Toxicology Digest

Toxicology Digest Vol. 1 (1) (2016) 21-24

WASOT
www.wasot.net

Layer performance and Egg Quality of Poultry Birds Exposed to Dichlorvos

[1*]Ethelbert Uchechukwu Ezeji, and [2]Ikechukwu N. E. Onwurah

[1]*Department of Biotechnology, Federal University of Technology, P.M.B. 1526 Owerri, Nigeria*
[2]*Pollution Control and Biotechnology Unit, Department of Biochemistry University of Nigeria, Nsukka*

Abstract

The effect of dichlorvos on reproductive performance of laying hens was studied. Seven weeks old pullets with an average weight of 557.5 ± 9.5 g were divided into four groups and fed *ad libitum* with commercial poultry feeds contaminated with 0.01, 0.02 and 0.04% dichlorvos (w/v). The group without dichlorvos served as the control. Exposure to dichlorvos was continued until nine weeks after the hens started laying eggs. There was a significant reduction ($p<0.05$) in feed intake between the control group and those exposed to dichlorvos. Egg laying was delayed in the hens exposed to the pesticide by as much as eighteen weeks. The ages of the hens at first egg lay were 18 weeks for the control, 23 weeks for hens fed on 0.01 and 0.02% contaminated diet and 36 weeks for those fed on 0.04% contaminated diet. The average daily egg production was reduced from 5 eggs in the control group to 1 egg in 0.04% contaminated group. The protein contents of the egg (yolk and egg-white) and cholesterol level of the egg yolk were lowered in birds exposed to dichlorvos. There was no significant difference in the weight of eggs between the control and those exposed to pesticide. Results of this study suggest that exposure of laying hens to dichlorvos could affect their reproductive success.

Keywords: Dichlorvos, Reproductive success, sexual maturity, egg laying hens.

Introduction

Use of pesticides in agriculture and domestic purposes may have adverse effects on humans and non-target animals. Dichlorvos is widely used as an insecticide to control household pests, in public health, protecting stored product from insects and control of parasites in livestock. As an reproductive toxicity and have resulted in a decrease organophosphate pesticide, dichlorvos works by inhibiting the activity of the enzyme, acetylcholinesterase (Yair *et al*., 2008). The excessive use of organophosphorus pesticides in agriculture has originated serious problems in the environment (Singh & Walker, 2006). Many environmental pollutants are known to cause in fertility level of human population (Whorton *et al*. 1972). The world-wide deaths and chronic diseases due to pesticide poisoning number about 1 million per year (Environews Forum,1999). Environmental contaminants such as agricultural chemicals and industrial wastes have been reported to have adverse effect on the reproduction of birds exposed to them (Fry, 1995).

Exposure to pesticides has been reported to cause decrease in egg production and embryo viability in birds (EPA, 2006). Sauter and Steelo (1972) have suggested pesticide residues as a major cause of declining population of several wild species of birds. Poultry may be exposed to pesticides either by ingestion of contaminated feed or through use of pesticides in poultry house (Foster, 1974). This study evaluates the effect of dichorvos on the reproductive performance of egg laying hens.

Correspondence
email: ucheezeji@yahoo.com; Phone: +234-8033429193

Materials and Methods

Forty (40) day old black pullets were obtained from Zartec Farms Ibadan, Nigeria. The birds were brooded under appropriate conditions until they were seven weeks old. The seven weeks old pullets (with an average weight of 557.5 ± 9.5 g) were then divided into four different groups containing ten birds each and housed in poultry pens at the livestock unit of the Department of Animal Science Technology, Federal University of Technology, Owerri. The four groups were fed *ad libitum* with commercial poultry feeds contaminated with 0.00, 0.01, 0.02 and 0.04% dichlorvos (w/v). The control group had no pesticide added to their feed. The pesticide exposure was continued until nine weeks after the first lay of eggs. The birds were weighed before and at the end of the exposure while the feed intake was also recorded. Eggs were collected daily and weighed. Total proteins of the eggs were estimated by the method of Lowry *et al*, (1951). Egg yolk cholesterol was determined as described by Shen *et al*. (1982).

Results

It was observed that exposure to dichlorvos affected the weight of the birds. The body weight of the control birds were significantly higher ($p<0.05$) than those exposed to the pesticide. The percentage gain in weight is shown in Table 1. For the control, the percentage gain in body weight was 126.5 % as against 68.75, 65.10 and 28.10 % gain in weight recorded for 0.01, 0.02 and 0.04 % contaminated diets, respectively.

There was a significant reduction ($p<0.05$) in feed intake in the birds fed on pesticide contaminated diet. The control group recorded an average feed intake of 924.59 ± 11.1g while those fed on 0.04 % DDVP recorded an average feed intake of 600.32 ± 8.99 g throughout the period of the experiment (Table 1).

Exposure to dichlorvos affected the layer performance of the birds. The birds fed on normal diet (control group) laid their first egg when they were 18 weeks old (126 days), while those fed on 0.01 and 0.02 % contaminated diets laid their first egg when they were 23 weeks old (161 days). Egg lay was further delayed in the birds exposed to 0.04% dichlorvos laying their first egg in the 36th week. There was also a reduction in egg production in the birds fed on pesticide contaminated diet. A total of 544 eggs were laid by the birds over a period of nine weeks. Out of these 52.75 % were laid by the birds fed on normal diet (control) while the remaining 47.25 % were laid by those fed on pesticide contaminated diet.

Analysis of the eggs from the birds exposed to different concentrations of dichlorvos showed that there was no significant effect on the weight of the eggs. There were also no significant differences ($p > 0.05$) in the weight of the egg shells between the control and those exposed to pesticide (Table 2). However, the highest egg shell weight (5.13 ± 0.36 g) was recorded in the group exposed to 0.04% pesticide. There was a slight reduction in the weight of egg white from 31.42 ± 0.45 g in the control to 29.35 ± 0.73 g in the birds exposed to pesticide (Table 2). This difference was also not statistically significant ($p > 0.05$). The differences in egg yolk weight was also not significant ($p > 0.05$), although the highest weight (14.59 ± 1.15 g) was recorded in the birds fed on 0.02% pesticide contaminated diet.

The protein content of the egg yolk was significantly ($p<0.05$) reduced from 161.54 ± 5.71 mgprotein/gyolk in the control to 139.73 ± 3.42 mgprotein/g yolk in the birds exposed to 0.04% pesticide (Table 3). There was also a significant ($p<0.05$) reduction in the protein content of egg white with increase in percentage pesticide contamination. A similar trend was also observed in the cholesterol content of the egg yolk (Table 3). The differences in cholesterol content of the egg yolk from the different groups were not significant ($p > 0.05$).

Table 1: Effect of DDVP exposure on body weight, feed intake and egg production of domestic fowl

Experimental Group	Control	0.01% DDVP	0.02% DDVP	0.04% DDVP
Body wt. gain (%)	126.50	68.75	65.10	28.10
Feed intake (g)	924.59	723.98	686.76	600.32
Age at 1st egg (days)	126	161	161	252
Wt of 1st egg (g)	35.27	41.54	42.02	45.60
Egg production (%)	52.75	22.42	23.34	1.47

Table 2: Effect of DDVP exposure on egg quality of domestic fowl

Experimental Group	Control	0.01% DDVP	0.02% DDVP	0.04% DDVP
Weight of egg (g)	52.85 ± 0.06	49.20 ± 1.48	51.70 ± 2.09	57.50 ± 0.03
Shell weight(g)	4.88 ± 0.08	4.67 ± 0.01	4.82 ± 0.32	5.13 ± 0.36
Wt. of egg white (g)	31.42 ± 0.01	29.35 ± 0. 01	29.32 ± 0.73	30.60 ± 0.87
Wt. of egg yolk (g)	13.46 ± 0.01	12.93 ± 0.00	14.59 ± 1.15	12.77 ± 4.0

Table 3: Egg yolk protein, egg white protein and yolk cholesterol of domestic fowl exposed to DDVP

Experimental Group	Egg yolk protein (mgProtein/gyolk)	Egg white protein (mgProtein/gEW)	Yolk cholesterol (mg/gYolk)
Control	12.51 ± 0.14	157.5 ± 5.71	120.34 ± 10.28
0.01% DDVP	12.40 ± 0.36	150.23 ± 4.56	115.5 ± 3.43
0.02% DDVP	12.21± 0.21	143.76 ± 4.68	107.42 ± 7.99
0.04% DDVP	11.92 ± 0.29	139.73 ± 3.43	100.15 ± 6.85

Discussion

It has been reported that environmental contamination by agricultural chemicals (including pesticides) have adverse effects on the reproduction of exposed birds (Fry, 1995). There was a reduction in feed intake in birds exposed to dichlorvos. This is in line with the work of Pym *et al*. (1984). Our results showed that dichlorvos has negative effects on the reproductive performance of poultry birds. Sexual maturity was delayed in the birds fed on pesticide contaminated diet. This is reflected in the delay in egg laying time by as much as 18 weeks in the hens fed on 0.04% pesticide contaminated diet compared with the control. The birds exposed to 0.01% and 0.02% pesticide respectively, laid their first eggs on the same day (23rd week) while those fed on 0.04% contaminated diet laid their first egg on the 36th week. Under normal circumstances, commercial egg layers will lay their first egg between 15-19 weeks.

Egg production was also affected by exposure to dichlorvos. The percentage egg production was significantly lowered ($p<0.05$) in the hens fed on pesticide contaminated diet compared with the control. A number of factors affect the reproductive capacity of domestic fowl. These include quantity and quality of feeds, availability of clean water, proper lighting and cleanliness of the pens, among others. Exposure to environmental pollutants have been reported to have some adverse effects on fertility and reproductive capacity of laying hens. Summer *et al*. (1996) reported significant decreases in egg production, weight and fertility of adult hens exposed to halogenated hydrocarbons. Pribilincová *et al*. (1996) also reported a negative effect on the reproductive performance of laying hens exposed to phenyl mercury.

Conclusion

Results of this study suggest that exposure of poultry birds to dichlorvos could affect their reproductive success as well as the quality of eggs laid.

References

Environews Forum (1999) Killer environment. *Environ Health Perspect*. 107: A62.

Environmental Protection Agency (2006). Decision documents for atrazine. Available at www.epa.gov/

Foster, T.S. (1974). Physiological and biological effects of pesticide residues in poultry. Reviews of environmental contamination and Toxicology, 51: 69-121

Fry, D.M. (1995) Reproductive Effects in Birds Exposed to Pesticides and Industrial Chemicals. *Environmental Health Perspectives*, **103(7**): 165-171.

Lowry, O.H., Rosenbrough, N.J., Fair, A.L., Randall and R.J. (1951). Protein measurement with the Folin – Phenol reagent. *J Biol Chem*, 193: 265-270.

Pym, R.A.E., Singh, G., Gilbert, W.S., Armstrong, J.P. and McCleary, B.V. (1984). effects of dichlorvos, maldison and pirimiphos-methyl on food consumption, egg production, egg and tissue residue and plasma acetylcholinesterase inhibition in layer strain hens. *Aust. J. Exp. Agric*. *Anim. Husb*. 24: 83-92.

Shen. C.S., Chen, I.S. and Sheppard, A.J. (1982). Enzymatic determination of cholesterol in egg yolk, *J Assoc Off Anal Chem.* 65(5):1222-1224.

Singh, B.K. and Walker, A. (2006). Microbial Degradation of Organophosphorus Compounds, *FEMS Microbiology Review*, Vol.30, No. 3, (May 2006), pp.428-471, ISSN 0168-6445.

Summer, C.L., Giesy, J.P., Bursian, S.J., Render, J.A., Kubiak, T.J., Jones, P.D., Verbrugge, D.A. and Aulerich, R.J. (1996). Effects induced by feeding organochlorine-contaminated carp from Saginaw Bay, Lake Huron, to laying White Leghorn hens. I. Effects on health of adult hens, egg production, and fertility. *J Toxicol Environ Health.* 49(4):389-407.

Whorton, D., Krauss, R.M., Marshall, S, and Milby, T.H. (1972). Infertility in male pesticide workers, *Lancet* 2: 1259-1261.

Yair, S., Ofer, B., Arik, E., Shai,,S., Yossi, R., Tzvika, D. and Amir, K. (2008). Organophosphate Degrading Microorganisms and Enzymes as Biocatalysts in Environmental and Personal Decontamination, *Applied Critical Review in Biotechnology*, Vol.28, pp. 265-275.