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Research Article

EFFECT OF SUBLETHAL DOSE OF PENICILLIC ACID TOXICITY ON LIVER LIPID PEROXIDATION AND ANTIOXIDANT STATUS IN BROILER CHICKENS

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ABSTRACT
Penicillic acid (PA), a mycotoxin, was originally isolated from the cultures of *Penicillium puberulum.* The present study was undertaken to find out the sublethal effect of penicillic acid mycotoxicosis on liver lipid peroxidation and antioxidant status of broiler chicken. Forty eight day-old broiler chicks were randomly allotted to four groups of 12 birds each and fed with 0, 7.5, 15 and 30 ppm of penicillic acid from 0 to 21 days of age respectively. On 21st day of trial, liver was collected to study the liver lipid peroxidation and antioxidant levels. Though the liver TBARS value did not show significant difference between the control and treated groups, there was a numerical increase in the liver TBARS value in the penicillic acid treated birds. Significant differences were observed between the control and penicillic acid toxin fed birds for CAT ($P<0.05$), GPx and GST ($P<0.01$) at 15 and 30 ppm groups. No significant differences were observed between the control and 7.5 ppm groups for CAT and GST. No significant differences were observed among toxin fed birds for CAT and GPx values. There was a significant ($P<0.05$) decrease in the CAT ($P<0.05$) and GPx ($P<0.01$) and increase in the GST ($P<0.01$) levels in the penicillic acid toxin fed birds when compared to the control group. Conclusions: Lower level of toxin employed in the present study could not induce significant lipid peroxidation in the liver. The decrease in the CAT and GPx and increase in the GST with non-significant increase in the TBARS levels indicated the low intensity of oxidative stress in penicillic acid toxicity in broiler chickens.

Keywords: *Broiler Chicken, Penicillic Acid Toxicity, Liver Lipid Peroxidation, Antioxidant Assay*

INTRODUCTION
Penicillic acid (PA), a mycotoxin, was originally isolated from the cultures of *Penicillium puberulum* (Alsberg and Black, 1913). Penicillic acid occurred in high concentrations in corn (Kurtzman and Ciegler, 1970) and was also produced concomitantly with other mycotoxins in poultry feed (Bacon *et al.*, 1973). Natural occurrence of penicillic acid has been detected in the poultry feed, corn, dried beans, cheese, salami and tobacco products (Kurtzman and Ciegler, 1970).

Available literature on the penicillic acid mycotoxicosis in poultry are scanty and literature search supported the need to find out whether the cell membrane damage is one of the mechanisms of penicillic acid toxicity. Hence, the present study was undertaken to assess the penicillic acid effect on antioxidant status in broiler chickens.

MATERIALS AND METHODS
Penicillic Acid Production
The *Penicillium cyclopium* NRRL 1888 culture was obtained from National Center for Agricultural Utilization Research, Microbial Genomics and Bioprocessing Research Unit, 1815 N University Street, Peoria, Illinois 61604, USA. The penicillic acid toxin was produced on maize (LeBars, 1980). The maize samples were pre-tested for the presence of mycotoxins. The penicillic acid from ground maize culture samples were quantified by using thin layer chromatography at the Central Animal Feed and Food Residue Laboratory, Directorate of Centre for Animal Health Studies, Tamil Nadu Veterinary and Animal Sciences University, Chennai–600 051. The *P. cyclopium* NRRL 1888 subcultured on potato dextrose agar and the culture material yielded 20–80 ppm penicillic acid.

Experimental Design

Forty eight day-old broiler chicks were randomly allotted to four groups of 12 birds each. They were fed with 0, 7.5, 15 and 30 ppm of penicillic acid mixed diets from 0 to 21 days of age respectively. On 21st day of trial, the birds were sacrificed.

Liver Lipid Peroxidation and Antioxidants

Liver tissue samples collected from control and toxin fed birds were stored at - 20°C till the required assays were carried out. Liver lipid peroxidation was estimated by the formation of thiobarbituric acid (TBARS) following the method of Yagi (1976).The protein content was estimated by the method of Lowry *et al.*, (1951). Glutathione peroxidase (GPx) was estimated by the method of Rotruck *et al.*, (1973), glutathione-S-transferase (GST) by the method of Habig *et al.*, (1974), superoxide dismutase (SOD) by the method of Marklund and Marklund (1974) and catalase (CAT) by the method of Caliborne (1985). Reduced glutathione (GSH) was estimated by the method of Moron *et al.*, (1979).

RESULTS AND DISCUSSION

Liver TBARS Assay

There was no significant difference between the control and penicillic acid toxin treated groups for TBARS values (Table 1). Though the liver TBARS value did not show statistically significant difference between the control group and treated groups, there was an increase in the liver TBARS value in the penicillic acid treated birds and suggested that the lower level of toxin employed in the present study could not induce significant lipid peroxidation in the liver.

Table 1: Mean (± SE) liver TBARS and antioxidant values in penicillic acid fed broiler chicks (n=6)

Penicillic acid toxin levels (ppm)	TBARS[1]	SOD[2]	CAT[3]	GPx[4]	GST[5]	GSH[6]
0	312.83 ± 51.61	0.17 ± 0.06	0.68^{a} ± 0.06	269.24^{x} ± 51.56	0.79^{y} ± 0.19	613.79 ± 74.52
7.5	468.40 ± 65.51	0.09 ± 0.00	0.56^{ab} ± 0.06	71.85^{y} ± 11.50	1.20^{y} ± 0.22	554.33 ± 62.64
15	634.07 ± 102.36	0.09 ± 0.01	0.40^{b} ± 0.05	101.76^{y} ± 23.23	3.09^{x} ± 0.52	523.91± 57.53
30	512.63 ± 77.33	0.09 ± 0.01	0.39^{b} ± 0.08	94.86^{y} ± 23.91	3.74^{x} ± 0.32	500.78 ± 102.55

Means with same superscripts within a column (a,b/x,y) do not differ from each other (P>0.05/P>0.01)
[1] *TBARS level in mg/g of tissue*
[2] *Enzyme required for inhibiting 50% pyrogallol autooxidation/min/mg protein*
[3] *Catalase required for decomposing μm of H_2O_2/min/mg protein*
[4] *GPx expressed as μm of glutathione utilized/min/mg protein*
[5] *GST expressed as μm CDNB–GSH conjugate formed/min/mg protein*
[6] *GSH level in mg/g of tissue*

Liver antioxidant assay

No significant differences were observed among toxin fed birds for CAT and GPx values. There was significant (P<0.05) decrease in the CAT (P<0.05) and GPx (P<0.01) and increase in the GST (P<0.01) levels in the penicillic acid toxin fed birds when compared to the control group (Table 1).

The decrease in the CAT and GPx and increase in the GST with non-significant increase in the TBARS levels indicated the low intensity of oxidative stress. However, Sarmadha (2003) reported a significant increase in the liver TBARS and decrease in the GST values but at higher level of feeding penicillic acid (50-480 ppm) to broiler chicken. Lower level of toxin (7.5-30 ppm) employed in the present study could not induce significant lipid peroxidation in the liver.

REFERENCES

Alsberg CL and Black OF (1913). Contribution to the study of maize deterioration. Biochemical and toxicological investigations of *Penicillium puberulum* and *Penicillium stoloniferum. United States Department of Agriculture Bureau Plant Index* 270 1-48.

Bacon CW, Sweeney JG, Robbins JD and Burdick D (1973). Production of penicillic acid and ochratoxin A on poultry feed by *Aspergillus ochraceus.* Temperature and moisture requirements. *Applied Microbiology* **26** 155-160.

Caliborne AL (1985). Assay of catalase. In: *Hand Book of Oxygen Radical Research* edited by Greenwald RA (CRC Press, Baco-Raton, New York).

Habig WH, Rabst MJ and Jakoby WB (1974). Glutathione-S-transferase. The first enzymatic step in mercapturic acid formation. *Journal of Biology and Chemistry* **249** 7130-7139.

Kurtzman CP and Ciegler A (1970). Mycotoxin from a blue-eye mold of corn. *Applied Microbiology* **20** 204-207.

LeBars J (1980). Enhancement factors of penicillic acid production by *Penicillium verrucosum var cyclopium* in food stuffs. *Annals of Research in Veterinary* **11** 321-326.

Lowry OH, Rosebrough NJ, Farr AL and Randall RJ (1951). Protein measurement with the folin phenol reagent. *Journal of Biological Chemistry* **193** 265-275.

Marklund SL and Marklund G (1974). Involvement of superoxide anion radical in the autooxidation of pyrogallol and a convenient assay for superoxide dismutase. *European Journal of Biochemistry* **47** 469-474.

Moron MS, Depierre JW and Mannervik B (1979). Levels of glutathione, glutathione reductase and glutathione-S-transferase activities in rat lung and liver. *Acta Biochemistry and Biophysics* **582** 67-78.

Sarmadha MK (2003). Penicillic acid mycotoxicosis in broiler chicken. M.V.Sc. thesis approved by the Tamil Nadu Veterinary and Animal Sciences University, Chennai.

Yagi K (1976). Simple fluorimetric assay for lipid peroxide in blood plasma. *Biochemisrty and Medicine* **15** 212-216.