The effect of high and low doses of ochratoxin A in feed on growing chicken

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Abstract

Effects of high and low dose of ochratoxin A (OTA) as pure toxin supplemented to feed were investigated on the performance of growing chicken. Two groups were fed with different doses of chemical pure OTA 0.5 ppm and 5 ppm in feed and the effects of toxin on body and organ weights were studied and compared with control group. No effects were observed by feeding 0.5 ppm OTA, whereas 5 ppm had a negative effect on the daily body mass gain. OTA in feed had a negative effect on the daily body mass gain. In contrary nephrotoxic effects could be observed by feeding the naturally OTA contaminated feed with only 0.2 ppm of OTA produced by Penicillium verrucosum.

Introduction

Ochratoxin A (OTA) is a toxic secondary metabolite produced by different species of Aspergillus and Penicillium. Different plant tissues and agricultural commodities has been reported to be contaminated world wide with OTA. The OTA producing species have been found especially in plants with high starch concentrations. But OTA also could be found in peas, sun flower, kernels, peanuts, cotton seeds as well as in hey, coffee, wine, beer and paprika (1,2,7). OTA was determined in different organs and tissues of husbandry animals. Especially an increased accumulation of OTA in blood and kidney could be observed. Within the food chain OTA seems to be a risk for people if contaminated inner organs are consumed. In our previous work we could show a correlation between the concentration of added OTA to broiler feed and the negative effects of OTA on the chicken performance (3). A negative effect on body conditions could be observed by feeding the animals with naturally contaminated
*Penicillium verrucosum* wheat at a rate of 60% and a concentration of 0.2 ppm OTA. The aim of the present study was to investigate the effects of high (5 ppm) and low (0.5 ppm) concentrations of pure chemical OTA on growing chicken in parameters such as body mass, feed intake, feed conversion, daily weight gain, water consumption, feces mass, mass of several inner organs, pathohistological section for nephrotoxicity and residues of OTA in feces, kidneys, livers and blood plasma.

**Material and Methods**

Chemical pure OTA standard, purchased from Sigma (USA) was dissolved in ethanol (96%) and added to the feed. The feed was then mixed well in order to homogenise. A commercial feed for growing chicken was used (Agra Tagger AG, Graz). Chicken were purchased as male layer hybrids Lohmann Brown (hatchery Schropper, Schottwien). The weight of animals were determined daily. At the end of three weeks trial, patho-anatomic and histological examination of the birds were carried out and blood and organs were taken for further HPLC analysis. OTA was determined in feed, blood, kidney, liver and faeces. The kidneys were prepared in formalin solution for preservation, and were then pathohistologically examined. The statistical interpretation were carried out by applying analysis of variance. Groups of 10 animals were housed in temperature controlled cages. Water and feed were given ad libitum. 1<sup>st</sup> group: negative control group without OTA in commercial mixed feed. 2<sup>nd</sup> group: positive group fed with 0.5 ppm pure OTA spiked feed. 3<sup>rd</sup> group: positive group fed with 5 ppm pure OTA spiked feed.

**Analytical procedure**

The mycotoxin extraction were carried out by using immunoaffinity columns Ochraprep® (Rhone Diagnostics, UK). The HPLC analysis were performed using an isocratic HPLC and fluorescence detection. HPLC system consists of Merck-Hitachi L-7100 pump, L-2750 autosampler and L-7480 fluorescence detector (Darmstadt, Germany). The mobile phase consisted of acetonitrile-2% acetic acid (70:30, v/v) with a LiChrospher 100 RP-18 column (250 x 4mm, 5μm).

**Results and Discussion**

Data are shown in Tables 1-4. As can be seen in Tab. 1 the body weights in 5 ppm group were significantly reduced at the end of trial. Tremendous depressing effect could be observed in the body weight gain. The feed intake as well as feed conversion ratios were negatively influenced by high OTA level throughout the experiments. Table 2 shows significantly increased relative organ masses in group 3 for kidneys. As it can be seen in Table 3 residues of OTA in kidney, liver and plasma as well as in feces were recorded in both toxin supplemented groups. Table 4 shows pathological effect of OTA. Specially in group 3 severe abnormalities were microscopically revealed. In contrast to our expectations we could observe no negative effects on animals if fed with 0.5 ppm pure OTA. After animals were fed with a higher concentration of pure OTA standard (5 ppm) effects on growth, feed intake and pathological deformations were observed in our experiments. In an earlier work we