



ORIGINAL ARTICLE

Oral administration of bismuth in broilers: Evaluation of clinical signs, Carcass lesions, pathology and serology

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ABSTRACT

Bismuth has been found to be effective against clostridium perfringens and cecal campylobacter jejuni in Broilers. Although increasing consumption and production of bismuth is predicted, there is no information about the direct toxic effect of this metal in broilers. For this purpose Ross broiler experiment chicks received two concentration of bismuth in their water and control group received water without bismuth. At the end, blood samples collected for serological evaluation and the chickens were then euthanized and samples from brain, kidneys, gastrointestinal tract, heart and liver were collected for histopathological studies. Gross and microscopic lesions in organs were evaluated. Gross evaluation showed the chickens of the control group remained healthy and active throughout the experiment, but those in the experimental group were lethargic and drowsy and some of them started to perish about two weeks after receiving bismuth. Also Black stool was seen in bismuth received chicks. Serological assessment showed that the Serum Glutamate Pyruvate Transaminase, Serum Glutamate Oxaloacetate Transaminase and Uric acid values didn't significantly alter among the experimented and control groups. Microscopic evaluation revealed that no pathological changes were noticed on the vital organs; Liver, kidneys, heart, brain and gastrointestinal tract of chickens of the control and all treated groups. So adding of bismuth to diet of broilers in order to prevention of bacteria colonization, even in three fold concentration, doesn't affect broiler health.

Keywords: Bismuth, broilers, clinical signs, pathology, serology

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INTRODUCTION

Bismuth which is located next to lead in the periodic table, is a rare metal found in the earth's crust and is one of the least toxic of the heavy metals however intoxication has occurred from its use in medicine (7&3). It has been used for more than 300 year for the treatment of various gastrointestinal disorders (3), however therapeutic bismuth compounds are now being marred by episodes of serious adverse reactions (3). Recently bismuth compounds is found to be effective against Campylobacter jejuni in Broilers (4). Besides, it has been demonstrated to reduce cecal colonization in broilers (4). Accumulation of high concentration of heavy metals may eventuate to pathological and physiological dysfunction of organs and the toxic effect of bismuth consumption in human and laboratory animals have been known (17). Although increasing consumption and production of bismuth is predicted, but to our knowledge there is no information about the direct toxic effect of this metal in broilers. So the objective of this study was to determine the pathological and clinicopathological effects of experimental administration of bismuth in broiler chicks.

MATERIALS AND MTHODS

Thirty one day old Ross broiler chickens from both sexes were purchased from a local hatchery and were kept at $30\pm 1^{\circ}\text{C}$, 40-50% humidity, controlled electrical heating batteries and at 12/12h light-dark cycle. They were maintained as a flock and were provided with commercial diet and water ad-libitum. After 20 days they were randomly divided into three group; A, B and C. The chickens of the experimental group B and C received daily 250 and 750 ppm bismuth respectively in their water, for 20 days, which was calculated on the base of the previous studies and our previous experiences. The animals of the control group (A) received water without bismuth. The animals of the control group received water without Bismuth. At the end of the experiment, blood samples were collected for chemical analyses of the Serum Glutamic Oxaloacetic Transaminase (SGOT), Serum Glutamic Pyrovic Transaminase (SGPT) enzymes and uric acid. The animals were then euthanized and all organs were carefully examined and samples from brain, kidneys, gastrointestinal tract, heart and liver were collected for histopathological examination. After fixation in 10% neutral buffered formalin, the tissue samples were washed, dehydrated by graded ethanol, cleared, embedded in paraffin wax, sectioned at $4\text{-}5\ \mu\text{m}$, stained with haematoxylin and eosin and examined by a light microscope (Olympus, Tokyo, Japan).

RESULTS

Signs and symptoms:

Gross evaluation showed the chickens of the control group remained healthy and active throughout the experiment, but those in the experimental group were lethargic and drowsy and some of them started to perish about two weeks after receiving bismuth. Also Black stool was seen in bismuth received chicks (Fig 1).

Serological analysis:

Statistical analysis of the serum SGOT, SGPT and Uric acid between the bismuth treated and control groups was done by the one way ANOVA test. The SGPT and SGOT values in bismuth received groups increased in a dose dependent manner, however they were not significant. Furthermore in contrast to control group, Uric acid level didn't alter significantly ($P>0.05$). The results are shown in Table 1.

Microscopic evaluation:

Microscopic evaluation revealed that no pathological changes were noticed on the vital organs; liver, kidneys, heart, brain of chickens of the control and all treated groups (Fig 1).

Table 1. Effect of Bismuth on serum SGPT, SGOT and Uric acid

	SGPT (u/l)	SGOT (u/l)	Uric acid (mg/dl)
Control	12 ± 0.31	238.80 ± 15.04	4.28 ± 0.47
Bismuth (250 ppm)	12.12 ± 0.15	216.19 ± 9	4.70 ± 0.25
Bismuth (750 ppm)	12.76 ± 0.67	263.36 ± 33.34	4.52 ± 0.19

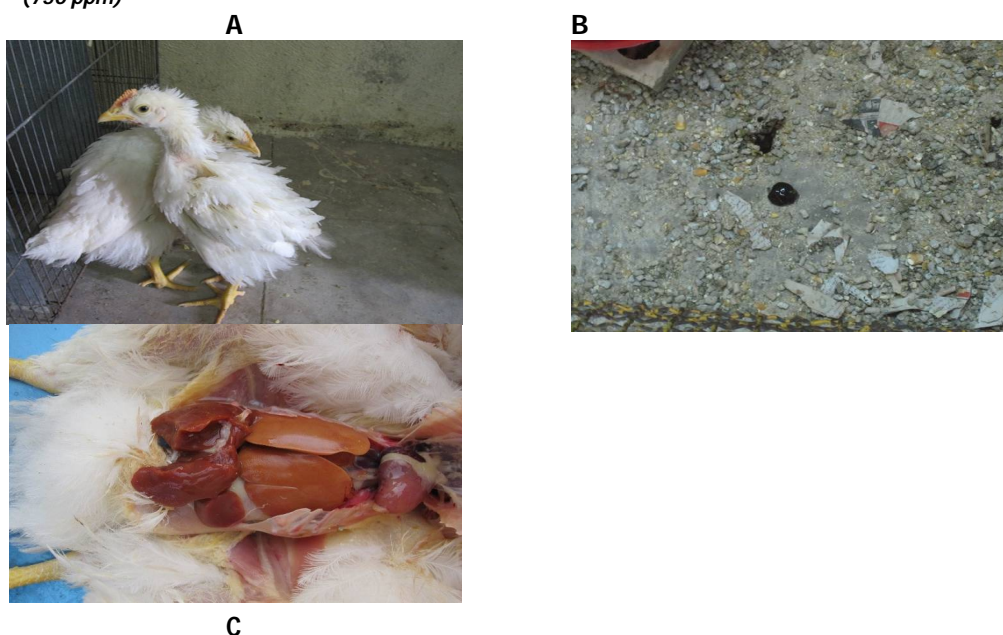


Fig 1:(a): Ruffled feather, (b): Black stool, (c): Gross view.

DISCUSSION

Research analyzing alternative methods to reduce the onset of clostridium perfringens induced necrotic enteritis and campylobacter jejuni in poultry has recently increased due to the concern of consumers regarding antimicrobial drug use in poultry and the perceived risk of drug resistance in humans (1). Even though probiotics have been used with some success to reduce campylobacter contamination in poultry, the protection has been reported to be inconsistent (11). So bismuth was selected instead of conventional antibiotics and probiotics for prevention of pathogenic bacteria colonization. Also it has antibacterial properties to pathogenic bacteria such as Escherichia coli, and Salmonella (10 & 13). Furthermore it has been shown to decrease mucin viscosity, prevent bacterial digestion of mucus, and reduce adherence of bacteria to gastric epithelium (16).

Results from this study indicate that none of bismuth receiving groups showed any macroscopic and microscopic lesion, however it would appear that bismuth salts, when taken in sufficient doses and for sufficiently prolonged periods, may lead to a range of toxicities, most notably encephalopathy and nephrotoxicity. Opposed to our findings, both human and laboratory animals have shown hepatic, renal, and neurotoxicity following bismuth exposure (3 & 12). In contrast to our finding, a number of animal studies have shown that bismuth salts induce congestion and fatty degeneration of the liver (2, 14, 6). Bismuth can produce neurotoxic effects in both humans and animals under certain dosing conditions. Ross et al. (1988) showed that bismuth levels above 50 ppb in blood could cause encephalopathy in humans. An extensive study of bismuth-induced damage in animals has also been reported by Kolmer et al. (5) who classified the damage into distinct grades. Demonstrated that when bismuth is absorbed, it leads to kidney, liver and central nervous system toxicity. Kidney damage was observed in rats receiving a single intramuscular injection of different bismuth compounds. In previous studies, birds were either fed 0, 50, or 200 ppm bismuth for 10 or 21 days and 200 ppm of either compound provided a consistent, albeit small, reduction in cecal Campylobacter colonization in chickens, so accordingly our dose and time of exposure were chosen.

In conclusion we declare that adding of bismuth to diet of broilers in order to prevention or treatment of bacteria colonization, even in three fold concentration, doesn't affect broiler health.

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