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Effect of environmentally realistic levels of mercuric chloride on hepatic P450 enzymes in rats after 14- and 90-day oral exposure

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Abstract

Although kidney is the primary target for mercury toxicity, considerable amount of mercury has been found to accumulate in the liver following exposure to this heavy metal. In view of the prominent role played by the hepatic cytochrome P450 (CYP) isoenzymes in metabolizing hormones, drugs and other xenobiotics, the present study was undertaken to primarily examine the effect of mercuric chloride on hepatic CYP isoenzymes in rats following short- and long-term exposure. Male Sprague Dawley rats were gavaged daily with 0 (control), 0.5, 1.0 or 1.5 mg/kg dose of mercuric chloride for 14 and 90 days. At the end of the experimental periods, the animals were sacrificed and liver microsomes prepared to assay the activities of various CYP isoenzymes. The 14 day mercuric chloride exposure resulted in no significant increase or decrease in the activities of ethoxyresorufin O dealkylase (EROD), pentoxyresorufin O dealkylase (PROD), benzyloxyresorufin O-dealkylase (BROD) and p-nitrophenol hydroxylase (CYP2E1) at any of the dosages used in this study. Similarly, the 90 day exposure neither increased nor decreased the activity of any of the CYP enzymes. Concomitantly determined levels of reduced glutathione (GSH) in the liver samples measured as a marker of oxidative stress showed, in general, no significant difference in GSH levels between the treated and control animals. Although these data suggest that exposure to mercury at maximum tolerated dose (MTD) or doses lower than MTD did not significantly alter the levels of CYPs and GSH, additional studies determining hepatic concentration of mercury and its effect on these parameters are needed to support the results presented in this study.

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Role of Cumin extract in alleviating N-nitrosodiethylamine induced oxidative stress

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Abstract

Nitrosamines such as N-nitrosodiethylamine (NDEA), cause oxidative stress due to the generation of reactive oxygen species (ROS) which can bring about peroxidative damage to the cell. Role of cumin extract in alleviating the NDEA induced oxidative stress in rats has been undertaken in the present investigation. For this one group of

rats were fed on semisynthetic diet prepared in lab and served as control group, while of other group (test group) were fed on same diet but supplemented with cumin extract (0.5%) and served on the test group. After two weeks of feeding, stress was induced to half the animals of each group by ip administration of NDEA @ 200 mg kg⁻¹ body weight and remaining half were administered normal saline (ns). Animals were sacrificed 48h post stress induction period. Intraperitoneal administration of NDEA evoked several biochemical and pathological changes such as decreased food intake, loss in body weight, increased activities of plasma amino transferases and increased urea levels. The effects were appreciably of lower degree in the test group. In vitro lipid peroxidation (LPO) in erythrocytes and tissues was appreciably of lower degree in the test group. Superoxide dismutase (SOD), peroxidase (Px) and catalase (CAT) activities showed varied responses in various tissues. The SOD activity increased whereas the Px and CAT activity decreased on stress induction by NDEA but these effects were relatively of lower degree in test groups. Thus it is evident from the present study that cumin extract supplementation can help prevent oxidative stress resulting from nitroso compounds.

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Kinetics of nonself surface adhesion and phagocytic response of hemocytes of Scylla serrata exposed to sodium arsenite

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Abstract

Edible mud crab Scylla serrata (Crustacea : Decapoda) is an economically important species. Hemocytes – the blood cells of the species perform diverse immunological functions including nonself recognition and phagocytosis of nonself particles. Kinetics of nonself surface (glass) adhesion of hemocytes was determined under the exposure of 1, 2, 3 ppm of sodium arsenite in diverse span of exposure i.e. 24, 48, 72 and 96 hours in controlled laboratory condition. Shifts in kinetics of adhesion were recorded against all the concentration screened. However, the patterns of shift were not uniform. Arsenic induced shift in surface adhesion of hemocytes indicated a state of immunological stress in the species. Phagocytosis of nonself particulates is considered as a classical immunological response in crab. We have examined phagocytosis of yeast (Saccharomyces cerevisiae) by hemocytes of animal exposed to 1, 2 and 3 ppm of sodium arsenite for 24, 48, 72 and 96 hours in vitro. Alteration in phagocytic response and adhesion of hemocytes is suggestive of cellular stress which may lead to decline in population of S. serrata in arsenic affected districts of West Bengal.

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Hepatoprotective effect of Andrographis paniculata against cadmium induced toxicity in male Wistar rats

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Abstract

The present work was carried out to evaluate the hepatoprotective effect of A. paniculata, a popular Indian ethnomedicine in the liver of cadmium chloride intoxicated rats. Oral administration of cadmium (5mg/kg body wt.) for 30 days resulted in a significant ($p<0.01$) elevation of serum aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP), lactate dehydrogenase (LDH) and bilirubin and the levels of lipid peroxidation marker, malondialdehyde (MDA) in liver. Cadmium also caused a significant reduction in the activities of superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx) and reduced the glutathione level in liver. Prior oral administration of A. paniculata extract (100 mg/kg body wt.) with cadmium chloride significantly decreased the serum hepatic marker enzymes viz., AST, ALT, ALP, LDH and the level of bilirubin along with the significant decrease in the levels of lipid peroxidation in the liver. In addition the A.paniculata extract significantly increased the activities of SOD, CAT, GPx and reduced GSH level in the liver of cadmium intoxicated rat. Our results demonstrate that the aqueous extract of Andrographis paniculata exhibited antioxidant property and decreased the lipid peroxidation against cadmium induced oxidative stress in liver.

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Desirability to prescribe quality specifications for aluminium foils used as food contact material

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Abstract

An exploratory study on metallic constituents in aluminium foils has been undertaken to assess the need to prescribe quality specifications. The aluminium content of foils was found to range from 90% to over 99% and contained alloying elements, namely iron, magnesium, manganese, copper and traces of zinc. Low quantities of lead and cadmium, the elements of high toxicity concern have been detected. The study suggests the need to specify functional elements in the starting alloys for aluminium foils and prescribe limits for some toxic metals. Such standards will encourage industries to select proper raw materials and adopt good manufacturing practices to ensure safety compliance.

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Effect of exposure to chromium on humoral and cellular immunity in fish

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Abstract

The water of a local rivulet (Buddha Nallah) was found to contain chromium in concentration of 0.065 mg/L (maximum permissible limit 0.05 mg/L). The effect of chromium on humoral and cellular immunity of common carp fish (Cyprinus carpio) was, therefore, evaluated. Fish were exposed for 3 months to water containing various

concentrations of chromium. Total plasma immunoglobulins (g/ml) were found to be 241.67 ± 4.77 , 190 ± 5.77 , and 130 ± 5.77 compared to the control value of 560 ± 7.30 g/ml after exposure to chromium at concentrations of 2, 3 and 5 mg/L, respectively for 90 days. The levels of rosette forming cells (T cells) were 9%, 11%, and 13% as compared to 20% in control fish after exposure to chromium at 5, 3 and 2 mg/L, respectively for 90 days. Thus, exposure to chromium was found to depress both, the humoral and the cellular immunity of fish.

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Zinc protected against lead induced changes in lipid peroxidation and antioxidative enzyme levels in CD1 mice liver brain and kidney

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Abstract

The present study was designed to elucidate protective effects of zinc on lipid peroxidation damage in lead-exposed mice. Male mice were divided into group I (control), group II (200ppm lead nitrate), group III, IV and V and were treated orally daily for 30 day with 0.78 mg/kg/d, 1.56 mg/kg/d and 3.12 mg/kg/d of zinc chloride, respectively, by oral gavage, and later these mice were exposed to 200 ppm lead nitrate, daily for 30 days. The body weight, feed intake and water consumption were decreased significantly in all the treated groups. MDA level increased in kidney and brain in group II, III, and IV. SOD and GPx levels in kidney and brain decreased in group II and III, and increased in group IV and V. GPx level in liver, increased significantly in all the treated groups, whereas, kidney and brain GSH level decreased in group II, increased in group IV and V. It is concluded that lead induces oxidative stress in kidney and brain by increasing the lipid peroxidation product and by decreasing the antioxidant enzyme levels. Zinc supplementation enhanced the levels of antioxidant enzymes and decreased the MDA levels, thus, exhibiting protective/beneficial effects.

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Studies on the effect of sodium selenite induced sub chronic selenosis on immune response in cow calves

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Abstract

The present investigation reports the effect of long-term administration of sodium selenite on immune response in calves. Sodium selenite was administered orally at dose rate of 0.1 and 0.25 mg/kg b.wt. for 98 consecutive days. Higher dose produced characteristic symptoms of selenosis whereas mild symptoms were observed with the lower dose. The toxic signs appeared when blood selenium levels were 1.68 ± 0.13 mg/ml. The forced anti-body titre against the alum precipitate Haemorrhagic septicemia vaccine was significantly higher in the treated animals. The cell-mediated immune response studied by delayed type hypersensitivity test was significantly higher in the treated animals. Thus, raised blood selenium levels augmented the immune response i.e. humoral and cell mediated immune response in the treated animals. Prolonged exposure to selenium also produced marked histopathological changes in the lymph nodes of treated animals.

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In vitro acetylcholinesterase inhibition and cytotoxic effect of some organophosphorus pesticides in human erythrocytes and HepG2 cells

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Abstract

In vitro effects of some novel organophosphates like RPR-II, RPR-V, chlorpyrifos, dimethoate and monocrotophos (MCP) were studied in human erythrocytes with special reference to acetylcholinesterase (AChE) and mitochondrial function (MTT assay) in HepG2 cell lines. The purpose of the present study was to quantify "in vitro" effect by means of the 50 percent inhibition (IC_{50}) using acetylthiocholine iodide as substrate in human RBC in the presence of different concentrations of pesticides. Our study indicated dose dependent AChE inhibition by all the OP compounds tested. The IC_{50} observed for RPR-II, RPR-V and chlorpyrifos was greater than 10 mM, whereas dimethoate and MCP showed 1.60 and 2.38 mM respectively showing dimethoate 1.48 times more potent than MCP. The kinetic constant (V_{max} and K_m) showed the trend of decreasing with all the compounds assayed indicating non-competitive inhibition. Similarly, the cell viability (MTT) also decreased by all the tested five OP compounds. RPR-II and RPR-V were found to be least toxic and IC_{50} observed was greater than 10 mM, whereas IC_{50} observed for chlorpyrifos, dimethoate and MCP were 0.835, 0.850 and 0.576 mM respectively. These results indicated dose dependent cytotoxic effect by all these OP compounds on HepG2 cell lines and relatively MCP was most potent in comparison to other compounds tested. From the present study, it can be concluded that the in vitro AChE and MTT assays are sensitive assays and can be used as biochemical marker for the exposure of organophosphates.

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Arsenic Induced haemato-biochemical and histopathological alterations and its levels in certain biological samples of goats

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Abstract

Effect of sodium arsenite at different dose levels 0.25, 0.5, 1 and 2mg/kg of body weight, given orally daily for 6 months was studied in the goats. Hepatotoxic effect was evident by a steady increase in enzyme levels of liver function test in dose dependent manner. Daily oral administration also alters the haematological picture. Elevated arsenic concentration was observed in different biological samples, but hairs are the biomarker of chronic toxicity. These results were further supported by histopathological changes seen at higher doses. Sodium arsenite at the dose rate of 0.25mg/kg of body weight dose not produce significant damage to the animal.

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A three-generation toxicity study of diethyl phthalate on histology of adrenal and thyroid glands of rats

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Abstract

The present study was undertaken to know the effect of Diethyl phthalate (DEP) over three generations on the histology of adrenal and thyroid glands of male and female Wistar rats. Healthy male and female rats (75 -100 g) were given DEP (in corn oil) mixed with diet at 50 mg/ kg of the diet /day. After treatment for 100 days, females were mated with males for 10 days. Exposure to DEP was continued throughout mating, gestation and until weaning. Six male and six female pups of both F1 and F2 generations were allowed to grow till they were 75 - 100 g. The treatment was then carried out similar to the F0 generation but with reduced dose of 25mg / kg of the diet/ day for F1 generation and 10 mg / kg of the diet/ day for F2 generation. Animals were sacrificed and histology of adrenal and thyroid glands was carried out. DEP-treated male rats of F0, F1 and F2 generation showed vacuolations and degeneration in the zona fasciculata region of the adrenal cortex, while in case of females the degenerative changes in the adrenal was much more evident in F2 generation rats. Thyroid gland showed pronounced changes of follicular shrinkage with loss of thyroglobulin and fibrosis of the interfollicular tissue in F2 generation. These changes were of lesser intensity in F0 and F1 generation male and female rats. The present study indicates that administration of DEP over generations can cause severe histopathological changes in the thyroid and adrenal gland incase of both the sexes.

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A standard hepatotoxic model produced by paracetamol in rat

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Abstract

Oral administration of paracetamol in graded doses (250, 500 and 1000 mg/kg, once orally) damaged the liver of rats after 48 hrs, and the severity and extent of liver damage appeared to be dose dependent. At histopathological examination, the hepatic lobules revealed congestion, degeneration and focal necrosis. The hepatocytes appeared large, vacuolated with small condensed pyknotic nuclei. Cytolysis, karyolysis and karyorrhexis of many hepatocytes showing vacuolar degeneration or with eosinophilic cytoplasm were observed. The zonal location of hepatic necrosis was mid to centrilobular. Based on the overview of the liver damage caused by different doses of paracetamol in rats, it has been concluded that paracetamol produces standard and uniform hepatic damage at a single oral dose of 500 mg/kg body weight. It suggests that paracetamol at this dose may produce a standard hepatotoxic model for experimental toxicology.