RESEARCH REPORT

HEPATOTOXIC AND GONADOTOXIC EFFECTS OF LOW DOSE OF INSECTICIDE DIAZINON IN MALE RATS

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ABSTRACT

Over the decades, more than hundred thousands of synthetic pesticides have been invented as a helpful source to eradicate nuisance pests and to maintain adequate food supply. Diazinon [*O,O*-diethyl-0-(2-isopropyl-6-methyl-pyrimidine-4-yl) phosphorothiote], an organophosphate insecticide has been widely used in agriculture and domestic scale. It is rapidly degraded by microbes in the environment and to a small extent by exposure to sun light. However, its ubiquitous and negligible amount in the environment presents a continuing health hazard to exposed farmers. Human beings can be potentially exposed to this semi-volatile insecticide through inhalation, ingestion and dermal contacts. Diazinon toxicity was proposed via oxidative stress by lipid peroxidation and relatively was less studied in male reproductive system. Hence the current work aimed to investigate the dose dependant adverse effects of diazinon on few physiological, biochemical and histopathological changes in liver and testis of adult male Sprague-Dawley rats based on LD_{50} as a measure of the lowest possible exposure in agricultural environment. The rats were gavaged with diazinon at 0.0, 0.2, 0.3 and 0.6% of LD_{50} (>5000 mg/kg body weight) in 3 durations of 1, 2 and 8 week(s). Activity of liver aspartate aminotransferase, alkaline aminotransferase, alkaline phosphatase, and lipid peroxidation exhibited an increase with consensus inhibition of reduced glutathione and catalase levels. Parallel with the biochemical changes, diazinon treatment significantly enhanced the damage in testis. The levels of lipid peroxidation was significantly increased with 0.06% dose in 1 week treatment and all doses in 2 and 8 weeks treatment, following with the significant decrement in reduced glutathione levels in all doses of 2 and 8 week and catalase diminishing trend. Diazinon significantly decreased serum testosterone levels in 8 week treatment and was accompanied with an increased incidence of sperm abnormality in testis. Increase in serum lactate dehydrogenase activity with a qualitative derangement in liver and testis histology possibly induces cytotoxic effects. The toxicity of diazinon with low dose exposure study revealed a dose and time dependant response in the parameters of this study. Different antioxidants and enzymes showed significant alterations with an increase in lipid peroxidation. Diazinon at low doses is cytotoxic to liver and germ cell lines.

ABSTRAK

Kesan-kesan Hepatotoksik dan Gonadotoksik Akibat daripada Pendedahan Racun Serangga Diazinon yang Berdos Rendah pada Tikus Jantan

Peningkatan jumlah penghasilan racun serangga sintetik sejak beberapa dekad menandakan keperluan global dalam menangani serangga perosak demi memantau keperluan sumber makanan. Diazinon [0,0-diethyl-0-(2-isopropyl-6-methyl-pyrimidine-4-yl) phosphorothiote] ialah sejenis insektisid organofosforus yang telah digunakan secara meluas dalam industri pertanian dan secara domestik. Diazinon mudah terurai di alam sekitar melalui tindakan mikroorganisma, malah turut dipengaruhi terik matahari. Namun demikian, penyebarannya yang meluas dalam kuantiti yang sangat kecil telah diabaikan dan wujud sebagai ancaman kesihatan yang berterusan kepada para petani. Manusia berpotensi terdedah pada insektisid separa meruap ini melalui respirasi, oral dan dermal. Ketoksikan diazinon dicadangkan melalui stres oksidatif yang dijana oleh proses oksidasi lipid. Sehubungan itu, kajian ini masih kurang dijalankan ke atas sistem pembiakan jantan. Oleh yang demikian, dos LD_{50} dipilih sebagai skala sukatan pendedahan terendah yang mungkin di kawasan pertanian. Kajian ini bertujuan untuk menyiasat kesan negatif diazinon ke atas perubahan fisiologi, biokimia dan histopatologi hepar dan testis tikus spesies Sprague-Dawley jantan. Tikus dirawat pada dos 0.0, 0.2, 0.3 dan 0.6% LD_{50} (>5000 mg/kg berat badan) diazinon dalam 3 kategori jangka masa iaitu 1, 2 dan 8 minggu. Aktiviti aspartat aminotransferase, alkali aminotransferase dan alkalin fosfatase serta oksidasi lipid menunjukkan peningkatan diikuti penurunan reduced glutathione dan katalase. Sejajar dengan perubahan biokimia, rawatan diazinon mengakibatkan kerosakan di testis. Oksidasi lipid ketara meningkat pada dos 0.6% rawatan seminggu, dan semua dos rawatan 2 dan 8 minggu. Ini diikuti penuruan paras reduced glutathione pada semua dos rawatan 2 dan 8 minggu serta katalase. Diazinon jelas menurunkan paras testosteron serum pada 8 minggu rawatan selaras dengan peningkatan insiden kecacatan sperma. Peningkatan aktiviti laktat dehidrogenase serum seiring dengan kemerosotan kualitatif di hepar dan testis menganjak kemungkinan kesan sitotosik diazinon. Kajian diazinon pada dos rendah menyingkap pekaitan hubungan kesan toksik dan dos dan tempoh pendedahan adalah saling berkaitan. Antioksida dan enzim jelas dipengaruhi dengan peningkatan oksidasi lipid. Pendedahan diazinon tampak sebagai agen sitotoksik kepada hepar dan testis walaupun dalam dos yang rendah.