Toxic Effect of Dimethoate and Diazinon on the Biochemical and Hematological Parameters in Male Rabbits

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Abstract

Dimethoate and Diazinon are two of widely used organophosphorus insecticides in agriculture. The irrational use of Dimethoate and Diazinon in Yemen play a crucial role in the occurrence of many diseases affecting plants, animals and man. One of the main factors causing pollution of the environment plays a crucial role in the occurrence of many diseases affecting plants, animals and man. The control of insect pests relies heavily on the use of synthetic insecticides. But, their widespread use has led to some serious problems including toxic residues on grass and toxicity to non-target organisms such as mammals, birds and fishes (Zettler and Cuperus 1990; White 1995; and Riebel et al., 2003).

Keywords: Dimethoate, Diazinon, Hepatotoxicity, Nephrotoxicity.

1. Introduction

The control of insect pests relies heavily on the use of synthetic insecticides. But, their widespread use has led to some serious problems including toxic residues on grass and toxicity to non-target organisms such as mammals, birds and fishes (Zettler and Cuperus 1990; White 1995; and Riebel et al., 2003).

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agriculture (Alahyary et al., 2008). Both Dimethoate and Diazinon, are two of the most widely and irrationally used insecticides in agriculture in Yemen. (Al-Haj et al., 2005).

Dimethoate is an insecticide with anticholinesterase mode of action (De-Bleecker et al., 1993; and Dongren et al., 1999).

Begum and Vijavaraghaven (1995) observed that, the exposure of Dimethoate to the fresh water fish clarias batrachus reduced the carbohydrates and proteins metabolism, and affect the aminotransferase activity in the liver. An increase in blood glucose in experimental rats was reported after Dimethoate orally administration period of 2 months in dose 21mg/kg. (Hagar and Fahmy 2009). An increase in lactate dehydrogenase, serum transaminase, and a decrease in the serum total protein, albumin, and globulin was observed in experimental rats after Dimethoate orally administration in dose 75mg/kg (Attia et al., 1993; and Dongren et al., 2005). Diazinon is an organophosphorus insecticide with anticholinesterase mode of action (Alahyary et al., 2008).

Mild structural and functional change in liver as well as in tests of experimental mice was observed after a single intraperitoneal administration of Diazinon (Dikshith et al., 1975).

Matin et al (1990) showed that the administration of Diazinon to experimental rats resulted in carbohydrate metabolism changes that were abolished by adrenalectomy, suggesting a possible involvement the adrenals in the induced changes in Diazinon-treated animals. The exposure of zebra fish to the Diazinon for up to 168 hours, a significantly reduced DNA , RNA and the total protein in the liver (Ansari and Kumar1988).

Jyostana et al (2003), observed a significant biochemical and hematological alterations due to the exposure to the various pesticides. Significant damage in the hepatic cells and glucose metabolism in liver was observed as the result of Diazinon administration (Fatima et al., 2006).

At the last 5 years in Yemen, we have noted a critical increase in number of people suffering from various liver and kidney diseases, as well as diabetic mellitus. Therefore, the purpose of the present study was to evaluate the hepatotoxic and nephrotoxic effects of the Dimethoate and Diazinon on male rabbits, also their effects on some liver and kidney diseases, as well as diabetic mellitus.

2. Materials and Methods:

2.1. Chemicals:

All chemicals used in this experiment were obtained from Sigma, USA, including Dimethoate and Diazinon.

2.2. Animals treatment and blood collection:

Thirty healthy male rabbits (1500-1700g) were divided into 2 treated groups and control, as follows:

- Control group: 10 animals treated with a single daily dose of 5ml corn oil orally period of 20 days.
- Dimethoate group: 10 animals treated with a single daily dose of 1/4 of LD$_{50}$ of Dimethoate (20mg/kg) in 5ml corn oil orally period of 20 days.

-Diazinon group: 10 animals treated with a single daily dose of 1/4 of LD$_{50}$ of Diazinon (25mg/kg) in 5ml corn oil orally period of 20 days.

All animals were maintained in standard environmental conditions and kept a standard commercial diet with water ad libitum.

All experiment was administrated in the Animal Physiology Laboratory, Department of Biology, Faculty of Science and Education, Aden University.

After 20 days the animals were fasted over night for12h. Then they were sacrificed, the blood was immediately collected. Blood samples were divided in two parts, one was maintained in EDTA bulb and plain tube for assay of blood factors, other was centrifuged, and serum was discarded and kept at - 21 °C for the biochemical testes.

2.3. Alanine- aminotransferase (ALT) and Asparatate-aminotransferase (AST) Assay:

The estimation was carried out according to the method originally developed by (Reitman and Frankel 1957).

2.4. Alkaline phosphatase Assay:

ALP was determined using a colorimetric method as described by (Kind and King 1954).

2.5. Total Protein Assay:

The total protein was determined by Biuret method explained by (Tietz 1976)

2.6. Albumin Assay:

Serum albumin was determined according to the method of (Doumas et al., 1971).

2.7. Glucose Assay:

Glucose was determined according to method of (Trinder et al., 1969).

2.8. Creatinine and Uric acid Assay:

Creatinine and uric acid was estimated according to method explained by (Houot 1985).

2.9. R.B.C., Hb and E.S.R. Assay:

The R.B.C. count, Hb level and E.S.R.time, were determined using method described by (Sood 1990).

2.10. Statistical analysis:

The statistical analysis was performed by SPSS; continuous data are expressed as mean ±S.E. Data were compared using one – way ANOVA. P value <0.01 was considered to be statistically significant.

3. Results:

Data in table1 show that the treatment with 1/4 of LD$_{50}$ of Dimethoate and Diazinon resulted in a statistically high significant increase in the level of alanin-aminotransferase (ALT) and asparatate-aminotransferase (AST) in the serum of both treated groups, as compared to the control, this increase was higher in the Diazinon treated rabbits.

As shown in the table 1 the level of alkaline phosphatase (ALP) in the serum of rabbits treated with Dimethoate and Diazinon statistically high significant
increased compared to control rabbits, this increase was higher in Diazinon treated rabbits.

Table 1: The biochemical parameters after 20 days of orally administration of Dimethoate in dose 20mg/kg. and Diazinon in dose 25mg/kg.

<table>
<thead>
<tr>
<th>Biochemical Parameters</th>
<th>Control</th>
<th>Dimethoate</th>
<th>Diazinon</th>
</tr>
</thead>
<tbody>
<tr>
<td>AST (IU/L)</td>
<td>351.37±3.7</td>
<td>85.47±2.32**</td>
<td>93.31±2.11**</td>
</tr>
<tr>
<td>ALT (IU/L)</td>
<td>44.50±2.70</td>
<td>168.27±4.86**</td>
<td>176.41±6.75**</td>
</tr>
<tr>
<td>ALP (IU/L)</td>
<td>65.52±2.3</td>
<td>160.25±3.7**</td>
<td>174.41±4.8**</td>
</tr>
<tr>
<td>T. Protein (g/dL)</td>
<td>7.67±0.12</td>
<td>5.16±0.13*</td>
<td>5.17±0.17*</td>
</tr>
<tr>
<td>Albumin (g/dL)</td>
<td>3.58±0.40</td>
<td>2.01±0.19*</td>
<td>2.11±0.22*</td>
</tr>
<tr>
<td>Glucose (mg/dL)</td>
<td>108.83±5.91</td>
<td>210.17±4.31**</td>
<td>245.20±5.40**</td>
</tr>
<tr>
<td>Uric acid (mg/dL)</td>
<td>4.02±0.74</td>
<td>7.85±1.34*</td>
<td>7.65±1.75*</td>
</tr>
<tr>
<td>Creatinine (mg/dL)</td>
<td>0.98±0.21</td>
<td>3.03±1.16*</td>
<td>3.33±1.55**</td>
</tr>
</tbody>
</table>

Values are expressed as means of 10 animals ± S.E.* Significance;** High significance at (P<0.01) vs. control.
Table 2: The hematological parameters after 20 days of orally administration of Dimethoate in dose 20mg/kg. and Diazinon in dose 25mg/kg.

<table>
<thead>
<tr>
<th>Hematological Parameters</th>
<th>Control</th>
<th>Dimethoate</th>
<th>Diazinon</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.B.C.</td>
<td>4.6±0.05</td>
<td>2.9±0.10*</td>
<td>2.6±0.25*</td>
</tr>
<tr>
<td>Mill/cu.mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hb.</td>
<td>12.6±1.01</td>
<td>8.7±0.23*</td>
<td>8.1±0.34*</td>
</tr>
<tr>
<td>g/dL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.S.R.</td>
<td>5.0±1.04</td>
<td>13.0±1.09**</td>
<td>12.0±0.85**</td>
</tr>
<tr>
<td>Mm/hr</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Values are expressed as mean of 10 animals ± S.E. * Significance ** High significance at (P<0.01) vs. control

Total protein and albumin levels significantly decreased in the serum of treated with Dimethoate and Diazinon rabbits, as compared to control.

Blood sugar level highly significant increased in the serum of Dimethoate and Diazinon treated rabbits, as compared to control, the increase in blood glucose was higher in the serum of Diazinon treated rabbits than in the Dimethoate treated group.

Uric acid and creatinine levels significantly increased in the serum of Dimethoate and Diazinon treated rabbits, compared to control.

Results in table 2 showed, that the R.B.C. count and Hb level significantly decreased in the blood of Dimethoate and Diazinon treated rabbits compared to control.

The erythrocytes sedimentation rate highly significant increased in the blood of Dimethoate and Diazinon treated rabbits as compared to control.

4. Discussion:

The noticed increase in the levels of aminotransferase (ALT and AST) and the level of ALP as well as the decrease in the in the levels of total protein and albumin in the serum, are the major diagnostic symptoms of liver diseases (Chatterjea and Shinde 2005).

The decrease in the serum albumin may also indicate to the renal inability keeps it in; therefore it excreted with urine (Albumiurea) (Vasilenko and Grebenev1990). The increase in the uric acid and creatinine in the serum are the major symptoms of glomerular filtration damage (Chatterjea and Shinde 2005).

Blood glucose increasing in many diseases such as Diabetes mellitus, and damage of the hepatic glycogenesis pathway (Guyton and Hall 2006).

Our results clearly showed the hepatotoxic and nephrotoxic effects of Dimethoate and Diazinon. The orally administration of 1/4 of LD₅₀ of Dimethoate and Diazinon for 20 days seriously affected the hepatocytes and renal functions, and may also the pancreas β-cells function. Our results are in agreement with (Ansari and Kumar 1988), who found that, Diazinon reduced the total protein level in Zebrafish, (Matin et al., 1990), who observed that Diazinon administration to rats reduced the carbohydrate and protein metabolism, (Begum and Vijavaraghaven 1995), who showed that Dimethoate inhibited the carbohydrates and proteins metabolism, and affected the aminotransferase activity in rats, (Fatima et al., 2006), who indicated an increase in blood glucose level in Diazinon administrated rats, (Attia and Nasr 2009), who noticed increase in serum aminotransferase,alkaline phosphatase and decrease in total protein and albumin in rats serum after orally administration of Dimethoate, (Hagar and Fahmy 2009), who showed that, Dimethoate orally administration resulted the increase in blood glucose level, and (Kossmann et al., 1997), who assured the nephrotoxic effect of pesticides.

The results of this study showed that, the hematological parameters RBC and Hb were significantly decreased in Dimethoate and Diazinon treated rabbits when the erythrocytes sedimentation rate was highly significant increased as compared to control. The effect of organophosphorus pesticides on the Hb of several workers has been studied by (Bhatnagar 1980; and Ray 1992). The decrease in the Hb along with the decrease in the RBC might be due to the effect of pesticides on blood forming organ (bone marrow and liver), and inhibition of many steps of heme biosynthesis in rabbits, as the result of pesticides exposure (Ray 1992). The poisoning by
pesticide residues leads to the development of anemia due to interference of Hb biosynthesis and shortening of the life span of circulating erythrocytes (Betrosian 1995; and Jyotsana et al., 2003). The increase of E.S.R.indicates to inflammation caused by organophosphorus pesticides (Elias and Saif 2009). Our finding is in agreement with (Jyotsana et al., 2003), that showed that pesticides decrease R.B.C.and Hb levels, and (Elias and Saif 2009), who noticed the reduce of R.B.C., Hb, and increase in erythrocytes sedimentation rate in rabbits exposure to orally dose of 10mg/kg.of the organophosphorus pesticide Methidathion.

The above mentioned effects of organophosphorus pesticides could be due to their ability to form free radicals (Hazarakia et al., 2003; and vidyasagar et al., 2004). The results of our previous work on Methidathion showed that the using of antioxidants vitamins A, C, and E, reduces the toxicity of Methidathion (Elias and Saif 2009). This fact may ensure the hypothesis of the ability of organophosphorus pesticides to form free radicals, which have been implicated as playing a role in the etiology of many alterations (Halliwell and Gutteridge 1995).

References


The serum biochemical parameters including urea, uric acid and creatinine were assayed using autoanalyzer (902 Hitachi automatic analyzer, Roche, India) moreover, the rate of MDA and serum total antioxidant were assayed using TBA (Thiobarbituric Acid) and FRAP (Ferric Reducing Ability of Plasma) methods respectively [12, 13].

Toxic effect of dimethoate and diazinon on the biochemical and hematological parameters in male rabbits. Jordan J Biol Sci. 2010; 3(2): 77-82. Toxic Effect of dimethoate and diazinon on the biochemical and hematological parameters in male rabbits. Jordan. J. Biol. Sci. 3:77-82. Sarabia, L., I. Maurer and E. Bustos-Obregon. 2009. Melatonin prevents damage elicited by the organophosphorous pesticide diazinon on mouse sperm DNA. Exotoxicol. Environ. Saf. 72: 663â€“668. Sekereioglu, C.H., G.C. Daily and P.R. Ehrlich. 2004. Ecosystem consequences of bird declines. Hence we decided to study the hematological and biochemical effects of tramadol and tramadol withdrawal on male albino rats. Rats were divided into four control rat groups (7 rats each), and four tramadol rat groups (7 rats each); two groups administrated a daily oral dose of tramadol (20 mg/kg b.wt) for 30 and 60 days and two groups also administrated a daily oral dose of tramadol for 30 and 60 days then tramadol withdrawal for 7 days. Key words: Tramadol; hematological parameters; liver function enzymes; kidney function parameters; lipid profile. INTRODUCTION. has toxic effects on the structure and function of hepatic, renal and testicular tissues of male albino rats (Youssef and Zidan, 2016). In addition, the neurotoxicity of tramadol has been reported by Hussein et al. Diazinon is an Organophosphate Insecticide (OPI) is commonly used in agriculture to protect of crops and to control pests in home gardens and farms. Many alterations observed by diazinon have been described, such as; alterations in blood factors (RBC, Hb and Hct), plasma testosterone and glucose levels. We selected 12 albino Wistar rats weighting between 220-280 g were divided into two experimental groups, as follow, control group and diazinon treated group. The effects of diazinon, on ratsâ€¦ CONTINUE READING. View on PubMed. The present work was conducted to investigate the alterations in biochemical and hematological factors in male rabbits after orally administration a single dose of 1/4 LD 50 of Dimethoate and Diazinon for 20 days. 30 Male Rabbits weighting 1500-1700g., were divided into 3 groups with 10 animals in each, first group served as control animals, they received 5 ml. of corn oil, while animals in second group received 1/4 LD 50 of Dimethoate, animals in third group received 1/4 of LD 50 of Diazinon. The concept of this study was to evaluate the.