Effect of deltamethrin insecticide on some haemato-biochemical parameters in buffaloes with its effect on immunoglobulins and its residues in raw milk

By

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SUMMARY

The objective of this study is designed to clarify the effect of deltamethrin on the haemato-biochemical as well as to evaluate its residue in milk of the buffaloes. Ten buffaloe aged 5-6 months from El-Nabrawy farm special private farm (Fakos–Sharkia) were divided into two equal groups (5 each). The first group was sprayed with (Butox)R (1:1000) two times with one week a part. Meanwhile, the second group was not spared served as control. Two samples collected from control and sparyed buffaloe before at third days, first, second, fourth and sixth week post spray. The first sample for haematological study and second sample for biochemical study. Milk sample were used for deltamethrin residue at third days, first, second, fourth and sixth week post spray.

Sprayed with Deltamethrin (Butox®) (1:1000) evoked a significant decrease in erythrocytic count, haemoglobin content, packed cell volume and significant increase in total leucocytic count and neutrophils associated with decrease in lymphocytes at the third days, first, second, fourth and sixth week after exposure.

Deltamethrin elucidated a significant reduction of total protein, albumin, globulin and immunoglobuline (IgG, IgM and IgA) in milk and serum. On the similar ground, deltamethrin (Butox®) application in buffaloe evoked a significant elevation liver enzymes (AST- ALT) alkaline phosphatase glucose and urea but creatinine insignificant increase at third days, first, second, fourth and sixth week post spray of deltamethrin.

Deltamethrin metabolites were detected in milk as 0.21 ± 0.05, 0.12 ± 0.007, 0.014 ± 0.002, 0.002 ± 0.0005 and 0.00022 ± 0.00005 ppm at third days, first, second, fourth and sixth week post spray, respectively. Application of deltamethrin as insecticide in buffaloes induce decrease in quantity of produced milk at third days, first, second week post exposure and insignificant decrease at fourth week.

It was concluded that the exposure to deltamethrin provoked a remarkable some adverse effect in the blood and picture some biochemical parameters as well as have immunosuppressive effect in buffaloes and have residue in milk above the permissible limit.
INTRODUCTION

Pesticides constituted the major source of potential environmental hazard to man and animals in Egypt as they are used extensively (Osfor et al., 1998). Pyrethroids are synthetic chemical insecticides that act in a similar manner to pyrethrins, which are derived from chrysanthemum flowers (Elliott, 1977). Synthetic pyrethroid as a group of insecticides are widely used in competing ectoparasite affecting farm animals (Doherty et al., 1987). The pyrethroid insecticides have been divided into two classes on the basis of their biochemical action and behavioral indices. Both types of pyrethroids have effects on sodium conductance and type II pyrethroids have been reported to antagonize gamma aminobutyric acid (GABA) by interacting with the t-butylbicy clophorothionate (TBPS) picrotoxinin binding site (Gilbert et al., 1989).

Deltamethrin is a pyrethroid insecticide that kills insects on contact and through digestion. It is a synthetic dibromo–Pyrothroid type II compounds insecticide based structurally on natural pyrethrins, which rapidly paralyze the insect nervous system giving a quick knockdown effect (Haug and Hoffman, 1990). It is a lipophilic compound of high molecular weight and consequent low volatility. Its mode of action is thought to be mainly central in action or at least originate in higher nerve centers of the brain (Leahey, 1985). It has very broad spectrum control. It is considered the most powerful of the synthetic pyrethroids. It is up to three orders more active than some pyrethroids (Bradbury and Cost, 1989). It inhibited blast formation of the lymphocytes in guinea pigs (Iskandarov et al., 1989). Also it inhibits humoral immune response (Jolanta and Jergy, 1992). It is rapidly absorbed and slowly excreted (Van-ant et al., 1990).

The pollution of milk and dairy products with pesticides are considered one main dangerous aspect in the last few years. Milk and its byproducts has been found to very good reference point for monitoring pollution by pesticides (Aba-Zahw et al., 1993). Milk and its products are one of the important media for accumulation of pesticides (Mukerijee and Gobal, 1993).

The present work was planned to investigate the effect of deltamethrin (Butox®) in inducing immunosuppressive effect on lactating buffaloes the determination on haematological, biochemical of deltamethrin in the milk is amid.
MATERIAL AND METHODS

Drug:
Deltamethrin (Butox)\textsuperscript{R} from Intervet company.

Animals:
Ten baldy buffaloe aged 5-6 months from El-Nabrawy farm (Fakos-Sharkia) were divided into two equal groups. First group was sprayed with deltamethrin (1:1000) two times with one week a part. Meanwhile, the second group was served as control.

Blood samples:
Two blood samples were collected from control and sprayed buffaloe before at third days, first, second, fourth and sixth week post spray, first sample was collected in heparenized tube for haematological study and second sample was collected in centrifuge tube to obtain clear serum for biochemical study.

Milk sample:
Milk yield per day:
Daily milk yield from buffaloes before treatment and third days, first, second, fourth and sixth week post deltamethrin pray were recorded.

Milk samples were collected from sprayed and non sprayed buffaloe, milk samples were collected in a sterile Macarteny bottles for determination of deltamethrin residue. All samples were transported to the laboratory. Each sample was labeled to identify the source and date of sampling. Delayed samples were stored in ice bag.

A) Haematological studies:--
Blood picture was performed according to techniques described by Jain (1986) and included the total erythrocytic count, haemoglobin content, pack cell volume percent, total leukocytic and differential count.

B) Biochemical studies:--
Sera of buffaloes were analysed for determination of serum transaminases (AST-ALT) according to (Reitman and Frankel, 1957), alkaline phosphatase (John, 1982), total protein (Doumas et al., 1981), albumin (Drupt, 1974), globulin was calculated as difference between total protein and albumin, glucose (Siet et al., 1981), Serum urea (Patton and Crouch, 1977), creatinine (Henry, 1974).

C) Immunoglobulins:--
Commercial radial immune diffusion plates were used to quantitate the immunoglobulins (IgA, IgG and IgM) in serum and milk according to the kits supplied by (Mancini et al., 1965).

Deltamethrin residue in raw milk:--
Extraction of deltamethrin in raw milk was performed according to Riva and Anadon (1991),
and cleaned up according to method described by Suzuki et al. (1979) and measured deltamethrin (Butox®) residue by gas liquid chromatography.

D) Statistical analysis:
The obtained data was statistically analyzed according to Petrie and Watson (1999).

RESULT

Haematological results:-
Table (1), revealed that the application of deltamethrin insecticidal spray evoked a significant decrease in erythrocytic count, haemoglobin content and packed cell volume but leukogram showed leucocytosis, neutrophilia, lymphopenia as compared with the control group. At 3rd day, 1st, 2nd and 4th week post application of deltamethrin.

Biochemical studies
Tables (2-3), indicated that the total protein, albumin, globulin, immunoglobuline (IgG, IgM and IgA) in milk and serum significantly decreased and significant increase in the liver enzymes (AST- ALT) alkaline phosphatase glucose and urea were also significantly increased but create-nine showed insignificant increase at 3rd day, 1st, 2nd and 4th week post-application of deltamethrin.

Deltamethrin (Butox®) residue of milk:
Table (4) showed that the deltamethrine metabolites were detected in milk as 0.21 ± 0.05, 0.12 ± 0.007, 0.014 ± 0.002, 0.002 ± 0.0005 and 0.00022 ± 0.00005 ppm at 3rd day, 1st, 2nd, 4th, 6th week post spray, respectively.

Milk yield per day:
Table (5) revealed that the application of deltamethrin insecticide in buffaloes induce significant decrease in the amount of produced milk at 3rd day, 1st, 2nd week post-exposure.
Table (1) Effect of deltamethrin (Butox®) on Haemogram and Leukogram of buffaloe (n=5).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Non sprayed buffaloes</th>
<th>Post spray</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3 day</td>
</tr>
<tr>
<td>RBCs (10^6/c.mm)</td>
<td>7.04±1.04</td>
<td>6.82±0.12*</td>
</tr>
<tr>
<td>HB (gm/dl)</td>
<td>12.42±1.20</td>
<td>10.83±0.64*</td>
</tr>
<tr>
<td>PCV (%)</td>
<td>38.62±1.57</td>
<td>31.83±1.79*</td>
</tr>
<tr>
<td>W.B.Cs10(^3)/cm.m</td>
<td>8.37±1.13</td>
<td>14.01±1.05**</td>
</tr>
<tr>
<td>Neutrophils</td>
<td>26.19±0.69</td>
<td>29.6±0.65*</td>
</tr>
<tr>
<td>Esinophils</td>
<td>6.15±0.42</td>
<td>6.96±0.27</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>63.11±1.51</td>
<td>60.03±0.29*</td>
</tr>
<tr>
<td>Monocytes</td>
<td>4.10±0.42</td>
<td>3.2±0.64</td>
</tr>
</tbody>
</table>
Table (2): Effect of deltamethrin (Butox®) on some biochemical parameters in buffaloe (n=5).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Non sprayed buffaloes</th>
<th>Post spray</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3day</td>
<td>1week</td>
</tr>
<tr>
<td>T. Protein (mg/dl)</td>
<td>8.42±0.65</td>
<td>6.06±0.48*</td>
</tr>
<tr>
<td>Albumin (mg/dl)</td>
<td>3.92±0.15</td>
<td>3.60±0.13*</td>
</tr>
<tr>
<td>Globulin (mg/dl)</td>
<td>4.50±0.27</td>
<td>2.46±0.42**</td>
</tr>
<tr>
<td>Glucose (mg/dl)</td>
<td>65.87±2.38</td>
<td>85.69±3.49**</td>
</tr>
<tr>
<td>AST (U/L)</td>
<td>38.94±1.17</td>
<td>49.08±1.75**</td>
</tr>
<tr>
<td>ALT (U/L)</td>
<td>13.86±0.95</td>
<td>19.29±0.84*</td>
</tr>
<tr>
<td>Alk. Ph. (I.U/ml)</td>
<td>13.09±0.92</td>
<td>9.24±0.92*</td>
</tr>
<tr>
<td>Urea (mg/dl)</td>
<td>37.83±1.06</td>
<td>42.91±0.14*</td>
</tr>
<tr>
<td>Creatinine (mg/dl)</td>
<td>1.82±0.41</td>
<td>2.07±0.43</td>
</tr>
</tbody>
</table>
Table (3) Effect of deltamethrin (Butox®) on immunoglobulins in serum and milk of buffaloe (n=5).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Serum</th>
<th>milk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non sprayed</td>
<td>Sprayed buffaloe</td>
</tr>
<tr>
<td></td>
<td>3 day</td>
<td>1 week</td>
</tr>
<tr>
<td>IgG (mg/ml)</td>
<td>2139±261</td>
<td>1159±163*</td>
</tr>
<tr>
<td>IgM (mg/ml)</td>
<td>363±63</td>
<td>237±74</td>
</tr>
<tr>
<td>IgA (mg/ml)</td>
<td>59.56±6.2</td>
<td>29.24±4.12*</td>
</tr>
</tbody>
</table>
Table (4): deltamethrin (Butox®) residue in milk of buffaloe (n=5).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Non sprayed buffaloes</th>
<th>Post spray</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3day</td>
<td>1week</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.01</td>
<td>0.34</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.002</td>
<td>0.12</td>
</tr>
<tr>
<td>Mean ± S.E.</td>
<td>0.0068 ± 0.002</td>
<td>0.21 ± 0.05</td>
</tr>
</tbody>
</table>

Table (5): Effect deltamethrin (Butox®) on milk production of buffaloe (n=5).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Milk production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3day</td>
</tr>
<tr>
<td>Non sprayed buffaloes</td>
<td>7.30 ± 0.21</td>
</tr>
<tr>
<td>Sprayed buffaloe</td>
<td>5.05 ± 0.42*</td>
</tr>
</tbody>
</table>
DISCUSSION

Nowadays, the wide spread utilization of pyrothroid compounds for control insect pests in agriculture, public health and veterinary field may cause environmental contamination to man, animals and birds with concentration enough to evoke adverse effect on body function. This study was undertaken to investigate the effects of the sprayed deltamethrin on the haematobiochemical as well as to evaluate its residue in milk of the buffaloes.

The present investigation revealed that a significant decrease in the total erythrocytic count, haemoglobin content and packed cell volume percent in buffaloes at third day, first, second and fourth week post-application of these drug. These results are comparable with the results obtained previously by Farouk, Venees (2007) who reported that a significant decrease in haematological values (erythrocytic count, haemoglobin content and packed cell volume %) in rats after short duration exposure to deltamethrin. El Katib et al. (1996) mentioned that other synthetic pyrothroid insecticide (Fenvalerate) can caused significant decrease in the total erythrocytic count, haemoglobin content and packed cell volume percent. Also, Shakoori et al. (1990) recorded that other synthetic pyrothroid (Cyhalothrin) induce a significant reduction in haemopgram.

The present study, showed significant leucocytosis, neutrophilia, lymphopenia at third day, first, second and fourth week post spray of the drug as compared with the control group. These results are in agreement with those of Hassan et al. (1988) and Farouk, Venees (2007) who found that this formulated increased total leucocytic count and neutrophils, but decreased lymphocytic count in rabbits and rats. Also, Catinot et al. (1989) reported that deltamethrin induced significant increase of eosinophils in rats. Elevations of leucocytes and neutrophils together with lymphopenia could be attributed to the toxic effect of chemicals on haemopoietic system (Varley et al., 1980). Also, the reduction in lymphocytes percent may be due to mitotic inhibition in bone marrow induced by deltamethrin (Agarwal et al., 1994). Stelzer and Gordon (1984) revealed that Permethrin and Cypemethein Pyrethroids inhibited the mitogenieses of lymphocytes.

Results of the present study revealed that deltamethrin induced a significant decline in serum total protein concentration, albumin and globulin at third day, first, second and fourth week post application of deltamethrin in buffaloes. These results agree with those of Shaker et
al. (1988) and Emam (2002), they found that deltamethrin induced a decrease in total protein and albumin. In addition another report by Mohamed and Adams (1990) showed that Fenvalerate in a dose of 112.5 mg / kg body weight induced a decrease in serum total protein in goats. A decline in the level of total serum protein may be attributed to liver damage and inability of liver to synthesize protein due to drastic effect of sprayed deltamethrin (Misra et al., 1996). EL-Asser (1982) recorded that reduction in serum protein in rabbits treated with dimethoate and deltamethrin was probably due to decrease in RNA and protein synthesis. Hypoalbuminaemia is attributed to impaired albumin synthesis by diseased liver (Kaneko, 1989). Significant decrease in globulins are in agreement with those of Shaker et al. (1988) who reported a significant decrease in globulins after administration of deltamethrin. Desi et al. (1986) proved that deltamethrin inhibits the humoral immune response. This is due to the concentration of deltamethrin in blood remained high for 28 days post application (Denise and Lgor, 1997). These pyrethroids may be bound to lipids or tissues and released to produce different concentrations (Marei et al., 1982).

The present work revealed that sprayed drug at concentration level of (1/1000) induced significant increase in glucose level. These finding were similar to that reported by Varshneya et al. (1992) and Manna et al. (2005) who mentioned that deltamethrin causes glycogenolysis and this may be a reason for decrease in liver glycogen leading to hyperglycemia.

It is evident from the present study that this sprayed deltamethrin induced a significant increase in liver enzymes activity (AST and ALT) and alkaline phosphatase at the first, second and fourth week post exposure. Similar results were recorded in earlier study Cremer and Seville (1982) and Farouk, Venees (2007) who found that deltamethrin induced significant increase in liver enzymes transaminase activity (AST-ALT) and alkaline phosphatase. The hepatotoxic effect of deltamethrin has been confirmed by the histopathological changes in hepatic tissues Varshneya et al. (1992) who found that deltamethrin induce liver necrosis. Also, these results may be due to hepatic degeneration and necrosis (Giray, et al., 2001). Flodstrom et al. (1988) mentioned that the pyrethroid insecticide Fenvalerate produced significant increase in liver enzymes in rats.

The present investigation revealed that buffaloe sprayed with this drug induced a significant redu-
ction of (IgG, IgM and IgA) on serum and milk at third day, first, second and fourth week post spray. This observation was previously recorded by Metawie (1999). These results may be attributed to decrease in total protein and globulin as suggested by Coria and McClurkin (1978) or might be attributed to lymphopenia as recorded in the present study.

Regarding the deltamethrin residues in the examined buffalo milk, Table (4) showed that the mean values of deltamethrin in milk were 0.21 ± 0.05, 0.12 ± 0.007, 0.014 ± 0.002, 0.002 ± 0.0005 and 0.00022 ± 0.00005 at third day, first, second, fourth and sixth week, respectively. The obtained results nearly coincide with those reported by Akhtar et al. (1986) who found that 0.42-1.62% deltamethrin was secreted in the milk in lactating dairy cows. Also, Ruzo and Casida (1979) recorded that the high deltamethrin intake of 10 mg/kg diet, the deltamethrin residue in milk was about 0.025 mg/liter. Moreover, another studies by Ruzo et al. (1978) who found that deltamethrin residues in the milk were dose-dependent and appeared to reach a plateau between seventh and ninth days after the start of treatment. The previous author Akhtar et al. (1992) found that trace amounts of deltamethrin metabolites 3-(2 ,2-dibro-movinyl)-2,2-dimethyl-cycl-o propane carboxylic acid (less than 0.0235 ppm) and 3-phenoxybenzoic acid (less than 0.034 ppm) were also detected in milk of treated lactating dairy cows fed deltamethrin (2 or 10 mg/kg feed) for 28 consecutive days, table (5) also indicated that the examined raw buffalo milk samples have deltamethrin residues at third days and one week post deltamethrin spray which were more than permissible limit but at second, fourth and sixth week post spray were less than permissible limit (0.05) as recommended by Codex Alimentations Comm issible Limit (2004).

The noticed significant decrease in milk production resulting from spray with drug were observed in our study, the milk quantity were improved fourth week post spray. This results are in agreement with those reported by Hassan et al. (1996) who found that another insecticide induce significant decrease in amount of milk post spray cattle with phoxim and attributed to that insecticide induced subclinical mastitis. (Zeccont et al., 1994) emphasized the fact that immune suppression of mammary gland defense mechanism is a significant factor to predisposing mastitis and Metawie and Mohamed (2000) recorded that the decrease in milk production considered one of the apparent symptoms of mastitis and comparing the tables (4) and (5) on
milk profile direct effect during the early two weeks as a stress factor that had not influenced the immunity profile and response to the drug used.

From our study we can concluded that this drug could be considered a hepato-toxic, nephro-toxic and they alter haematological picture as well as liver and kidney function in addition to decrease in amount of milk production and detect residue in milk, we recommended its use under specific precautions as advice by manufacture and special rules of using pesticides. Veterinarian dealing with the health of the animal and its hyper-events are responsible for these ill healthy disorder under whom is taken the responsibility.

REFERENCES


Varley, H.; Gownlock, A. and Bell, M. (1980): "Practical Cl-
