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Role of biomarkers in evaluating interactions among mixtures of lead or cadmium and chlorpyrifos

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A toxicological interaction is a circumstance in which exposure to two or more chemicals results in qualitatively or quantitively altered biological response relative to that predicted from the actions of a single chemical. The present study was carried out to investigate the *in vivo* neurological, biological and hematological effects of organophosphorus insecticide; chlorpyrifos and heavy metals (lead or cadmium) on in the albino rats at various time intervals (1 hr and 1, 10 and 20 days). These pollutants were used individually or in combination. The studied parameters included blood picture (erythrocytes and leukocytes counts, hemoglobin content and packed cell volume), muscarinic cholinergic receptors as well as some enzymes such as delta amino levulinic acid dehydratase (δ-ALAD), acetyl cholinesterase (AChE) and Na+,K+–adenosine triphosphatase (Na+,K+–ATPase). The results demonstrated that chlorpyrifos alone caused significant inhibition of AChE and significant decrease of muscarinic cholinergic receptors, while it did not show any potential to inhibit Na+,K+–ATPase and did not change the blood picture of animals. On the other hand, lead or cadmium alone showed the ability to inhibit AChE, δ- ALAD as well as Na+,K+–ATPase and cause changes in blood pictures while it slightly reduced the muscarinic cholinergic receptors. The combination of chlorpyrifos with heavy metals caused striking effect on all tested targets.

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Genotoxicity of chromium, copper and arsenate (CCA) and the ameliorative effects of vitamin C using mouse sperm morphology assay

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The persistence of chromium, copper and arsenic in the environment has been widely documented. They are found in the environment as active components of a wood preservative called CCA (Chromate-Copper-Arsenate) with widespread exposure to human and wildlife populations. Interactions between these elements may induce elevated genotoxic effects more than single element itself. In vivo germ cell DNA damage induced by individual compound and CCA were investigated in mice using sperm morphology assay and testes histology. Vitamin C effect in alleviating the genotoxicity was also studied. 0.5 mL of sub-lethal concentrations; 0.0625x, 0.125x, 0.25x, 0.5x and 1x of LD50 for the individual and CCA combination, were intraperitoneally injected for 5 days according to the mice body weights. Similar treatments were given to distilled water and cyclophosphamide (20 mg/kg b.w.t) groups; negative and positive controls, respectively. A separate group was administered with vitamin C (20 mg/kg b.w) before the LD50 concentration. Animals were sacrificed on the 35th day for sperm morphology assay and testes histology. There was increase in the induction of abnormal sperm morphology and various testicular lesions in treated mice compared to the negative control. However, only CCA and chromium were statistically significant ($p<0.05$). Vitamin C treated mice presented insignificant abnormal sperm morphologies with mild or no visible testicular lesions. The findings of this study showed that though arsenic and copper might not be genotoxic, interaction between elemental components of CCA may be capable of inducing genotoxic effects. The study also showed that exposure to CCA may increase reproductive toxicity in mammals.

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