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Ionophore (Salinomycin) Toxicosis in Adult Turkeys: A Case Report

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Abstract

Turkey production in Nigeria and Africa at large has been influenced by many factors, some of which include diseases, intense climatic changes and scarcity of feed stuffs. Ionophore antibiotics are commonly used as feed additives for the prevention of coccidiosis in poultry. This case report is on ionophore poisoning in adult turkeys. A complaint of possible ionophore poisoning in a turkey flock of 119 was received at the University of Nigeria Veterinary Teaching Hospital (UNVTH) Nsukka, Nigeria. Dead turkeys were presented. History was taken and post mortem examination of dead turkeys was done following standard procedures. Tissue samples were collected for further bacteriology and histopathology investigation. The farm was also visited and it was observed that the feed given to the turkeys bore a label showing that it contains the ionophore, Salinomycin (Bio-Cox®). The population of the affected birds comprised 48 fully mature adults, 41 young adults and 18 poults. Clinical signs observed in affected adult turkeys were incoordination, leg weakness, abnormal gait, inability to stand, ruffled feathers, diarrhoea, paralysis and death. Necropsy findings included hydropericardium, multifocal areas of necrosis in the liver, haemorrhagic intestinal ulcers, egg peritonitis and atrophy of the spleen. Histopathology revealed degenerative changes in the liver parenchyma and necrosis of the liver hepatocytes. In the kidney the proximal and distal tubules were swollen with the epithelium appearing necrotic. Bacteriological culture as well as parasitological examinations showed no microbial growth and no parasites. Ionophore poisoning was suspected based on history, clinical signs, necropsy findings, and confirmed based on the observation of immediate recovery of the affected adult turkeys following withdrawal of the offending ionophore containing feed and introduction of new brand feed that did not contain ionophore antibiotics.

Keywords: Ionophore toxicosis; Salinomycin; Poisoning; Turkeys; Pathology.

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Introduction

Ionophores are a class of compounds that form complexes with specific ions and facilitate their transport across cell membranes (Freedman, 2012; Novilla *et al*., 2017). They are commonly used as feed additives that enhance growth and feed efficiency, and which also prevents/control rumen acidosis, fog fever and coccidiosis in ruminants and poultry (Novilla *et al*., 2017; Diaz *et al.,* 2018; Pugh *et al*., 2020). Ionophores have been commonly used to manage coccidiosis for over two decades. Some ionophores have both anti-coccidial and anti-bacterial effects, and have been used extensively in poultry and ruminant feeds (Richard and Labar, 2008). Earlier reports has shown that coccidiosis can be prevented and treated by extensive administration of ionophores such as salinomycin, lasalocid, monensin, narasin and maduramicin (Lindsay and Blagburn, 2001; Pugh *et al*., 2020). The safety margin of ionophores is usually narrow and difficulty in ensuring its even distribution in the feed is usually encountered (Pugh *et al*., 2020).

Coccidiosis has been a health problem in the poultry industry especially in intensive poultry production worldwide. Like other parasitic diseases; it affects young birds more because the immunity only develops following infection which then protects the birds against later exposures (Saif, 2008). In coccidiosis, cross immunity does not occur between Eimeria species in birds and further outbreak can occur as a result of other species; therefore medication for the disease is required continuously (Martin *et al.,* 2022). Most cases of coccidiosis are relatively mild though most young birds receive prophylactic medication with unsubstantial level of anti-coccidial medication with the view of preventing disastrous outbreaks that can result to heavy economic losses (McDougald and Fitz-Coy, 2008). Three possible approaches have been used in controlling coccidiosis; sanitation, chemotherapy and immunological methods (Long, 1984). Chemotherapeutic drugs ideally should not have any adverse effects on either growth or feed intake of the birds, and should have protective effects against all important species of Eimeria and present no residues in meat (Laurie, 1992). Coccidiosis can be prevented and treated by extensive administration of ionophore antibiotics such as salinomycin, lasolocid, monensin, narasin, and meduramicin. Salinomycin has been reported to cause severe health and production problem in poultry especially in turkeys (Lindsay and Blagburn, 2001).

The toxic effect of ionophores usually occurs in association with dehydration consequent upon diarrhoea or water deprivation. Toxicity of ionophores varies with species and age. It has been reported that adult birds are more susceptible, particularly adult turkeys which are usually more severely affected than broilers (Hoop, 1998). The toxic effects of ionophores have been attributed to their ability to initiate the movement of potassium out of cells and calcium penetration to cells, mainly myocytes, leading to death of the cells. Reports of ionophore toxicity in turkeys in Nigeria is scarce. The present article reports a case of ionophore toxicosis in adult turkeys fed with grower's mash containing the ionophore antibiotic, salinomycin.

Case Report

Primary Complaint: Five dead turkeys were brought to the Veterinary Teaching Hospital, University of Nigeria, Nsukka (VTH, UNN), Enugu State, Nigeria, with a primary complaint of turkeys dying 72 hours after introduction of a new brand of grower mash. On the same day, one full mature female turkey in a concrete pen was found dead by the midday without prior signs of ill-health. Over the next day 18 hours later, two more adult females died within the concrete pens while one male

and five females died in the outside (chain-fenced) enclosure. About eight others were showing clinical signs of different degrees of leg weakness, paralysis and huddling together. All the turkeys were in very good condition without signs of respiratory or enteric abnormality. Those that died were in good body condition, and either while running or lying down suddenly collapsed, or were unable to move the hind limb, which were usually stretched backward.

Flock History: The affected turkey flock were reared in semi- intensive system whereby the birds were either completely inside the pen where they were provided with feed or water or in a chain-fenced enclosure where they receive feed and water while moving around to pick grasses. They were de-wormed and routinely vaccinated against Newcastle disease and fowl pox. The population of the turkeys flock was 119 while the affected turkeys were 107 comprising 48 fully mature adults, 41 young adults and 18 poults. While the young adults and adults were fed grower mash, the poults were fed broiler starter. Clean drinking water was provided *ad libitum* for both the adult and young birds. It was observed that the brand of feed used in the farm bore a label showing that it contains the ionophore Salinomycin (Bio-Cox®).

Clinical findings: On the farm one full mature female turkey in a concrete pen was found dead by the midday without prior sign of ill-health. Over the next day 18 hours later two more adult females died within the concrete pens while one male and five females died in the outside (chain- fenced) enclosure. About eight others were showing clinical signs of different degrees of leg weakness, paralysis and huddling together (Figures 1 and 2). All the turkeys were in very good condition without signs of respiratory or enteric abnormality. Those that died were in good body condition, and either while running or lying down suddenly collapsed, or were unable to move the hind limb, which were usually stretched backward. It is noteworthy that mortality was recorded only in the adults, while none of the young adults taking the same grower feed showed any sign of ill-health.

Figure 1: Turkeys suspected to be poisoned with ionophore salinomycin, showing paralysis and clustering together.

Figure 2: Dead turkeys in a flock suspected to be poisoned with the ionophore, salinomycin.

Post mortem examination: Some of the dead turkeys were necropsied. The necropsy findings included egg peritonitis, hydropericardium (Figure 3), multifocal areas of necrosis in the liver (Figure 4) and atrophy of the spleen.

The lungs, liver and kidney were harvested and fixed in 10% formal saline. The fixed tissues were trimmed after 48 hours,

dehydrated using graded levels of ethanol, embedded in molten paraffin wax and sectioned into 5 micron (µm) using microtome sectioning machine. The thin sections of 5 µm thick were stained with hematoxylin and eosin (H & E) as earlier described by Drury and Wellington, (1976) and Survarna, *et al.* (2018), and studied using a microscope. Histopathological lesions observed were degenerative changes in the parenchyma of the liver. There was also necrosis of the liver hepatocytes (Figure 5). In the kidney the proximal and distal tubules were swollen with the epithelium appearing necrotic (Figure 6). The kidney tubules were also congested. Sections of the lungs showed areas of infiltration of lymphocytic cells in interstitial space of the alveoli (Figure 7).

Figure 3: Carcass of turkey suspected to have been poisoned with the ionophore salinomycin, showing hydropericadium (arrowed).

Sample Collection and further Laboratory Examination

Serology: Blood samples were collected from ten (10) surviving birds using plain sterile bottles. The blood was allowed to clot and the sera were aspirated and stored at -20^{o}C for detection of antibody against Newcastle disease virus (NDV). NDV haemaglutination inhibition (HI) antibody quantification was done using haemaglutination (HA) and haemaglutiation inhibition (HI) tests. The antigen used for the HI was a phosphate buffered saline (PBS) suspension of LaSota vaccine which had 4 HA units. The HA and HI tests were done following the method of OIE (2012). The serology examination was negative of Newcastle disease virus.

Figure 4: Carcass of turkey suspected to have been poisoned with the ionophore salinomycin, showing enlargement of the liver and multifocal areas of necrosis on the liver (arrowed).

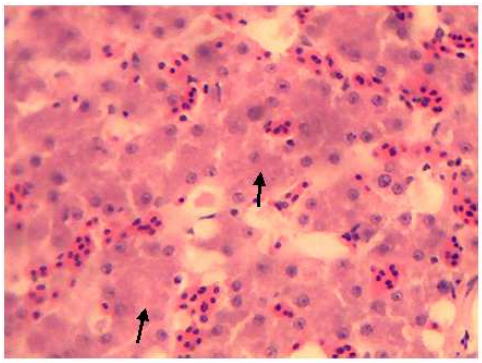

Figure 5: Photomicrograph of section of the liver of turkey suspected of having been poisoned with the ionophore salinomycin, showing degeneration and necrosis (arrowed) in the parenchyma of the liver, [H & E, × 400].

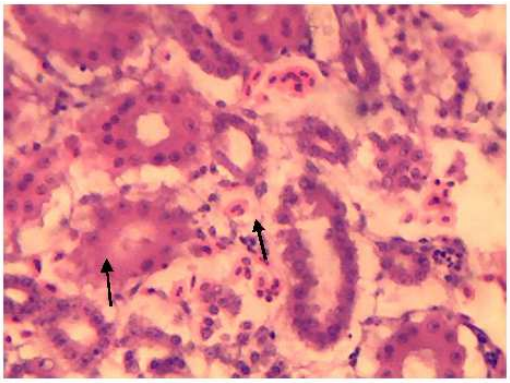

Figure 6: Photomicrograph of section of kidney of turkey suspected of having been poisoned with the ionophore salinomycin, showing necrosis of the tubular epithelial cells (arrowed), [H & E, × 400].

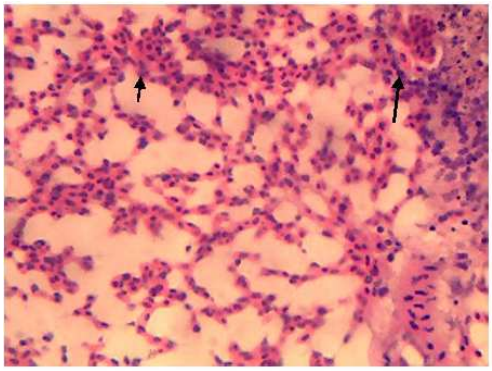

Figure 7: Photomicrograph of section of the lung of turkey suspected of having been poisoned with the ionophore salinomycin, showing area of infiltration of lymphocytic cells in interstitial space (arrowed), [H & E, × 400].

Bacteriological and parasitological examination: Organs such as liver, spleen, kidneys, heart and lung were collected for routine bacteriological examination and were cultured in blood and MacConkey agar and incubated for 24 hours at 37^0C. The bacteriological media used were prepared following their respective manufacturer's instructions. Portions of intestines were examined for helminth ova and protozoa. The bacteriological culture showed no growth and parasitological examination tests were negative for any known important parasite.

Treatment

Multivitamin and antibiotic (Vitalyte and Neodoxynor®, Kumasi Ghana) were initially given to the turkey flock in drinking water. The clinically affected birds were kept separate in another pen and provided with a new brand of grower mash from another source which was ionophore free.

The clinical signs earlier observed ceased immediately following the introduction of new brand of grower's mash that was ionophore-free. Within two weeks of change of brand of feed, all the turkeys that showed clinical signs regained their health and were re-introduced into their general pens.

Discussion

Ionophore toxicity is often fatal and usually occurs as a result of accidental treatment or abuse of some ionophores, and this has been reported in several species of animals including dogs, cats, sheep, cattle, quail, chicken, ostrich and horses (Linde-Sipman *et al.,* 1999; Bila *et al.,* 2001; Agaoglu *et al.,* 2002; Konstantinos *et al.,* 2013). All recorded cases of poisoning with ionophores involved inappropriate use of anti-coccidial ionophore or growth promoters. The toxicity of a variety of chemotherapeutic agents in poultry and pigeons has been reviewed (Reece, 1985; Reece *et al.,* 1988).

A diagnosis of ionophore poisoning in birds can be done based on flock history, clinical signs, pathological lesions and pattern of recovery. The clinic-pathologic features of ionophore poisoning in turkey are not pathognomonic and may sometimes resemble those of Newcastle disease virus infection. It had earlier been reported that low doses of ionophore can be toxic to turkeys especially adult turkeys (Potter *et al.,* 1986; Ficken *et al.,* 1989). It has further been reported that some ionophores such as salinomycin has been used

in broilers worldwide for many years but its accidental use in turkeys has caused major health problems (Halvorson, 1982; Van Assen, 2006).

The findings from this outbreak concurred with earlier reports which showed that ionophore poisoning could severely affect the health status of point of lay and breeder turkeys as well (Griffiths *et al*., 1989; Andreasen and Schleifer, 1995). The clinical signs recorded in the present case report which includes drop in feed intake, inability to move, paralysis and death were similar to clinical signs reported by Konstantion *et al.* (2013) who also found out that older turkeys were more susceptible to ionophores poisoning when compared to younger ones. This is thought to be as a result of the physiological changes peculiar to older and fully matured birds. The gross lesions recorded in this case report, such as egg peritonitis, liver degeneration, hydropericardium also agree with the earlier reports of Wagner *et al.* (1983) and Konstantion *et al.* (2013).

The present case report highlights the potential hazard that salinomycin ionophore constitutes to adult turkeys, and that withdrawal of the offending feed was able to lead to recovery of affected turkeys. This information is considered useful and important for veterinarians and poultry farmers.

Conflict of Interest

The authors declare no conflict of interest with respect to the research, authorship and publication of this article.

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