HISTOPATHOLOGICAL AND HAEMATOLOGICAL STUDIES ON RATS FED ON YELLOW CORN GRAINS CONTAMINATED WITH ASPERGILLUS FLAVUS AND / OR WITH AFLATOXIN

Eisa (Nawal), A.¹; A. E. Badr¹; S. K. Abdel Reheem² and M. F. Abo El-Alaa²

1 Pathology Division Dept. of Agric. Botany, Fac. of Agric., Moshtohor, Zagazig Univ., Benha Branch, Egypt.
2 Central Lab. for Food and Feed (CLFF), Agric. Res. Center, Giza, Egypt.

ABSTRACT

Eight groups of rats which represent eight treatments were fed on yellow corn grains infected with a sore spension of A. flavus (2500-3000 spores/g. grains). Weight of rats was significantly reduced in all groups contained diets contaminated with aflatoxins, spores or both of them when compared with the control (non-infested). The reduction in weight of rats was increased by increasing concentration of the aflatoxins. Also, the rats fed on diets contained high concentration of aflatoxins showed some clinical changes such as falling of their body hair.

Some alteration in liver as, severe congestion (hyperaemia) of the central vein, sinusoides, and degenerative changes in the form of vascular and hydropic degeneration were show in the groups fed on diets containing different concentration of aflatoxins (B1 and/or B2) and/or spores of A. flavus.

Significantly reduced count of red blood cells (RBC's) was recorded in rats fed on diets contained high concentration of aflatoxins, while significantly increased count of white blood cells (WBC's) was found in these group. Concentration of hemoglobin (Hb) and activity of serum glutamate pyruvate transaminase (SGPT) and serum glutamate oxalacetate transaminase (SGOT) were raised in the blood.

INTRODUCTION

The increased need of corn in recent years put the corn among the major grains produced in the world for food and feed. Corn as a feed is the second component that has commercial value. It is used mainly as a feed stuff for animals and poultry wealth. The importance of reliable quantitative information on aflatoxins arising from the bad conditions of corn storage has increased considerably in recent years.

Aflatoxins are mycotoxins that has acute, chronic and sometimes mutant effects. Aflatoxins B1, B2, G1, and G2 are the main toxins produced by Aspergillus flavus and A. parasticus (Diener and Davis, 1986). Bearing in mind all the above mentioned points, the present study was conducted to
study the histopathological and the hematological effects of the aflatoxins on experimental rats.

Delvi (1986) reported that, factors influenced the toxic affects of aflatoxin were age, sex, nutrition, environmental stresses and exposure to chemicals (duration and dose) including other mycotoxins.

Hamilton (1986) stated that, aflatoxin has many effects on farm animals, including malabsorption of various nutrients, decreased tissus integrity, poor growth, poor efficiency of feed conversion, enhanced susceptibility to infection, vaccine failure, drug failure, reproductive problems in males and females and increased sensitivity to temprature extremes. Toxic residue of aflatoxin in animal products were harmful to public health. The minimum effective dose (MED) of aflatoxin determined according to epidemiological studies coupled with laboratory experiments and mathematical corrections, was found to be less than 10 p.p.b. It may be assumed that no level of aflatoxin is free of risk.

Panangala et al. (1986) found that, weanling swine when fed on 500 p.p.b dietary aflatoxins caused reduction in growth rate and feed efficiency, while feed containing 300 p.p.b aflatoxins could affect growth rate when feeding process was prolonged.

Pier (1986) reported that, aflatoxicosis of mammalian animals caused a variety manifestations, due to the ability of aflatoxin to impair protein synthesis, react with macromolecules and cellular organells and interfere with normal production of cellular regulators. Acute aflatoxicosis caused hepatic necrosis, dearangement of hepatic functions, Coagulopathy and extensive hemorrhagic lesions, resulting death of the animal. Subacute or chronic aflatoxicosis caused fatty changes in liver, enlargement of the gall bladder, periportal fibrosis with proliferative changes in bileduct epithelium, icterus and also reduced rate of growth production. In addition to liver, the thymus gland is also a primary target organ of aflatoxin. Consumption of aflatoxin caused thymic aplasia and marked suppression of cell-mediated immune responses, as well as non sepecific factors of the native defense mechanisms, such as macrophages and production of complement (C4), T. cell population of the peripheral blood and antibody titers are usually normal. Immunosuppresssive effects are thought to arise from effects on antigen presentation and lumphokine production. Acut aflatoxicosis has pathognomic signs and hence it was relatively diagnosed easly. Major economic losses in animals were associated with the subacute or chronic forms of aflatoxicosis, which are the most difficult ones to recognize. Carcinogensis is an important aspect of aflatoxicosis in animals.

Baker and Green (1987) showed that, the coagulation defect caused by aflatoxicosis is primarily due to diminished hepatic synthesis of coagulation factors, except when hepatic necrosis is sever enough to strat interavascular coagulation and consnotion of coagulation factors.

Coppock et al. (1989) found that, aflatoxicosis was diagnosed in 600 pigs (2500-3500μg aflatoxin/kg of feed) of which 400 were died, 150 were destroyed and 50 were markedly affected.
Roger et al. (1991) found that, cereal brans had no longterm effect on body weight as a nutrient during rat experiment, but influenced differently each of total serum lipid levels and intestinal weights.

Slowik et al. (1985) mentioned a clear correlation between morphological changes in the lymphatic system and that in the liver.

Harvey et al. (1988) analysis of blood samples drawing from pigs at the 28th days of feeding diets containing 0, 1, 2, 3 or 4mg aflatoxin/kg showed that, haemoglobin decreased in aflatoxin-treated pigs comparing with control ones. Examination of bone marrow samples collected after slaughtering (at the 29th days) showed a decrease in granulocytic cellularity in aflatoxin feeding pigs.

Browne (1988) reported that, serum aspartate aminotransferase (SGOT) activities were indicative of hepatotoxicity. Lactate dehydrogenase (LHD) activity was significantly increased under treatment with aflatoxin B1.

Harvey et al. (1989) noticed changes in enzymatic activities of alkaline phosphatase, aspartate tranaminase (GOT), creatine kinase, and  δ-glutamyl transferase (GPT) in blood serum of pigs treated with aflatoxin B1.

Steele and Winsch (1989) reported that, many enzyme are synthesized by liver cells, but not all of them have been found useful in diagnosis of hepatoma and hepatocirrhosis. Some enzymes have been found useful in this respect such as, serum glutamate pyruvate transaminase (SGPT).

In order to check the hazardous of aflatoxins and/or spores of Aspergillus flavus on the microscopic structure of tissues (specially liver tissues) and on some blood components, this study was conducted.

**MATERIALS AND METHODS**

**Experimental animals and diets:**

For histopathological examination, the method described by (Pearse, 1968) was used. Eight groups, each with six male rats weighing approximately 70-75 g. were used. The diet consisted of corn (represent 60% treated with A. flavus,) Casein, Oil, Vitamin B+K, Mineral mixture, Cellulose, Carbohydrate and Methionine. Each rat fed in a single cage and was weighed daily during the experiment for 25 days. Eight groups of rats which represente eight treatments were tabulated in table (1) as follows:-
Table (1): Groups of treatments and their components.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Commercially stored corn for 30d</td>
<td>3</td>
<td>17</td>
<td>54.8</td>
<td>27.4</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>Stored corn at 28°C. for 30d</td>
<td>3</td>
<td>17</td>
<td>10.3</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>Stored corn at 18°C. for 180d</td>
<td>3</td>
<td>17</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Stored corn at 10°C. for 180d</td>
<td>3</td>
<td>17</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Stored corn at 28°C. for 3.</td>
<td>3</td>
<td>23</td>
<td>986.3</td>
<td>219.0</td>
<td>+</td>
</tr>
<tr>
<td>6</td>
<td>Stored corn at 18°C. for 180d</td>
<td>3</td>
<td>23</td>
<td>174.0</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>7</td>
<td>Stored corn at 10°C. for 180d</td>
<td>3</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>Control</td>
<td>3</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

d =day  
+ = Presence of spores in diet  
- = Absence of spores in the diet.  
B1 = Aflatoxin B1 produced by A. flavus.  
# = AACC, 1962  
* = USFGS, 1990.  
** = AOAC Methods, 1990

Histopathological examination:-

At the end of the experiment all rats were sacrificed and samples. Samples were fixed in 10% formaline solution, followed by washing in tap water, then dehydrated by different grades of alcohol (70, 85, 96 and 99%) and finally cleared by xylene and embedded in paraffine wax. The paraffine embedded blocks were six-micron cutted, stained by hematoxyline and eosin and then subjected to a histopathological. (Pearse, 1968).

Haematological examination:

For haematological examination, blood samples were taken from vein of rat's eye at the end of experiment in Wasserman test tubes containing anticoagulant. Counting of red blood cells (RBC's) and white blood cells (WBC's) were done according to the method of Jain (1986). Haemoglobin was determined according to Van Kampen and Zijlstra (1961).

To determine the activity of serum glutamate pyruvate transaminase (S.G.P.T.) and Serum glutamate oxalacetate transaminase (S.G.O.T.), the method described by Karmen, (1955) was carried out.

Data obtained were subjected to the proper analysis of variance (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

The histopathological effects:-

With respect to, effect of feeding on diets contaminated with aflatoxins and/or spores of A. flavus on the weight of experimental rats, data in the present study indicated that, weight of rat was significantly reduced in all groups contained diets contaminated with aflatoxin, spores or both when
compared with control. In the same time, the reduction in rat weight was increased with increase of aflatoxin concentration. Also, rats fed on diets contained high concentrations of aflatoxin (B1 and B2) showed some clinical changes such as, falling of body hairs. These results are in agreement with those stated by Smith and Hamilton (1970); Garlich and Hamilton (1971); Washburn and Britton (1971); Thurston et al., (1972); Pier (1973); Wyatt et al., (1973); Brigg et al., (1974); Osborne et al., (1976); Howarth and Wyatt (1980); Gianbrone et al., (1985); Hamilton (1986); Panagala et al., (1986); Pier (1986) and Rosiles (1986).

Table (2): Effect of contaminated diets with aflatoxin and/or spores of *A. flavus* on weight of experimental rats.

<table>
<thead>
<tr>
<th>Group</th>
<th>Sample</th>
<th>Aflatoxin</th>
<th>Other content</th>
<th>Weight at the beginning of the Experimental (g)</th>
<th>Weight at the end of the Experimental (g)</th>
<th>Reduction in the Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>G3 TN M17 (30 days)</td>
<td>54.8</td>
<td>27.4</td>
<td>Spores</td>
<td>74.0</td>
<td>68.9</td>
</tr>
<tr>
<td>Group 2</td>
<td>G3 T28°C M17% (30 days)</td>
<td>10.3</td>
<td>-</td>
<td>Spores</td>
<td>82.6</td>
<td>74.7</td>
</tr>
<tr>
<td>Group 3</td>
<td>G3 T18°C M17% (180 days)</td>
<td>986.3</td>
<td>219.0</td>
<td>Spores</td>
<td>76.3</td>
<td>66.46</td>
</tr>
<tr>
<td>Group 4</td>
<td>G3 T10°C M17% (180 days)</td>
<td>-</td>
<td>-</td>
<td>Spores</td>
<td>75.2</td>
<td>70.1</td>
</tr>
<tr>
<td>Group 5</td>
<td>G3 T28°C M23% (30 days)</td>
<td>174.7</td>
<td>-</td>
<td>Spores</td>
<td>84.3</td>
<td>75.2</td>
</tr>
<tr>
<td>Group 6</td>
<td>G3 T18°C M23% (180 days)</td>
<td>-</td>
<td>-</td>
<td>Spores</td>
<td>72.3</td>
<td>64.96</td>
</tr>
<tr>
<td>Group 7</td>
<td>G3 T10°C M23% (180 days)</td>
<td>-</td>
<td>-</td>
<td>Spores</td>
<td>81.3</td>
<td>74.26</td>
</tr>
<tr>
<td>Group 8</td>
<td>Control</td>
<td>-</td>
<td>-</td>
<td>Free</td>
<td>69.3</td>
<td>8.7</td>
</tr>
</tbody>
</table>

Where:-

G3 = Grade 3  
M = Moistcontent  
TN = Natural temperature  
L.S.D. at 5% for reduction in weight = 5.0

Results showed that, liver in group No. 8 which was fed on control diet (containing aflatoxins - free corn) was normal. On the other hand, the groups of experimental rats (groups No. 1-7) which were fed on diets containing different concentrations of aflatoxins (B1 and B2) and/or spores of *A. flavus* showed some alterations in liver such as, severe congestion (hyperaemia) of the central vein and sinusoids (Fig.1) and degenerative changes in the form of vacuolar and hydropic degeneration (Fig. 2).

These results are in accordance with those reported by Salmon and Newberne (1963); Buttler (1966); Thurston et al., (1972); Edss (1973);
Fig (1): Liver showing severe congestion of the central vein and sinusoids (H. & E. X 450)
1- Normal central vein  2- Congested central vein

Fig (2): Liver showing degenerative changes in the form of vacuolar and hydropic degeneration (H. & E. X 450).
1- Normal cell showing nucleus and cytoplasm.
2- Abnormal cell showing nucleus and vaculated (hydropic)cytoplasm.
Chen et al. (1985); Hamilton (1986); Pier (1986); Rosiles (1986); Baker and Green (1987) and Hamza et al. (1989).

The haematological effects:

Data presented in Table (3), generally showed that, no obvious differences were observed in the count of red blood cells in all tested groups, except in groups 5 (where there was high concentration of aflatoxins) there was significant decrease in count of red blood cells (RBCS), indicated a case of erythrocytopenia, in comparison with either experimental control or normal one. Also, no significant differences were noticed in count of white blood cells (WBCS) in all tested groups, except in group 5 (where there was a high concentration of aflatoxins) there was significant increase in count of white blood cells (WBCS), indicated a case of leucocytosis, in comparison with either experimental control or the normal one. In the same time, the concentration of hemoglobin showed insignificant differences in all tested rat groups, except in group (5) where there was significant increase in concentration of haemoglobin (Hb) in comparison with either experimental or normal controls. With respect to the tested blood enzymes (SGPT and SGOT), the present data showed that, there were no significant differences in concentrations of either (SGPT) or (SGOT) in all tested groups, except in group (5) where the differences were significant in comparison with either experimental or normal controls.

Generally aflatoxins (B1 and B2) in high concentrations significantly reduced count of red blood cells (RBCS) and significantly increased count of white blood cells (WBCS), concentration of haemoglobin (Hb) and activity of either SGPT or SGOT. Also these results are in accordance with the histopathological results and may be attributed to the hazardous effects of aflatoxins on liver as formerly indicated, or on the bone marrow as the main generator of blood components, or on both. SGPT and SGOT are liver enzymes and their presence in blood in high concentrations mean that liver was exposed to some histopathological changes and so could be used as indicators of such changes.

Lun (1978); Slowik et al. (1985); Sova et al. (1985); Dafalla et al. (1987); Browne (1988); Hamza et al. (1989); Harvey et al. (1989) and Steele and Winsch (1989). Also, the haematological results in this study are in accordance with the histopathological results Lun (1978) stated that, SGOT measuring activity is useful for identifying inflammation and necrosis of the liver SGOT enzyme is located in the microsomal mitochondrial portion of the hepatic cell and also is present in the epidermis of the skin, heart, skeleton muscle, pancreas and kidneys. Increased enzyme SGOT activity in blood may be due to the damage of the hepatic cell as a result of inflammation or hepatocellular infection.. Slowik et al. (1985) mentioned to a clear correlation between morphological changes in the lymphatic system and that in the liver. Steele and Winsch (1989) reported that, some enzymes have been found useful in diagnosis of hepatoma and hepatocirrhosis, such as, serum glutamate pyruvate transaminase (SGPT)
Table (3): Hematological changes by aflatoxins and/or spores of *A. flavus* in male rats.

### Red blood cells (RBCs)

<table>
<thead>
<tr>
<th>Group</th>
<th>G1 (Mean ± S.D)</th>
<th>G2 (Mean ± S.D)</th>
<th>G3 (Mean ± S.D)</th>
<th>G4 (Mean ± S.D)</th>
<th>G5 (Mean ± S.D)</th>
<th>G6 (Mean ± S.D)</th>
<th>G7 (Mean ± S.D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated</td>
<td>5.14 ± 0.461</td>
<td>5.36 ± 0.601</td>
<td>5.42 ± 0.523</td>
<td>5.52 ± 0.623</td>
<td>3.96 ± 0.327</td>
<td>4.82 ± 0.391</td>
<td>4.98 ± 0.426</td>
</tr>
<tr>
<td>Control (G8)</td>
<td>5.72 ± 0.53</td>
<td>5.72 ± 0.53</td>
<td>5.72 ± 0.53</td>
<td>5.72 ± 0.53</td>
<td>5.72 ± 0.53</td>
<td>5.72 ± 0.53</td>
<td>5.72 ± 0.53</td>
</tr>
<tr>
<td>Normal</td>
<td>5.37 ± 0.39</td>
<td>5.37 ± 0.39</td>
<td>5.37 ± 0.39</td>
<td>5.37 ± 0.39</td>
<td>5.73 ± 0.39</td>
<td>5.37 ± 0.39</td>
<td>5.37 ± 0.39</td>
</tr>
</tbody>
</table>

(T) test | N. S. | N. S. | N. S. | N. S. | S. | N. S. | N. S. |

### White blood cells (WBCs)

<table>
<thead>
<tr>
<th>Group</th>
<th>G1 (Mean ± S.D)</th>
<th>G2 (Mean ± S.D)</th>
<th>G3 (Mean ± S.D)</th>
<th>G4 (Mean ± S.D)</th>
<th>G5 (Mean ± S.D)</th>
<th>G6 (Mean ± S.D)</th>
<th>G7 (Mean ± S.D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated</td>
<td>7800 ± 2261.7</td>
<td>7100 ± 2989.3</td>
<td>5700 ± 421.9</td>
<td>6950 ± 3691.7</td>
<td>10300 ± 1639.2</td>
<td>9650 ± 2371.2</td>
<td>4650 ± 726.7</td>
</tr>
<tr>
<td>Control (G8)</td>
<td>8350 ± 2371.4</td>
<td>8350 ± 2371.4</td>
<td>8350 ± 2371.4</td>
<td>8350 ± 2371.4</td>
<td>8350 ± 2371.4</td>
<td>8350 ± 2371.4</td>
<td>8350 ± 2371.4</td>
</tr>
<tr>
<td>Normal</td>
<td>7860 ± 428.9</td>
<td>7860 ± 428.9</td>
<td>7860 ± 428.9</td>
<td>7860 ± 428.9</td>
<td>7860 ± 428.9</td>
<td>7860 ± 428.9</td>
<td>7860 ± 428.9</td>
</tr>
</tbody>
</table>

(T) test | N. S. | N. S. | N. S. | N. S. | S. | N. S. | N. S. |

### Hb (g / 100ml) Mean ± SD (P = 0.05)

<table>
<thead>
<tr>
<th>Group</th>
<th>G1 (Mean ± S.D)</th>
<th>G2 (Mean ± S.D)</th>
<th>G3 (Mean ± S.D)</th>
<th>G4 (Mean ± S.D)</th>
<th>G5 (Mean ± S.D)</th>
<th>G6 (Mean ± S.D)</th>
<th>G7 (Mean ± S.D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated</td>
<td>8.26 ± 0.248</td>
<td>8.93 ± 0.369</td>
<td>10.69 ± 0.561</td>
<td>8.87 ± 0.298</td>
<td>11.36 ± 0.44</td>
<td>9.63 ± 0.44</td>
<td>8.312 ± 0.329</td>
</tr>
<tr>
<td>Control (G6)</td>
<td>9.81 ± 0.326</td>
<td>9.81 ± 0.326</td>
<td>9.81 ± 0.326</td>
<td>8350 ± 2371.4</td>
<td>9.81 ± 0.326</td>
<td>8350 ± 2371.4</td>
<td>9.81 ± 0.326</td>
</tr>
<tr>
<td>Normal</td>
<td>10.41 ± 0.429</td>
<td>10.41 ± 0.429</td>
<td>10.41 ± 0.429</td>
<td>10.41 ± 0.429</td>
<td>10.41 ± 0.429</td>
<td>10.41 ± 0.429</td>
<td>10.41 ± 0.429</td>
</tr>
</tbody>
</table>

(T) test | N. S. | N. S. | N. S. | N. S. | S. | N. S. | N. S. |
Table (3) Continued.

**Serum glutamate pyruvate transaminase (SGPT)**

<table>
<thead>
<tr>
<th>Group</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
<th>G6</th>
<th>G7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Treated</td>
<td>131 ± 7.1</td>
<td>129 ± 5.65</td>
<td>119 ± 2.1</td>
<td>113 ± 5.56</td>
<td>139 ± 12.7</td>
<td>124 ± 2.1</td>
<td>106 ± 10.6</td>
</tr>
<tr>
<td>Control (G8)</td>
<td>121</td>
<td>121</td>
<td>121</td>
<td>121</td>
<td>121</td>
<td>121</td>
<td>121</td>
</tr>
<tr>
<td>Normal</td>
<td>154</td>
<td>154</td>
<td>154</td>
<td>154</td>
<td>154</td>
<td>154</td>
<td>154</td>
</tr>
<tr>
<td>(T) test</td>
<td>N.S.</td>
<td>N.S.</td>
<td>N.S.</td>
<td>N.S.</td>
<td>S.</td>
<td>N.S.</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

**Serum glutamate oxalacetate transaminase (SGOT)**

<table>
<thead>
<tr>
<th>Group</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
<th>G5</th>
<th>G6</th>
<th>G7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Treated</td>
<td>231 ± 9.9</td>
<td>225 ± 5.56</td>
<td>173 ± 31.1</td>
<td>209 ± 5.56</td>
<td>229 ± 8.5</td>
<td>219 ± 1.4</td>
<td>143 ± 52.3</td>
</tr>
<tr>
<td>Control (G8)</td>
<td>217</td>
<td>217</td>
<td>217</td>
<td>217</td>
<td>217</td>
<td>217</td>
<td>217</td>
</tr>
<tr>
<td>Normal</td>
<td>195</td>
<td>195</td>
<td>195</td>
<td>195</td>
<td>195</td>
<td>195</td>
<td>195</td>
</tr>
<tr>
<td>(T) test</td>
<td>N.S.</td>
<td>N.S.</td>
<td>N.S.</td>
<td>N.S.</td>
<td>S.</td>
<td>N.S.</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

which is useful in identifying inflammation and necrosis of the liver. Acute hepatocellular inflammation increased SGPT. SGPT enzyme released in the blood when liver was damaged. Enzyme activity has been used to monitor drug toxicities.

**ACKNOWLEDGMENTS**

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**REFERENCE**


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دراسات هستوباثولوجية وهيماتولوجية لفئران غذى على حبوب أذره صفراء ملوثة بالأسبريلس فلافس و/أو بالأفلاتوكسين

نوال عبد المنعم عيسي١ - أبو الزيز إمام بدر١ - سيد كامل عبد الرحيم٢ - محمد فتحي أبو العلا٢

١ قسم النباتات الزراعى فرع الفطر وأمراض النباتات - كلية الزراعة - جامعة الزقازيق
٢ المعهد المركزى للاطفال والانفلوانزا - مركز البحوث الزراعية - الجيزة - مصر

أجري هذا البحث لدراسة بعض التغيرات النسيجية وبعض التغييرات في مكونات الدم لفئران تجارب تحت تغذيتها على حبوب صفراء ملوثة بالأفلاتوكسينات و/أو الفطر الأسبريلس فلافس. وقد أدت تغذية فئران التجارب على غذاء ملوث بالأفلاتوكسنين أو الرياحم (أو كليهما) (الفطر الأسبريلس فلافس) إلى خفف بعض معنويات الوزن مقارنة بالهوارن. وقد قدرت زيادة الإفراز في وزن الفئران بزيادة تركيز الأفلاتوكسين في الغذاء الملوث بالأفلاتوكسينات. (ب (٢) ميكروجرام/كم حبوب) و (١١٦) ميكروجرام/كم حبوب) + جرائيم الفطر الأسبريلس فلافس وأيضاً فإن الفئران التي تغذى على هذه العلاج أظهرت بعض التغيرات المرضية مثل سقوط شعر الجسم.
أظهرت النتائج البيولوجية لقطاعات في نسيج الكبد أن كتبت مجموعة فئتين التجارب المقارنة والتي عُرفت على غذاء خالي من الأفلاتوكسينات كان طبيعيًا. وعلى الجانب الآخر فإن مجموعة فئتين التجارب والتي عُرفت على غذاء يحتوي تركيزات مختلفة من الأفلاتوكسينات (B1, B2) أو جراثيم الفطر أسير جنس فلادرك. أظهرت بعض التغييرات في تركيب نسيج الكبد مثل وجود اختلاف في الوريد المركزي والأوعية والشعيرات الدموية، واستثناء في خلايا الكبد.

أظهرت اختبارات الدم أن التركيز العالي من الأفلاتوكسينات أدى إلى خفض معنوي عدد كرات الدم الحمراء، كما أدى إلى زيادة معنويه لكل من عدد كرات الدم البيضاء وتركيز الهيموجلوبين وتركيزات بعض إنزيمات الكبد والتي تدرس في الدم مثل جلوتامات أوكسايل ترانسنز أبيناز السيروم (SGPT) والتي تستخدم كدالة على التغييرات البيولوجية في الكبد.