ALLEVIATION OF FLUORINE TOXICITY IN LAYING HENS WITH ALUMINIUM

ATTIA M.Y[1]., A. ZEIN EL-DEIN[2] , A. BASSIOUNI[3] AND A. MOTAAL[1].

1 Animal Production Research Institute, Agricultural Resereach Centre Ministry of Agriculture, Dokki – Giza - Egypt

2 Faculty of Agriculture Ain Shams University

3 Faculty of Veterinary Medicine, Cairo University

(Manuscript received 23 August 2003)

Abstract

The study examined the effect of dietary fluoride (NaF) and aluminum $Al_2(SO_4)_3$ on laying hens performance. A total of 108 White Hy-line hens was housed in individually cages (4 hens/cage) and divided into three equal groups. They were fed a diet supplemented with 0 (as control), 1300-ppm F and 1300-ppm F plus 1040-ppm Al, respectively. The body weight, egg mass, feed consumption, feed conversion, egg quality measurements and blood parameters were taken.

It could be noticed that high F intake significantly depressed body weight, egg number,egg weight, egg mass, feed consumption and feed conversion ratio. However, these depressions were not as severe when Al was present in the diet. Also, the depression in performance due to F feeding was not simply due to the depressed feed intake but was a result of metabolic function of F.

With respect to blood parameters, it could be noticed that the high F intake significantly decreased hematocrit level, plasma calcium and phosphorus. However, dietary Al minimized the effect of high fluoride toxicity

It could be concluded that the fluoride levels in plasma , liver , kidney and tissues were significantly increased when the 1300 ppm F diet was fed. Also, the kidney contained more fluoride than the liver or muscle . The addition of Al to 1300 ppm F diet reduced the fluoride level in plasma , muscles and kidney.

INTRODUCTION

Poultry are known to be the most fluoride (F) tolerant of domestic animals. Interest in the role of F in poultry nutrition arose, not from deficiency symptoms, but rather from toxicosis problems induced by feeding raw rock phosphate as a calcium-

phosphate source (Jacob and Reylnods, 1928). Guenter (1979) demonstrated a progressive reduction in feed intake when hens were fed 400 ppm or more of F, resulting in a concurrent reduction in egg production and feed efficiency. The author also noted that continuously feeding 1000 and 1300 ppm F reduced egg size and shell quality. Concern has been expressed about the rise of high F concentrations occurring in poultry products destined for human consumption (Klose, 1980). Significant amount of fluoride could be added to chemically deboned meat products from bone fragments, because bone is the major F accumulator (Michel *et al.*, 1984).

Initial studies on the use of aluminum sulphate as a fluorine toxicity alleviator in poultry were confined to turkey poults and broilers. Aluminium sulphate over a short time period proved to be an effective alleviator of F toxicity , a ratio of 1.0 F/0.8 Al was found effective eliminating the toxic effect of F in turkey poult rations (Cakir *et al.*, 1978). The use of aluminum sulphate as an F toxicity alleviator in laying hen rations has received little attention.

This work was designed to study the effects of high dietary fluoride level on laying hen performance, and evaluate the use of Al2(SO4)4 as an alleviator of F toxicity in laying hens.

MATERIALS AND METHODS

This experiment was carried out at Poultry Breeding Farm, Poultry Production Department, Faculty of Agriculture, Ain Shams University. A total of 108 White Hy-line pullets, aged 16 weeks, was used. These pullets were housed in individually cages (4 pullets/cage). They were divided into three equal groups fed a diet supplemented with 0 (as control) , 1300 ppm fluorine (as sodium fluoride) and 1300 ppm F plus 1040 ppm aluminium (as aluminium sulphate $Al_2(SO_4)_3$, [Al]) , respectively. Experimental groups were reared under similar managerial, environmental and hygienic conditions. They were exposed to 16 hours photoperiod. The feed and water were providing *ad libitum*. The composition and calculated chemical analysis of the basal diet are shown in Table 1.

Measurements and observation

Individually body weights of laying hens were recorded at 4 weeks intervals. Likewise, egg mass and feed consumption were recorded at 4 weeks intervals. Also, feed conversion ratio was calculated. Eggs laid were individually weighed and recorded. Cumulative mortality rate was recorded for each treatment from 18 to 34 weeks of age.

At 34 weeks of age, an egg quality study was done for treated groups. A total of 150 eggs was collected from each treatment (50 / each). Each egg first weighed to the nearest 0.1g. The force required to fracture was determined using the new apparatus. The liquid contents of egg were put aside and shell plus membranes washed to remove adhering albumen. After drying, shells were weighed upon cooling to the nearest 0.01g. The thickness (mm) was measured using a dial gauge micrometer. The shell percent was calculated as the ratio of shell weight to egg weight multiplied by 100.

At 34 weeks of age, a total of 30 blood samples (10 samples / treatment) was assigned for hematological assessment. A 3.0 ml blood sample was withdrawn from the brachial vein. A portion of the blood was used for hematocrit determination using capillary tubes and a microhematocrite centrifuge. The hematocrit figures were measured after spinning microhematocrite for 12 min. The resulting plasma was stored at –20°C for later analysis. The frozen plasma was allowed to thaw prior to analysis. Calcium , phosphorus, GOT and GPT were determined by enzymatic methods using available commercial kits SCLAVO INC., 5 Mansard Count., Wayne NJ07470, USA.

Fluoride anion in plasma, liver, kidney and tissue were determined using Ion-Selective Electrode Ani ORION 960 (ION meter).

Table1.The composition and calculated chemical analysis of the basal diet.

Ingredients	%
Yellow corn	61.8
Soybean meal 48%	19.3
Limestone	6.92
Glutfeed 16%	4
Corn gluten meal	2.9
Bone meal	2.45
Decortecated cotton seed meal	2
Salt	0.32
Vit –mineral mix*	0.25
Dl-Methionine	0.04
Lysine	0.02
Total	100.00
Calculated chemical analysis:**	
Crude protein, %	17.91
Crude fat %	3.0
Crude fibre %	2.7
ME (kcal/kg)	2787
Calcium %	3.31
Available Phosphorus, %	0.42
Lysin %	0.87
Methionine %	0.38
Methionine + cystine %	0.68

*Each 2.5 Kg of Vit-mineral mix contain: Vit.A 12 m.I.U., Vit . D 4 m.I.U., Vit E 15 g , Vit K_3 2 g ,Vit B_1 1g , B_2 8 g ,Vit B_6 2 g ,Vit B_{12} 10 mg ,Pantothenic acid 10 g , Nicotinic acid 30 g ,Folic acid 1g ,Biotin 150 mg , Choline chloride 600 g , Copper 5 g ,Iodine 0.5 g ,Iron 35 g ,Manganese 70 g, Zinc 60 g and Selenium 0.15 g.

**By calculation according to (NRC ,1994) .

Statistical analysis

Data were subjected to a one-way analysis of variance with treatment effect using the General Linear Model (GLM) procedure of SAS User's Guide, 1994.Duncan's Multiple Ranges Test was used to test the differences between means (Duncan ,1955).

RESULTS AND DISCUSSION

Body weights of laying hens as affected by dietary fluoride and aluminium supplementation are summarized in Table 2.

Table 2. Effect of dietary fluoride and aluminium supplementation on body weight of laying hens.

Age (wk)	Treatment		
	Control	1300 ppm F	1300 ppm F+1040 ppm Al
18	1303.9±19.58	1303.8±20.24	1301.8±18.81
22	1475.8^{a}±22.25	1326.0^{b}±29.27	1430.6^{a}±35.91
26	1550.0^{a}±23.22	1278.95^{b}±35.72	1479.4^{a}±26.10
30	1591.0^{a}±27.10	1406.1^{b}±38.80	1519.4^{a}±38.24
34	1572.5^{a}±25.78	1356.1^{b}±26.47	1523.5^{a}±32.83

Means within rows with the same letters are not significantly differ ($P < 0.01$).

Results obtained showed that the body weight was significantly reduced when hens were fed a diet added 1300 ppm F. The reduced body weight may be due to the reduced feed intake. Suttie (1968) showed that increased F levels in blood altered the action of certain metabolites that resulted in appetite depression. Also, fluoride toxicosis, by feeding 1300 F , ppm, by minimal body weight gain, lower feed intake resulted in a significant decrease in nutrients available for maintained egg production and body weight gain (Hahn and Guenter, 1986). The lower weight gain of the high F can explain the growth depression of body gain resulted due to high F level diet (Holland, 1979).

In addition, results in Table 2 showed that there was no significant difference between the control group and the third group (1300 ppmF + 1040 ppmAl) in body weight at all ages . This result was supported by finding of Hahn and Guenter (1986).

Egg number of laying hens as affected by dietary fluoride and aluminium supplementation are listed in Table 3. Results obtained indicated that when 1300 ppm F added to the ration of laying hens resulted in significantly decreased the egg number as compared to control - fed group. However, the aluminum supplementations modified the action of fluoride in the diet.

Table 3. Effect of dietary fluoride and aluminium supplementation on egg number of laying hens.

Age (wk)	Treatment		
	Control	1300 ppm F	1300 ppm F+1040 ppm Al
18-20	8.27a ± 1.19	6.44b ±1.03	9.53[a]±0.80
20-22	12.05[a]± 0.77	9.35[b] ±1.05	13.71[a]±0.19
22-24	13.5[a] ± 0.22	10.55[b]±0.72	13.76[a]±0.11
24-26	13.55[a]± 0.21	9.45[b] ±0.94	13.29[a]±0.34
26-28	13.65[a]± 0.15	8.89[b] ±1.04	12.88[a]±0.48
28-30	12.30[a]± 0.38	8.65[b] ±1.04	11.65[a]±0.86
30-32	13.20[a]± 0.24	9.61[b] ±0.87	12.41[a]±0.54
32-34	13.27[a]± 0.33	9.27[b] ±1.37	11.71[a]±0.81

Means within rows with the same letters are not significantly differ($P< 0.01$).

Egg weight of laying hens as affected by dietary fluoride and aluminum are presented in Table 4. Results showed that the dietary fluoride at 1300 ppm had a negative effect on egg weight when compared to control-fed group. However, the egg weight produced from hens fed a diet containing 1300 ppm F plus 1040 ppm Al did not significantly differ when compared with control - fed group.

Table 4. Effect of dietary fluoride and aluminium supplementation on egg weight of laying hens.

Age (wk)	Treatment		
	Control	1300 ppm F	1300 ppm F+1040 ppm Al
18-20	41.97±0.48	42.49±0.59	41.75±0.67
20-22	47.21[a]±0.39	45.47[b]±0.39	48.49[a]±0.46
22-24	51.04[a]±0.49	47.55[b]±0.27	51.08[a]±0.42
24-26	54.19[a]±0.50	50.12[b]±0.59	54.59[a]±0.47
26-28	55.61[a]±0.51	51.93[b]±0.81	56.80[a]±0.47
28-30	55.98[a]±0.43	52.58[b]±0.54	57.08[a]±0.51
30-32	56.52[a]±0.45	53.47[b]±0.46	58.19[a]±0.45
32-34	56.85[a]±0.68	54.49[b]±0.74	57.73[a]±0.74

Means within rows with the same letters are not significantly differ ($P<0.01$).

Egg mass, feed consumption and feed conversion ratio of laying hens as affected by dietary fluoride and aluminium supplementation are summarized in Table5.

Egg mass of laying hens was significantly affected by dietary fluoride supplementation , whereas, the control group had significant higher egg mass by

about 32.1% as compared with 1300 ppm F fed group at 30-34 weeks of age. However, aluminium sulphate when added to 1300 ppm F the egg mass of laying hens was reduced by about 7.0% only at the same mentioned age stage.

Feed consumption for the control hens was significantly greater than for those fed diet containing 1300 ppm F. It is possible that some of the depression in feed intake was due to gastric or intestinal irritation by NaF. Decka *et al.* (1978), in human studies, demonstrated that elevated F doses caused gastric irritation which could be reduced by administering supplemental aluminium. These results are in agreement with previous findings of Van Toledo and Combs (1984) and Guenter and Hahn (1986). It was suspected that F ion- plasma slowly built up to level high enough to result in sudden appetite depression and bird gradually recovered as F cleared from plasma. Simon and Suttie (1968), found that dietary F depressed feed consumption in rats when plasma F increased to 3 ppm, but, after a period of reduced feed intake, feed consumption returned to normal. The fluoride supplementation at 1300-ppm level had a negative effect on egg mass of laying hens, but, the aluminium supplementation at 1040-ppm level modified the negative effect of fluoride.

Table 5. Effect of dietary fluoride and aluminium supplementation on egg mass, feed consumption and feed conversion ratio of laying hens.

Period (wk)	Treatment		
	Control	1300- ppm F	1300-ppm F +1040-ppm Al
	Egg mass (g)		
18-22	914.9 ^{a} ±18.22	695.7 ^{b} ±17.40	1066.2 ^{a} ±16.22
22-26	1423.4 ^{a} ±20.31	977.7 ^{b} ±22.18	1429.4 ^{a} ±20.17
26-30	1447.6 ^{a} ±23.70	916.7 ^{b} ±27.15	1397.0 ^{a} ±22.30
30-34	1502.1 ^{a} ±35.22	1020.1 ^{b} ±33.32	1396.9 ^{a} ±31.15
	Feed consumption (g)		
18-22	2517.5 ^{a} ±31.18	2014.5 ^{b} ±29.72	2690.7 ^{a} ±20.92
22-26	3157.0 ^{a} ±36.12	2420.8 ^{b} ±33.72	2488.1 ^{b} ±31.12
26-30	3428.3 ^{a} ±4 0.22	2798.7 ^{b} ±37.18	3237.8 ^{a} ±38.15
30-34	3200.5 ^{a} ±41.72	2800.8 ^{b} ±42.17	3139.0 ^{a} ±40.17
	Feed conversion ratio		
18-22	2.8 ^{a} ±0.17	2.9 ^{a} ±0.13	2.5 ^{b} ±0.11
22-26	2.2 ^{b} ±0.30	2.5 ^{a} ±0.20	1.7 ^{b} ±0.22
26-30	2.4 ^{b} ±0.31	3.1 ^{a} ±0.31	2.3 ^{b} ±0.28
30-34	2.1 ^{b} ±0.36	2.8 ^{a} ±0.22	2.3 ^{b} ±0.18

Means within rows with the same letters are not significantly differ ($P < 0.01$).

Feed conversion ratio was significantly increased when hens fed a diet added 1300 ppm F except from 18-22 weeks. Opposite trend was noticed when aluminium sulphate was added to the 1300 ppm F. The lower feed conversion was probably due to the lower intake and a greater proportion of the feed being required for body maintenance . Also, a reduction in laying performance was associated with increasing the dietary fluoride level which depressed the feed conversion parameter. The higher F diets also tended to yield lower metabolizable energies in spite of increased fat retention (Guenter and Hahn, 1986).

Mortality rate of laying hens as affected by dietary fluoride and aluminium supplementation are shown in Fig.1. It could be noticed that the mortality rate of control and fluoride plus aluminium equal zero. However, the mortality rate of fluoride-fed group was equal to 15 %. The results obtained by Van Toledo and Combs (1984) agreed with our results. They reported that there was a positive relationship between mortality rate and dietary fluorine.

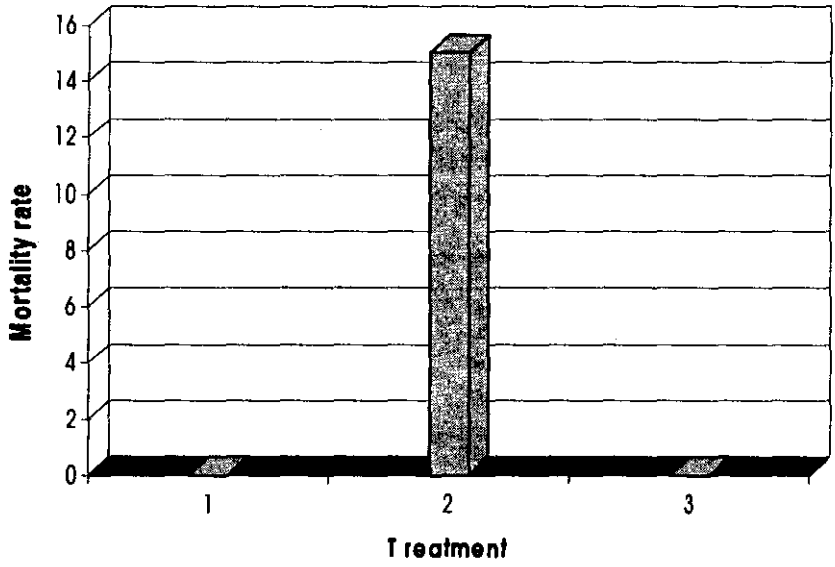

Fig.1. Effect of dietary fluoride and aluminium supplementation on mortality rate of laying hens.

1 = Control 2 = 1300 ppm F3 = 1300 ppm F+1040 ppm Al

Effects of dietary fluoride and aluminium supplementation on egg quality of laying hens aged 34 weeks are summarized in Table 6 .

Egg weight of laying hens fed on diet added 1300 ppm F was significantly lighter than that of control-fed group. Also, there was a significant difference between control and fluoride plus aluminium-fed groups for egg weight.

There was no significant difference among treated groups either for albumen or yolk percentages.

Table. 6. Effect of dietary fluoride and aluminium supplementation on egg quality measurements.

	Treatment		
	Control	1300-ppm F	1300-ppm F+ 1040-ppm Al
Egg weight (g)	55.60^{a}±0.62	50.40^{b}±0.55	54.82^{a} ±0.45
Albumen (%)	60.52±0.41	60.82±0.32	60.56±0.34
Yolk (%)	29.51±0.18	30.52±0.22	29.26±0.17
Albumen height (mm)	14.88^{a}±0.19	12.08^{b}±0.18	14.67^{a}±0.15
Yolk height (mm)	20.45^{a}±0.17	18.38^{b}±0.21	19.82^{a}±0.19
Yolk diameter (mm)	3.92±0.10	3.72±0.10	3.84±0.12
Shell weight (g)	5.54^{a}±0.10	4.37^{b}±0.09	5.50^{a}±0.10
Shell weight (%)	9.97^{a}±0.22	8.67^{b}±0.32	10.03^{a}±0.21
Shell thickness (mm)	0.39^{a}±0.01	0.27^{b}±0.03	0.32^{a}±0.02

Means within rows with the same letters are not significantly differ ($P < 0.01$).

There was a significant difference among F treated groups for albumen height, whereas, the albumen height of fluoride-fed group was significantly lower than that of control and fluoride plus aluminium-fed groups. Similar trend was observed for yolk height. However, the yolk diameter had not significantly affected by dietary fluoride and aluminium. These results are in agreement with Hahn and Guenter (1986).

Absolute shell weight was significantly affected by dietary fluoride supplementation. However the egg shell weight produced by hens fed dietary fluoride plus aluminium was equal to that belonging to control group. Similar trend was observed for shell percentage, whereas ,the shell percentage was significantly decreased when birds were fed a diet containing 1300-ppm F as compared to control-

fed group. However, there was no significant difference between control and fluoride plus aluminium-fed groups for shell percentage. With respect to shell thickness, it could be noticed that the shell thickness of laying hens was significantly affected by dietary fluoride at 1300-ppm level, whereas, the shell thickness of fluoride-fed group was significantly thinner than that of control-fed group. Similar trend was noticed for fluoride plus aluminium-fed group, but the difference was not significant. Guenter (1979) reported that the continuously feeding 1300-ppm F reduced egg size and shell quality. Also, shell quality (deformation and thickness) declined as dietary F increased, resulting in a greater incidence of uncollectible (cracked and thin shelled) eggs. The previous result suggests that the Ca intake of hens fed the high F diets was inadequate to maintain good shell quality or F inhibited Ca metabolism in the hen (Guenter and Hahn, 1986).

Effect of dietary fluoride and aluminium supplementation on breaking strength at 34 weeks of age are listed in Fig. 2. It could be observed that the breaking strength was significantly affected by dietary fluoride supplementation at 1300 ppm level. However, the aluminium supplementation at 1040 ppm level modified the negative effect of fluoride on breaking strength.

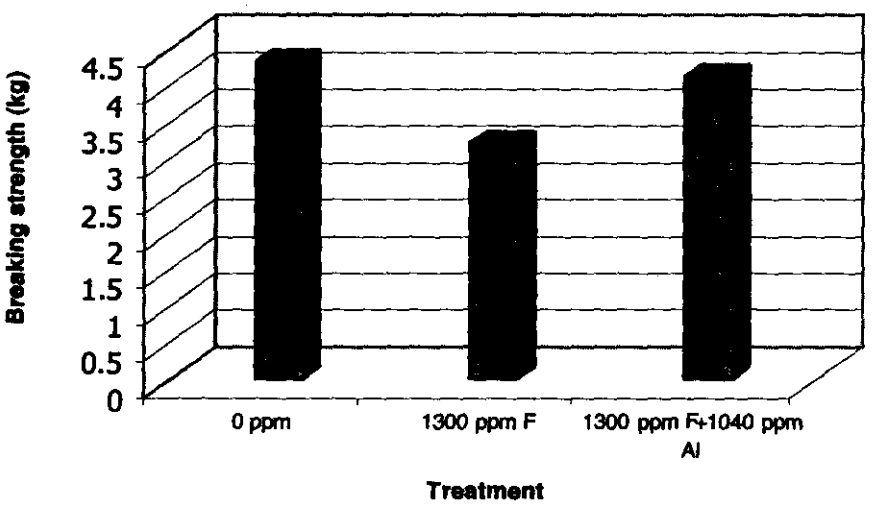

Fig. 2. Effect of dietary fluoride supplementation only or with aluminium on breaking strength at 34 weeks of age.

Blood parameters of laying hens as affected by dietary fluoride and aluminium supplementation are presented in Table 7.

Hematocrit level of laying hens was affected by dietary fluoride supplementation at 1300 ppm level, whereas, the fluoride-fed group had significantly lower hematocrit level as compared with control-fed group. Similar trend was noticed for fluoride plus aluminium supplementation, the difference was significant. This may have resulted from decreased blood supply to the organs, especially the ovary.

It could be noticed that the fluoride-fed group significantly decreased plasma calcium as compared to control-fed group. However, the difference between control and fluoride plus aluminium-fed group for plasma calcium was not significant. The decreased plasma calcium of laying hens when fed a diet added 1300 ppm F could be attributed to decreased egg production, shell weight and shell strength of eggs produced from these hens. Chang *et al.* (1977) reported that urinary Ca excretion increased in rats fed 200-ppm F, resulting in less Ca available for bone formation.

Table. 7. Effect of dietary fluoride and aluminium supplementation onsome blood parameters.

	Treatment		
	Control	1300 ppm F	1300 ppm F+ 1040 ppm Al
Hematocrit, %	29.2 ^{a} ±2.51	25.5^{b}±2.17	26.7 ^{b} ±2.22
Calcium (mg/dl)	21.7 ^{a} ±1.85	14.8 ^{b} ±1.92	22.3 ^{a} ±1.70
Phosphorus (mg/dl)	7.6 ^{a} ±0.57	4.3 ^{b} ±0.49	7.4 ^{a} ±0.54
GOT (U/L)	54.4^{b}±3.16	61.8^{a}±4.00	56.3^{b}±3.65
GPT (U/L)	17.2^{c}±1.30	19.3^{a}±1.22	18.2^{b}±1.70

Means within rows with the same letters are not significantly differ ($P < 0.01$).

Results obtained showed that the laying hens fed a diet added 1300 ppm F had significantly decreased plasma phosphorus as compared to control-fed group. The adverse effect of dietary fluoride level can be demandable by supplying the dietary fluoride with aluminium sulphate supplementation.

With respect to GOT activity, the results obtained showed that the fluoride-fed group was significantly higher in GOT activity as compared with control-fed

group. However, there was no significant difference between control and fluoride plus aluminium-fed groups. Concerning the GPT activity, it could be noticed that the fluoride-fed group was significantly higher in GPT activity as compared with control-fed group. Similar trend was noticed for fluoride plus aluminium-fed groups.

Effects of dietary fluoride plus aluminium supplementation on concentration of fluoride in plasma, liver, kidney and tissue are shown in Table 8. Results showed that the fluoride levels in plasma, liver, kidney and muscles were significantly increased when the 1300 ppm F diet was fed. It could be noticed that the kidney contained more fluoride than the liver or muscles. However, dietary Al tended to reduce the ionic F concentration in plasma. The addition of Al to 1300 ppm diet reduced the fluoride level in muscles , liver and kidney. These results are in agreement with Cakir *et al.*, (1978).

Table 8. plasma, liver, kidney and muscles fluoride content of hens fed dietary fluoride plus aluminium.

	Treatment		
Trait	Control	1300 ppm F	1300 ppm F+ 1040 ppm Al
Plasma	$0.67^{c}\pm0.15$	$2.18^{a}\pm0.16$	
Liver	$4.26^{c}\pm0.21$	$18.67^{a}\pm0.19$	$9.85^{b}\pm0.23$
Kidneys	$3.52^{c}\pm0.18$	$32.15^{a}\pm0.17$	$11.83^{b}\pm0.20$
Muscles	$4.3^{c}\pm0.25$	$6.18^{a}\pm0.28$	$5.30^{b}\pm0.21$

Means within rows with the same letters are not significantly differ($P< 0.01$).

In conclusion, high F intake significantly depressed feed intake, egg production, feed conversion and egg shell quality. However, these depressions were not as severe when Al was supplemented to the diet. The last observation attributed to the dietary Al tended to reduce the ionic F concentration in plasma (Hahn and Guenter, 1986). Also, Aluminium compounds have been the most frequently used alleviators of fluorosis (Cakir *et al.*, 1978). The Mode of action of alleviation has been related to reduction of fluorine absorption. Peters (1971) found increased fecal F excretion with the aluminium supplementation.

REFERENCES

1. Cakir, A., T. Sullivan and F. Mather. 1978. Alleviation of fluorine toxicity in starting turkeys and chicks with aluminum. Poultry Sci., 57:498-505.

2. Chang, Y., O.M. Pan, and T. Varnell. 1977. The effect of fluoride on calcium absorption in rat. Rep. Int., 16:539-547.

3. Decka, R., S. Kacker and G. Shambaugh. 1978. Intestinal absorption of fluoride preparations. Laryngoscope 88:1918-1921.

4. Duncan , D.B. 1955. Multiple range and multiple F test .Biometrics , 11 : 1- 42 .

5. Guenter, W. 1979. Fluorine toxicity and laying hen performance. Poultry Sci., 58:1063. (Abstr).

6. Guenter, W. and P.H.B. Hahn.1986. Fluorine toxicity and laying hen performance.Poult. Sci., 65:769-778.

7. Hahn, P.H.B., and W. Guenter. 1986. Effect of dietary fluoride and aluminum on laying hen performance and fluoride concentration in blood, soft tissue, bone and egg. Poult. Sci., 65:1343-1349.

8. Holland, R. I. 1979. Fluoride inhibition of protein synthesis. Cell Biol. Inter. Rep., 3:701-705.

9. Jacob, K.D. and D.S. Reynolds. 1928. The fluorine content of phosphate rock. J.O.A.C., 11:237-250.

10. Klose, A.A.1980. Fluoride contents of commercially prepared mechanically deboned poultry meat. Poultry Sci., 40:938-944 .

11. Michel, J.N., J.W. Suttie and M.L. Sundie. 1984. Fluorine deposition in bone as related to physiological state. Poultry Sci., 63:1407-1411.

12. National Research Council, NRC. 1994. Nutrient requirements of poultry 9th rev. ed. National Academy of Science , Washington, D.C.

13. Peters, L.H. 1971. The effect of aluminum phosphate on the gastrointestinal absorption of fluoride from diets containing fish protein concentrate or casein. Diss. Abstr. Int. Ser., B31:3844-3845.

14. SAS Institute. 1994. SAS/STAT User's Guide: Statistics. Ver. 6.04, Fourth Edition SAS Institute Inc., Cary, NC.

15. Simon, G. and J.W. Suttie. 1968. Effect of dietary fluoride on food intake and plasma fluoride concentration in the rate. J. Nutr., 96:152-156.

16. Suttie, J.W. 1968. Effect of dietary fluoride on pattern of food intake in the rat and development of a programmed pellet dispenser. J. Nr., 96:529-536.

17. Van Toledo, B., and G.F. Combs, Jr. 1984. Fluoride in the laying hen. Poult. Sci., 63:1543-1552.

معالجة سمية الفلور في الدجاج البياض بإضافة الألومنيوم

مصطفى يوسف عطية[1] ، على زين الدين حسن[2] ، احمد عبد الحميد بسيونى[3] ، علاء الدين محمد عبد المتعال[1]

١ معهد بحوث الإنتاج الحيواني – مركز البحوث الزراعية – وزارة الزراعة – الدقى – جيزة – مصر
٢ كلية الزراعة – جامعة عين شمس
٣ كلية الطب البيطري – جامعة القاهرة

صممت هذه التجربة لدراسة تأثير إضافة الفلور والألومنيوم في العلائق على الأداء الإنتاجي للدجاج البياض. استخدم في هذه الدراسة عدد ١٠٨ دجاجة من سلالة إلهاي لاين الأبيض. تم إسكان هذه الدجاجات في بطاريات سلكية فردية (٤ دجاجة/قفص). قسمت هذه الدجاجات آلي ثلاث مجموعات متساوية. غذيت المجموعة الأولى على عليقه كنترول (خالية من الفلور) وغذيت * على عليقه تحتوى على ١٣٠٠ جزء في المليون فلور بينما غذيت المجموعة الأخيرة على عليقه تحتوى على ١٣٠٠ جزء في المليون فلور بالإضافة آلي ١٠٤٠ جزء في المليون ألومنيوم. وكانت أهم المقاييس المأخوذة وزن الجسم- إنتاج البيض – استهلاك العلف- معامل التحويل الغذائي – جودة البيض- بعض مقاييس الدم.

أوضحت النتائج أن التغذية على مستوى عال من الفلور أدت إلي انخفاض معنوي في وزن الجسم، عدد ووزن وكتلة البيض و استهلاك العلف ومعامل التحويل الغذائى ونسبة الكالسيوم والفوسفور فى بلازما الدم. وقد لوحظ أن إضافة الألومنيوم إلي هذه العليقة المحتوية على الفلور أدى آلي تقليل التأثير السام لعنصر الفلور.

إن استخدام علائق تحتوى على ١٣٠٠ جزء فى المليون فلورأدى إلى زيادة تركيز عنصر الفلور فى بلازما الدم والكبد والكلى والانسجة مع ملاحظة ان تركيزة فى الكلى اعلى من الكبد. وأدى اضافة عنصر الالومنيوم الى هذه العلائق الى تقليل تركيز عنصر الفلور فى بلازما الدم والانسجة والكبد والكلى.