidation of thiols and lipids in the presence of ferrous ions. The latter mechanism provides a simple pathway for the formation of malonaldehyde[14].

How much contribution is made by the products of lipid peroxidation in liver injury promoted by heavy metals is a matter of debate. However, toxicity of lipid peroxides in general deserves a brief mention. They are known to produce damage to protoplasmic moieties at molecular level[15]. Over production of free radicals blocks the mitotic cycle and conversely cell reproduction is inhibited by peroxidation initiators[16]. Alteration in peroxidative balance results in hemolysis[17]. Regarding kinetics, it is well known that higher the degree of unsaturation of fatty acid molecule, the faster is the rate of peroxidative decomposition. Inorganic ions further complicate the biological situation and force us to conclude that peroxidative decomposition of membrane is one of the key steps involved in heavy metal induced liver injury.

Lead, cadmium and zinc inhibited peroxidative derangement of unsaturated lipids. Although it is a first information on lead and cadmium, antiperoxidative property of zinc has already been established. The addition of zinc to liver microsomes exposed to U.V. light prevents the formation of malonaldehyde[3]. Studies made on protection offered by lead nitrate on CCl_4 lethality[18], indirectly support our observations. However, anti-peroxidative property of cadmium is a highly significant finding. Further work on the protective effects of antioxidants against heavy metal poisoning is in progress. Positive results would confirm the present hypothesis at least for mercury, molybdenum, copper, chromium and manganese.

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