Simultaneous Occurrence Of Neosolaniol In Poultry Feeds With High Incidences Of Decreased In Feed Conversion Efficiency, Weight Gain, Egg Production And Thinner Egg Shell

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Abstract. Two layer hens poultry farms, one in Riyadh (the capital city of Saudi Arabia), and the second one in Tabouk (Northern of Saudi Arabia), showed decreased feed conversion efficiency, weight gain, decreased egg production and thinner egg shell. The feed samples were analyzed for the incidence and levels of 15 mycotoxins including Aflatoxins (B_1, B_2, G_1 and G_2), Sterigmatocystin, ochratoxin A, citrinin, Zearalenone and type A and type B trichothecenes (diacetoxyscirpenol, neosolaniol, HT-2 toxin, T-2 toxin, nivalenol, fusarenon-x, deoxynivalenol). The feed samples were contaminated with neosolaniol (NEO) in concentrations ranged from 6.25 to 200 μg/kg. None of the other mycotoxins were detected. Thus, the presence of NEO in feed consumed by the layer hens caused decreased feed conversion efficiency, weight gain as well as egg production and thinner egg shell.

Key words: Neosolaniol, poultry, feed conversion efficiency, weight gain, egg production, thinner egg shell.

Introduction

Most data now exist to indicate the global scale of contamination of cereal grains and animal feed with *Fusarium* mycotoxins (D'Mello *et al.,* 1998). Of particular importance are trichothecenes, which have been distributed in nature as saprophytes and plant parasites. Their occurrences have been investigated in animal feed and foodstuffs (Al-Julaifi and Al-Falih, 2001), cereal grains and grain products (Ueno, 1977; Greenhalgh *et al.,* 1983,).

Trichothecenes are subdivided into four basic groups, with types A and B being the most important and the most highly toxic members. Type A trichothecenes include, diacetoxyscirpenol (DAS), neosolaniol (NEO), HT-2 toxin and T-2 toxin. Type B includes deoxynivalenol (DON), nivalenol (NIV) and fusarenon - x (F-X) (Stoloff, 1976; Steyn, 1995,). These two types of trichothecenes are produced by *Fusarium* species, although other fungal genera such as *Acremonium* (*Cephalosporium*), *Cylindrocarpon, Cladosporium, Dendrodochium, Myrothecium, Trichoderma, Trichothecium, Stachybotrys* and *Verticimonosporium* also reported to synthesize trichothecene family (Ueno, 1977; Greenhalgh *et al.*, 1983).

Trichothecenes have been indicated in alimentary toxic aleukia (ATA) (Atrochi *et al.*, 1995; Rotter *et al.*, 1996). They have also been implicated in the disease associated with yellow rain involves *Fusarium* species, and the toxins produced include NIV and DON (Ramakrishna *et al.*, 1989). When some cereals infected by these fungi are ingested nausea, vomiting and diarrhea resulted (Smith and Moss, 1985; Wang *et al.*, 1993). Moreover, these two toxins are often found in food commodities and acute symptoms characterized by vomiting, emesis, nausea, refusal of feed, hemorrhage, hematological alterations including leukopenia and anemia, neural disturbance, abortion (Ueno *et al.*, 1973; Sato and Ueno, 1977; Leisttner and Pitt, 1977; Rotter *et al.*, 1995), stachybo-tryotoxicosis, anorexia and alters immune function (Eppley, 1975) are attributed to them. However, as the toxic potential of NIV, DON, HT-2 and T-2 have been indicated as being widely distributed (Hsu et al., 1972, Smalley and Strong, 1974, Ueno, 1983), F-X, DAS and NEO have rarely been reported to occur.

The present work was build when two layer hens poultry farms in two regions in Saudi Arabia showed decrease on feed conversion efficiency, weight gain, decreased egg production and thinner egg shell. Thus, the occurrence of Aflatoxins B_1, B_2, G_1 and G_2, Sterigmatocystin (STR), ochratoxin A (OTA), citrinin (CIT), trichothecenes DON, NIV, F-X, NEO, DAS, HT-2 & T-2 toxins, and Zearalenone (ZEN), were surveyed in order to discover toxins caused the previous problems.

Materials and Methods

Sample Source and Preparation

On the year 2000, two layer hens poultry farms located in Riyadh region (the capital city of Saudi Arabia) and in Tabouk (Northern of Saudi Arabia), showed decrease on feed conversion efficiency, weight gain, decreased egg production and thinner egg shell. Samples of poultry feeds (2 Kg) were collected from the silos and feeders. The samples were finely ground using an Osterizer laboratory mill then thoroughly mixed before taking subsample for analysis.

Aflatoxins, Sterigmatocystin and Zearalenone analysis

The toxins from the feed samples were extracted by the BF method (Richard *et al.*, 1993; AOAC, 1995; Krska, 1998). Subsamples (25 g) were extracted into acetonitrile-water (9:1 vol/vol) then cleaned up using Romer Lab MycoSep column no. C224 (Romer Lab., Inc., Union, MO, USA). The solvents were evaporated and the residue taken up in 300 µl of toluene–acetonitrile (97:3 vol/vol) then carried out on SG-60 A TLC plates.

Ochratoxin A and Citrinin analysis

The methods of Gimeno (1984) and Dunne *et al.* (1993) with some modifications were used for OTA and CIT analysis. Twenty five grams of the samples were extracted with methylene chloride plus 12.5 ml of orthophosphoric acid (0.1%). The filtrates were passed through Romer Lab MycoSep column no. C212. The column was flushed with 20 ml methylene chloride-formic acid (99:1 vol/vol) and the eluent collected was evaporated to dryness. The residue was re-dissolved in 500 µl of toluene-acetic acid (99:1 vol/vol) then analyzed by SG-60 A TLC plates.

Trichothecenes analysis

The trichothecenes were extracted and determined as described by Al-Julaifi and Al-Falih (2001). The Romer Lab MycoSep column no. C224 or no. C225 and no. C216 were used for cleaning-up the extracts. Type B (F-X, DON & NIV) were analyzed using SG-60 A TLC plates and Reversed Phase C-18 TLC plates were used for *type A (NEO, DAS, HT-2 & T-2 toxin).*

The identity and amount of positive samples were confirmed by High-performance liquid chromatography (HPLC) using HP 1100 system (Al-Julaifi and Al-Falih, 2001).

Results and Discussion

The occurrence of fifteen mycotoxins were studied where high incidence of decrease on feed conversion efficiency, weight gain, decreased egg production and thinner egg shell have been reported on two layer hens poultry farms in Saudi Arabia. The poultry feeds samples collected from the silos and feeders were analyzed for AFS (B_1, B_2, G_1 and G_2), STR, OTA, CIT, DON, NIV, F-X, NEO, DAS, HT-2, T-2 toxins, and ZEN. All samples analyzed were found to be uncontaminated by mycotoxins except for one *Fusarium* toxins. NEO was the only mycotoxins detected in the range of 6.25 to 200 µg/kg in 100% of feed samples.

Since the layer hens were daily fed with this type of contaminated feeds, this meen that the poults were in died with the NEO toxin. Thus, symptoms occurred on layer hens including weight gain, decreased feed conversion efficiency, decreased egg production and thinner egg were associated with consumption of NEO contaminated feeds contained 6.25 to 200 µg/kg. These conditions are similar to aflatoxins and trichothecenes intoxication. Vesonder et al. (1979) attributed feed refusal, vomiting and emetic factors due to contamination of feeds by the trichothecenes toxin deoxynivalenol (DON). Moreover, Vesonder *et al.* (1973) and Wyatt (1979) supported this views by thier observations on feed contained DON and T-2 toxin fermented with specified strains of *F. culmorum*, *F. poae*, *F. moniliforme* or *F. nivale*. Conditions of decreased feed conversion efficiency and weight gain were reported on turkey poults due to consuming rations containing *Fusarium tricinctum* invaded maize (Christensen *et al.*, 1972). Similar effects are produced by diets containing wheat inoculated with *F. poae* and *F. sporotrichioides* (Joffe and Yagen, 1978). Most of these species are NEO metabolites producing fungi. Wyatt *et al.* (1975) pointed out that decreased egg production and thinner egg shells in layers follow exposure to T-2 toxin. Fumonisins and Moniliformin, as groups of mycotoxins produced from various species of *Fusarium*, were found to reduce final body weight, weight gain, feed consumption and feed efficiency (Harvey et al., 2002). The NEO as one of the type A members of the trichothecene group of compounds involved, is a *Fusarium* metabolite. No adequate data for the toxicity of NEO on animal and human are avilable. Ueno et al. (1973) reported the toxicity of *F. lateritium* (Strains 5013 and K.5036) and *F. oxysporum* (Strains 11.6 and ii .7) extracts to mice where it caused radiomimetic pathological changes. They found that these strains were able to produce five trichothecenes, i.e., diacetoxyscirpenol, diacetylnivalenol, neosolaniol and two new trichothecenes, 7-hydroxydiacetoxyscirpenol and 7,8-dihydroxydiace-toxyscirpenol.

In conclusion, as the average of feed chicken daily consumed is 100 g per bird, this means consuming a concentration of about 10.3 µg NEO per day. The individuals chicken in the farm consuming about 1586 µg of NEO before starting the period of egg production. And because no information is available on the cumulative effects of NEO on poultry health, so from the results obtained in this study, it appears that more attentions should be highlights on NEO effects in both human and animal. Moreover, the regulation of neosolaniol levels in poultry feeds requires attention by regulatory organizations of governments.

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تزامن ظهور سم النيوسولانيول في أعلاف الدواجن مع حدة في إنخفاض كفاءة التحول الغذائي، إنخفاض في زيادة الوزن، إنخفاض في كمية إنتاج البيض و ضعف في قشرة البيض

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الملخص: أظهرت مزرعتين للدجاج البياض، إحداهما في الرياض و الأخرى في تبوك، بعض الأعراض المرضية على الطيور منها إنخفاض في كفاءة التحول الغذائي، إنخفاض في زيادة الوزن، إنخفاض في كمية إنتاج البيض مع ضعف في قشرة البيض. و لإرتباط تلك الأعراض ببعض السموم الفطرية، فقد تم تحليل عينات من الأعلاف المستخدمة في تغذية الطيور للكشف عن إمكانية تواجد بعض السموم الفطرية (١٥ سم فطري) منها الأفلاتوكسينات (ب١، ب٢، ج١ و ج٢) الستريجماتوسستين، الأوكراتوكسين أ، السترينين، الزيرالينون، و الأنواع أ و ب من التريكوثيسينات (داي أسيتوكسي سكيربينول، نيوسولانيول، سم إتش تي تو، سم تي تو، النيفالينول، فيوزارينون إكس و الديوكسي نيفالينول.

و قد بينت النتائج تلوث عينات الأعلاف المفحوصة بسم النيوسولانيول بتراكيز تراوحت بين ٦,٢٥ إلى ٢٠٠ ميكروجرام/كجم. لم تكشف نتائج التحليل عن وجود أي تركيز من بقية السموم الفطرية الأخرى.

يتضح من هذه الدراسة أن السم الفطري النيوسولانيول يمكن أن يظهر بعض الأعراض المرضية المتمثلة في إنخفاض كفاءة التحول الغذائي، إنخفاض في زيادة الوزن، إنخفاض في كمية إنتاج البيض مع ضعف في قشرة البيض مثله مثل بقية السموم الفطرية الشائعة.