

The Effects of Organophosphorus Insecticides on Liver of Male Mice

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Abstract

Background: Pesticides cause ecological problems which may result in immediate mass mortality and biological magnifications. Objectives: To study the effect of organophosphorus on liver of male mice. Material and Methods: Male Balb/c mice weighing 30-35 gm, 60 days old, were treated orally with monocrotophos ($1/3 LD_{50}$, 1.8 mg/kg bw) and methyl parathion ($1/3 LD_{50}$, 2.8 mg/kg bw) for 30 days. The liver weight, and aminotransferase, acid phosphatase and alkaline phosphatase in homogenates were estimated. Results: The present study revealed the levels of acid phosphatase, alkaline phosphatase, aspartate aminotransferases and alanine aminotransferases, were significantly ($p < 0.05$) increased in liver with all of the two organophosphates. Conclusion: It has been concluded that (monocrotophos and methyl parathion) caused increased in the levels of phosphatase and aminotransferase as well as decreased in liver weight.

Key words: Monocrotophos, Mice, Phosphatase, Aminotransferase.

الخلاصة

تتسبب المبيدات الحشرية مشاكل بيئية مختلفة والتي قد تؤدي بشكل مباشر الى الوفيات وإلى تراكمات بيولوجية مختلفة الهدف من الدراسة : دراسة تأثير المبيدات العضوية على الكبد في ذكور الفئران المختبرية المواد وطرق العمل: تم استخدام ذكور الفئران البيضاء بأعمار ٦٠ يوما بوزن ٣٠-٣٥ غرام ولقد عوملت عن طريق الفم بإعطائها ٣١١ من الجرعة المميتة للمبيد. ولقد تم اخذ وزن الكبد مع النشاط الانزيمي للانزيمات (الامينوترانسفيريز والالانين والاسبارتات) وكذلك الاسيدفوسفاتيز والالكلاين فوسفاتيز النتائج: وجد ان مستوى هذه الانزيمات يزيد معنويا مع زياده تركيز المبيدات بينما وزن الكبد ينخفض معنويا مع الزيادة الاستنتاج: نستنتج بأن (المونوكروتوفوس وكذلك مثيل باراثيون) يسببان زياده في مستوى الأنزيمات المذكورة وكذلك نقصان في وزن الكبد الكلمة المفتاح: مونوكروتوفوس، فئران، فوسفاتيز، امينوترانسفيريز

Introduction

Toxicity in humans is a threatening truth and much more than any disease caused by any organism as toxic substances are everywhere- in air, in water and in food, many of these compounds which are essential to use for human.

In the mid-sixties, there was a shift in the type of compounds used from chlorinated hydrocarbons to organophosphorus and carbamate derivatives, due to their (Organochlorines) persistence in the environment (Pant, et al 1992). Pesticides are being lavishly used in agricultural operations to curtail pest menace. Several chemical used as pesticides are unselective and toxic to many non-target including humans (Murphy, 1986). Exposure to these pesticides can induce pathological changes in liver, kidney, heart and lung (Handa, 2003, Gathwan, 2006). The effect of two commonly used organophosphates, monocrotophos and methyl parathion have been evaluated following their subchronic administration in doses on the activities of some plasma and liver enzyme in male of mice.

Materials and methods

Adult male mice 60 days old, weighing (30-35) gm, were housed into three groups (A, B, C) each group constituted at least 6 animals. For each pesticide treated group an equal number of rats were given vehicle (water) and kept as control. Animals in group (A) was given tap water and served as control. Group (B) were given daily oral doses of monocrotophos (1/3 LD₅₀, 1.8 mg/kg bw) and group (C) were given daily methyl parathion (1/3 LD₅₀, 2.8 mg/kg bw) for 30 days. The doses value organophosphates were taking pesticide manual and available information (Dikshi, et al 1991, Jmamura, et al 1983). A day after the last dose, the animal were killed by cervical dislocation, liver was collected and homogenized in phosphate buffer saline. Aminotransferase, acid phosphatase and alkaline phosphatase in homogenates were estimated by standard procedures (Kind, et al 1954, Reitman, et al 1974). The values were analyzed using student t-test.

Results

The signs of pesticide toxicity were observed within 30 days of administration of organophosphate pesticide to male mice. The results of different treated groups have been compared with control. The intake of feed and water by treated mice reduced as compared with control. The decrease in liver weight was significant with treated mice (Fig.1).

The present study revealed the levels of acid phosphatase (Table-1), alkaline phosphatase (Table-2), aspartate aminotransferases (Table-3) and alanine aminotransferases (Table-4), were significantly increased in liver with all of two organophosphates (value $p < 0.05$).

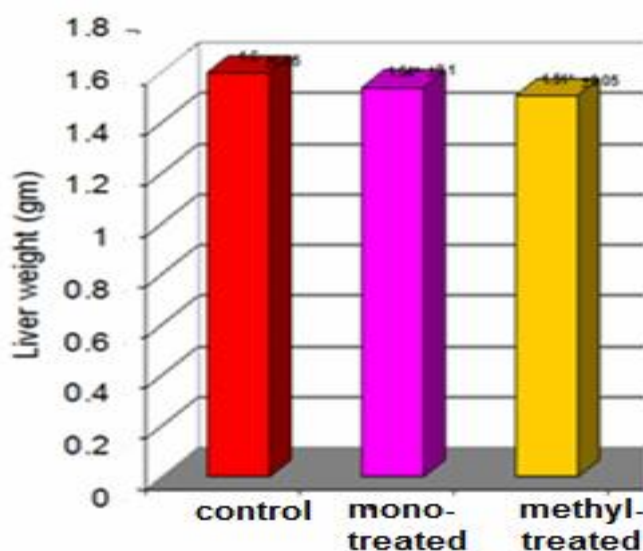


Figure1: *In vivo*, effect of pesticides on liver weights of male mice, mean \pm SD, n=6, $p < 0.05$.

Table 1: Effect of organophosphorus pesticide on activities of acid phosphatase in liver male of mice, mean \pm SD, n=6 (p<0.05).

Treatment	Liver(μ mole phenol produced/min/g)
Control	49.6 \pm 4.2
Methyl parathion	39.5 \pm 4.2
Control	52.1 \pm 7.2
Monocrotophos	31. \pm 5.9

Table 2: Effect of organophosphorus pesticide on activities of alkaline phosphatase in liver of male mice, mean \pm SD, n=6 (p<0.05).

Treatment	Liver(μ mole phenol produced/min/g)
Control	37.6 \pm 8.6
Methyl parathion	93.2 \pm 9.5
Control	37.8 \pm 8.9
Monocrotophos	83 \pm 9.3

Table 3: Effect of organophosphorus pesticide on activities of aspartate aminotransferase in liver of male mice, mean \pm SD, n=6 (p<0.05) .

Treatment	Liver(μ mole pyruvate produced/min/g)
Control	43.6 \pm 0.6
Methyl parathion	44.2 \pm 0.5
Control	35.8 \pm 3.9
Monocrotophos	37.3 \pm 4.3

Table 4: Effect of organophosphorus pesticide on activities of alanine aminotransferase in liver male of mice, mean \pm SD, n=6 (p<0.05).

Treatment	Liver(μ mole pyruvate produced/min/g)
Control	53.6 \pm 1.7
Methyl parathion	54.2 \pm 4.5
Control	45.8 \pm 1.9
Monocrotophos	49.3 \pm 4.3

Discussion

The present study has been showed the various effects of sub lethal doses of organophosphorus insecticides on enzyme activity of liver in male of mice. Liver is a target organ and primary site of detoxification and is generally the major site of intense metabolism and is therefore prone to various disorders as a consequence of exposure to the toxins of extrinsic as well as intrinsic forms. Liver plays important

role in metabolism to maintain energy level and structural stability of body (Guyton and Hall 1996). It is also site of biotransformation by which a toxic compound has been transformed in less harmful form to reduce toxicity (Hodgson, 2004). However, this will damage the liver cells and produce hepatotoxicity. Alanine transaminase (ALT) and aspartate transaminase are enzymes that help in metabolism of protein. When the liver is damaged, ALT which is increased in liver and released in the bloodstream.. An increase in AST levels may indicate liver damage or disease. Aspartate transaminase is the mitochondrial enzyme, predominantly found in the liver, skeletal muscles and kidneys. Alanine transaminase is a cytosolic enzyme, which is more specific for the liver than aspartate transaminase (Paliwal, et al 2009). The toxic effect of organophosphorus insecticides is to conjugate with the natural complement of enzyme in the body, thereby inactivating them. Organophosphorus pesticides (Monocrotophos , methyl parathion), caused significant in liver enzyme (aminotransferases ,acid phosphatases. and alkaline phosphatases). However, phosphate enzymes act by hydrolyzing phosphomonoester including 3, and 5, phosphoproteins and these may also be involved in the transfer of phosphate, phosphatases are involved in many different processes that require mobilization of phosphate ion or dephosphorylation as part of anabolic, catabolic or transfer processes (Hanafy, et al 1991). Transaminases are the metabolic enzymes which collect the amino groups from many different amino acids in the form of only one C-glutamate. The glutamate channels amino groups either into biosynthetic pathways or into a final sequence of reactions by which nitrogenous waste products are formed and then excreted (Leninger, et al 1993).

In the present study , the increased level of phosphatases and aminotransferases in blood may be indicate to metabolic activity , perhaps to meet the stress induced by prolonged exposure to the pesticides . These enzyme changes are indicative of the cellular toxicity and tissue damage induced by these pesticides in the mice probably by altering the specific molecular pathways.

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