A STUDY ON DIMETHOATE INSECTICIDE TOXICITY IN SHEEP WITH SPECIAL REFERENCE TO ITS BREAKDOWN TIME

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ABSTRACT

Forty mixed breed sheep were classified into four groups each of ten. They were offered green forage (barseem) sprayed with dimethoate, two, four and six days after spray to the first, second and third groups respectively. The fourth group was kept as control and given dimethoate free feed. The period of experiment extended along one month. The effect of feeding dimethoate contaminated ration on growth rate, blood parameters and immune response were recorded. Also the residues of the insecticide was estimated in the plant after various times of application. The results indicated that dimethoate affected blood parameters, reduced growth rate and immune response. Also residues of dimethoate could be detected in plants after two, four, six and eight days after spraying. After ten days the levels of dimethoate were undetected which revealed the breakdown of the insecticide in the plant within this period.

INTRODUCTION

It is a well known fact that one of the primary points for maintaining the productivity and reproductive of farm animals is to provide them with non contaminated feed and wholesome drinking water free from chemicals and biological causes of diseases. Pesticides are widely used to control insects; however, they leave some residues in crops representing a great hazard to animals consuming such treated forage. The toxic effect of these pesticides is reflected on productivity of farm animals.

Dimethoate is an organophosphorous insecticide used extensively in agriculture as a systemic insecticide and acaricide for treating garden, vineyards and field crop pests (Humphreys, 1988). Moreover, it was applied externally for the control of Warble fly larvae in cattle (Miethe et al., 1973).

The toxic effect of dimethoate were studied by many authors. Metelov et al., (1977) reported that dimethoate have a neurotoxic effect in sheep, calves and fish. In 1995, Institoris et al., studied the immunotoxicity of repeated doses of dimethoate and methyl parathion given to rats and found that dimethoate had a detectable effect on body weight, birth weight and number, organ weight, haematological parameters and immune function.

Regarding the residues of dimethoate after application on plants, Pareek and Kavadia (1988) recorded that the persisting period for dimethoate as 5 to 6 days to avoid consumer risk after its application at 0.03% on musk melon, and ridge gourd. On the same aspect, Cabras et al., (1995) studied the persistency of some organophosphorous compounds on orange fruit and found that the residues of dimethoate was only found in the fruit peel and a very low concentrations were detected in the fruit pulp.

The aim of the present investigation is to study the effect of dimethoate residues within the plant tissues on growth, immune response of sheep and furthermore to record the suitable time after which the animal can be fed dimethoate sprayed forage safely.
MATERIAl AND METHODS

Dimethoate:

An organophosphorous insecticide obtained as emulsifiable liquid concentration containing 40% (w/v) active ingredient from El-Nasr Co. Egypt. Its chemical name is o,o dimethyl S-(N-methyl) carbamayl methyl phosphorodithioate. It was diluted to 2% concentration in water just before being sprayed on barserm and was offered to animals at various intervals after spraying.

Animals:

The study was conducted on 40 apparently healthy mixed breed sheep (3-5) months age belonging to the sheep farm at Faculty of Agriculture, Moshtobor. The animals were classified into four equal groups (each of ten). Animals offered the green forage sprayed with dimethoate (motor sprayed) after various periods as follows :

Group I : offered barsems after two days from dimethoate spraying
Group II : offered barsems after four days from dimethoate spraying
Group III : offered barsems after six days from dimethoate spraying
Group IV : was kept as control and was given green forage free from dimethoate

The feeding period extended along one month. Body weight was recorded at the onset and after the end of experiment.

Haematological examinations

At the end of experiment, blood samples were collected on anticoagulant (Na EDTA) for estimation of total and differential leucocytic counts according to Kelly, (1984). Also serum samples were isolated and used for determination of total protein, albumin and globulin after Weichselbaum, (1946); Daumas et al., (1971) and Coles (1986) respectively. Also serum immunoglobulin was measured using radial immunodiffusion kits according to Mancini et al., (1965).

Estimation of dimethoate residue in plants:

After different periods from spraying (2,4,6,8 and 10 days) one gram of the plant was thoroughly homogenized in 10 ml of absolute alcohol (HPLC Grade) then centrifuged at 3,000 r.p.m. for 15 minutes. The supernatants were then filtered through 0.45 u Millipore transferred to clean tubes and used for estimation of dimethoate residues using high performance liquid chromatography with acetoniitrile-water as a mobile phase and UV detector at wave length of 254 according to Zehra et al., (1995).

Statistical analytical studies have been adopted by Sendecor, (1971)

RESULTS

Table (1): Effect of Dimethoate contaminated ration offered to sheep at various intervals of spraying along one month on body weight / kg:

<table>
<thead>
<tr>
<th>Period after spray / day</th>
<th>Body Weight / kg</th>
<th>Growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before the start of exp.</td>
<td>At the end of exp.</td>
</tr>
<tr>
<td>Two</td>
<td>31.6 ± 0.86</td>
<td>33.3 ± 0.93*</td>
</tr>
<tr>
<td>Four</td>
<td>30.7 ± 0.61</td>
<td>33.9 ± 0.79*</td>
</tr>
<tr>
<td>Six</td>
<td>30.9 ± 0.75</td>
<td>35.6 ± 0.87 NS</td>
</tr>
<tr>
<td>Control</td>
<td>30.4 ± 0.68</td>
<td>36.7 ± 0.76</td>
</tr>
</tbody>
</table>

*Significant at P<0.05  NS. non significant
Table (2): Effect of Dimethoate contaminated ration offered to sheep at various intervals of spraying along one month on total and differential leucocytic count:

<table>
<thead>
<tr>
<th>Item &amp; group</th>
<th>GPI (2 days)</th>
<th>GP2 (4 days)</th>
<th>GP3 (6 days)</th>
<th>4 (control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TWBCs 10³/mm³</td>
<td>7.75±0.71**</td>
<td>8.62±0.65*</td>
<td>9.86±0.21</td>
<td>10.12±0.06</td>
</tr>
<tr>
<td>Lymphocyte%</td>
<td>52.42±0.41**</td>
<td>53.73±0.39*</td>
<td>54.77±0.22</td>
<td>56.21±0.40</td>
</tr>
<tr>
<td>Neutrophil%</td>
<td>33.95±0.45**</td>
<td>34.80±0.38**</td>
<td>34.76±0.34</td>
<td>36.17±0.50</td>
</tr>
<tr>
<td>Monocyte%</td>
<td>3.89±0.62*</td>
<td>2.90±0.42*</td>
<td>2.82±0.29</td>
<td>1.20±0.36</td>
</tr>
<tr>
<td>Basophil%</td>
<td>3.86±0.35</td>
<td>2.85±0.21*</td>
<td>2.81±0.33</td>
<td>1.22±0.46</td>
</tr>
<tr>
<td>Eosinophil%</td>
<td>5.88±0.22</td>
<td>5.54±0.38</td>
<td>4.84±0.35</td>
<td>5.20±0.41</td>
</tr>
</tbody>
</table>

TWBCs = total white blood cells  *Significant at P<0.05  ** Highly significant at P<0.01

Table (3): Effect of Dimethoate contaminated ration on some serum parameters of immune

<table>
<thead>
<tr>
<th>Item &amp; group</th>
<th>GPI (2 days)</th>
<th>GP2 (4 days)</th>
<th>GP3 (6 days)</th>
<th>GP4 (control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total protein gm/dl</td>
<td>6.2±0.33**</td>
<td>6.8±0.37**</td>
<td>7.90±0.40 NS</td>
<td>8.92±0.50</td>
</tr>
<tr>
<td>Albumin gm/dl</td>
<td>2.3±0.31**</td>
<td>2.5±0.32**</td>
<td>3.20±0.55*</td>
<td>3.81±0.25</td>
</tr>
<tr>
<td>Globulin gm/dl</td>
<td>3.9±0.50**</td>
<td>4.3±0.22*</td>
<td>4.70±0.47*</td>
<td>5.11±0.30</td>
</tr>
<tr>
<td>Immunoglobulins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IgG mg/ml</td>
<td>17.82±2.17**</td>
<td>17.92±1.80**</td>
<td>18.80±2.1*</td>
<td>19.70±1.42</td>
</tr>
<tr>
<td>IgM mg/ml</td>
<td>3.22±1.12*</td>
<td>3.25±0.43 NS</td>
<td>3.30±0.36 NS</td>
<td>3.43±0.79</td>
</tr>
</tbody>
</table>

NS non significant  *Significant at P<0.05  ** Highly significant at P<0.01

Table (4): Residues of Dimethoate in plant after different time of spraying (ppm):

<table>
<thead>
<tr>
<th>Period after spraying</th>
<th>Levels of Dimethoate</th>
<th>Destructed Value</th>
<th>Rate of Breakdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginning (0 day)</td>
<td>6.22±0.03 ppm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two days</td>
<td>3.80±0.09 ppm</td>
<td>2.42</td>
<td>38.91 %</td>
</tr>
<tr>
<td>Four days</td>
<td>2.82±0.08 ppm</td>
<td>0.98</td>
<td>15.76 %</td>
</tr>
<tr>
<td>Six days</td>
<td>1.75±0.06 ppm</td>
<td>1.07</td>
<td>17.20 %</td>
</tr>
<tr>
<td>Eight days</td>
<td>0.60±0.04 ppm</td>
<td>1.15</td>
<td>18.49 %</td>
</tr>
<tr>
<td>Ten days</td>
<td>Zero</td>
<td>0.60</td>
<td>9.64 %</td>
</tr>
</tbody>
</table>
DISCUSSION

Dimethoate is an organophosphorus compound that is used widely for treating garden and field crops (Humphreys, 1988) and also applied externally for the control of some external parasite on farm animals (Mieth et al., 1973).

Many investigations dealt with harmful influence of insecticides used for control of animal parasites, but few studies were done on plant insecticide to find out their hazards on animals which may consume forage recently treated by such pesticides.

In the current work we aimed to explore the effect of feeding dimethoate contaminated ration on growth rate, blood parameters and immune response in sheep. Furthermore we tried to investigate the elapsed time for breakdown of dimethoate after being sprayed on green forage to be safe for animal feeding.

Table 1 indicates that dimethoate contaminated feed reduced the rate of growth in sheep and this reduction was dependent on the time elapsed after spraying. Body weight gain reduced significantly in sheep offered the green forage after two and four days of spraying while in group offered the forage after six days of spray, the decrease in body weight was not significant. We suggest that the decrease in body weight may be due to the poor assimilation of feed resulted from the affection of liver and kidney either functionally or pathologically as previously recorded by Abou-Salem et al., (1997). Also we suggest that the variation in body weight reduction in relation to time of spraying may be attributed to the destruction of the insecticide in feed by time as presented in the current study table (4).

With regard to the effect of dimethoate contaminated ration on blood picture, table (2) revealed that dimethoate reduced the number of total leucocyte count in the first and second group and the decrease was non significant in the third group given the insecticide after six days of spraying. In the same time it is evident that the reduction in white blood cells seems to be basically due to decreased level of lymphocyte and this may be the first point indicating the involvement of dimethoate with the immune status of the body. Our results coincided with the results previously recorded by Institoris et al., (1995).

Table (3) shows the effect of dimethoate contaminated ration on some serum parameters illustrating the immune function. A pronounced reduction was recorded due to dimethoate on the levels of total protein and globulin with no remarked effect on the level of albumin. This reduction in protein levels especially globulin fraction is surely a bad indication for involvement of immune function with dimethoate and also explain the loss of body weight in animal fed dimethoate contaminated diet (table 1). The decrease in total protein may be due to damaging effect on protein biosynthesis machinery and or inhibition to RNA transcription (El-sheikh et al.,1993).

Concerning to the breakdown of dimethoate on the plant, table (4) demonstrates that dimethoate is broken down by time where the rate of its destruction was 38.91%, 15.76%, 17.20%, 18.49% and 9.64% from its original concentrations after two, four, six, eight and ten days of spraying that is to say this finding reveals that the whole concentration of dimethoate is broken-down after ten days of spraying. This mean that this insecticide is degradable under normal environmental conditions.

CONCLUSIONS

* Dimethoate like the majority of organophosphorous compounds is harmful to farm animals inducing either toxicity or in subclinical cases may disturb the immune function leading to higher susceptibility of animals to the prevailing diseases.

* Care should be given during spraying of animals and animal feed sprayed with the insecticide should be kept away for a suitable time sufficient for its degradation.
REFERENCES


10-Metelov, V.V.; Brichko,V.F. and Korzhevenko, G.N.(1977) : Residues of some organophosphorous compounds and their effect on fish.Veterinary , Moscow, USSR, 1-100-103 .


الملخص العربي

دراسة عن التسمم بالمبيد الحشرى (الدايموثيت) في الأغذام

وتقدير الوقت اللازم لتكسيره

منى محمد عشوب
إلهام عبد المنعم الشيري
أستاذ مساعد صحة الحيوان
مدرس السموم
كلية الطب البيطري جامعة الزقازيق فرع بها

قُسمت 50 رأس من الأغنام إلى أربع مجموعات كل منها 10، تم إعطائهم طعنة خضراء مرشوشة بالدايموثيت لمدة يومين. بعد 4 أيام، تم رش الأغنام في المجموعات الثلاثة على الترتيب. وتحركت المجموعة الرابعة بدون دايموثيت كمجموعة ضابطة. واستمرت التجربة لمدة شهر. بعد ذلك، تم دراسة تأثير التنشئية بعطلة متوسطة دايموثيت على معدل النمو، قياسات الدم والإستجابة المناعية. كما تم تقييم مستويات المبيد بعد أوقات مختلفة من الاستعمل.

وأوضحت النتائج أن المعالجة بالدايموثيت أثرت في قياسات الدم وقلت معدل النمو والإستجابة المناعية. كما أن قياس مستويات الدهون في الدم بعد يومين، أربعة، سبعة، ثمانيات أيام من الرش ولكن لم يتم تعينها بعد عشرين أيام مما يوضح تكسير المبيد في النباتات خلال تلك الفترة.