

Toxicological Effects of Neem Seed Oil and Neem Seed Kernel Water Extract (Azadirachta Indicia) on Broiler Chickens in Khartoum State, Sudan

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Abstract

Aim and Background: Neem tree is a medicinal plant having anti-coccidian effect in broilers and it is used as a pesticide and acaricide. Based on these facts this study aims to detect the toxicological effect of the Neem seed oil and Neem water extract on broiler chickens.

Material and Methods: Forty Bovan chicks were housed within the premises of the Veterinary Laboratories at Soba. At the age of 30 days they were grouped into 8 groups. The groups were used for feeding (Neem seed powder) and dipping (Neem seed oil and Neem water extract) tests with two concentrations of Neem seed powder, Neem seed oil and Neem water extract (0.0, 0.5% and 15%) for one-week period. The average weight of the chicks before and after feeding and dipping was recorded. Then chicks were slaughtered a week after feeding and dipping. Specimens from the liver, kidney and brain were fixed in 10% formalin for Histopathological examination.

Results: The gain in weight for the control group was 0.241 grams for a week's time while the gain in weight for chicks fed on 0.5% Neem seed powder was 0.417 grams and 0.945 grams for that fed on 15% Neem seed powder. The groups fed or dipped in Neem seed powder, Neem oil and Neem seed kernel water extract perform no clinical signs or post-mortem changes in chick's internal organs (liver, kidney and brain); however, some Histopathological changes seen may be reversible. The severity of these Histopathological changes were less when compared with those induced by chemical pesticides. Conclusion: The Neem seed kernel powder fed to chicks increase the body weight as the concentration increase. Neem oil and Neem seed kernel water extracts induce no clinical signs or post-mortem changes in chick's internal organs (liver, kidney and brain) when fed or dipped with different concentrations.

Keywords: Bovan Chicks; Dipping; Feeding; Histopathology; Neem Oil and Neem Water Extract

Introduction

The Neem tree *Azadirachta indica* is widely grown in Sudan for shade and as avenue tree. The tree is an indigenous tropical, predominate plant in Sudan. It is considered as a medicinal plant having anti-coccidian effect in broilers and it is used as a pesticide and acaricide [1-5]. Poultry feed should provide proteins, carbohydrates, fats, minerals and vitamins. Incomplete and unbalanced diets often result in nutritional diseases. Neem oil which is rich in fats acts as a substitute in poultry feed [6]. Neem products are generally recognized safe to mammalian species. The Neem leaf powder was added to poultry mash in order to increase weight of the chicks and egg production [7].

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The aim of this study was to evaluate the toxicity of Neem products through feeding and dipping of Bovan broiler chicks in comparison to synthetic anti- helminthic and acaricide.

Material and Methods

Experimental design

Forty-one-day old Bovan chicks were housed within the premises of the Veterinary Research Laboratories at Soba (Khartoum, Sudan). Food and water were provided ad libitum. The cages were in an open system. Light was day light and artificial at night. Pens dimensions were standard. At the age of 30 days the chicks were divided at random into 8 groups each of 5. Group one were fed on a balanced starter ration and served as controls. Group two was fed on Neem seed powder added to the ration to give a total dietary concentration of 0.5%. Group three was fed on Neem seed powder added to the ration to give a total dietary concentration of 15%. Checks were fed on these concentrations for a week time. Groups four, five, six, seven and eight were fed on a balanced starter ration for a week time. Group four were dipped in 0.5% Neem oil for 10 min. while group five were dipped in 15% Neem oil for 10 min. also, twice in a week interval. Group six and seven were dipped in 0.5% and 15% Neem seed water extract respectively. Group eight (control) were dipped in distilled water mixed with 15% Tween-20.

Growth parameters

The average weight of the chicks before and after feeding was recorded. The average weight of the chicks before and after dipping was also recorded.

Samples collection

Chicks were slaughtered a week after feeding. Specimens from the liver, kidney and brain were taken and fixed in 10% formalin. A week after dipping chicks were slaughtered. Specimens from the liver, kidney and brain were taken and fixed in 10% formalin.

Histopathological study

The tissue samples were then processed for histological procedures and stained with Hematoxylin and Eosin (H and E) [8]. The slides were photographed using light microscope with X40 magnification.

Results

The weights of the chicks increase with the increasing of the neem powder concentration. For the control the gained body weight was 0.417 while that of 15% neem powder concentration was 0.945. The total results before and after feeding indicates that the increasing in weight gained was concentration dependent (Table 1).

Con.% of Neem Seed Powder	Initial Body Weight (Kg)	Average Weight of Chicks After Feeding (Kg)	Weight Gained (Kg)
0.0	0.758	1.175	0.417
0.5	0.071	1.212	0.241
15	0.821	1.766	0.945

Table 1: The effect of feeding on chicks with Neem seed powder.

The post-mortem examination showed no changes in the internal organs. Histopathological changes in liver cells of chicks fed on 0.5% and 15% of Neem seed kernel powder vary from haemorrhage and/ or congestion to liver cell degeneration, parenchyma degeneration and cell infiltration. There is also haemosiderosis (Figure 1 to 6).

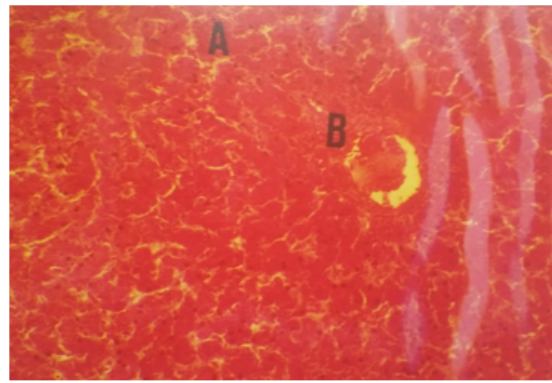


Figure 1: Liver cells of chicks fed on seed kernel powder. .Note haemosiderosis A and cell degeneration and infiltration B.

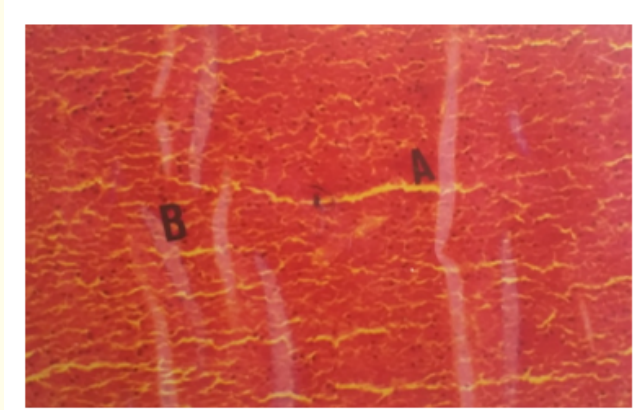


Figure 2: Liver cells of chicks fed on seed kernel powder. .Note haemorrhage A and haemosiderosis H and E (x40).

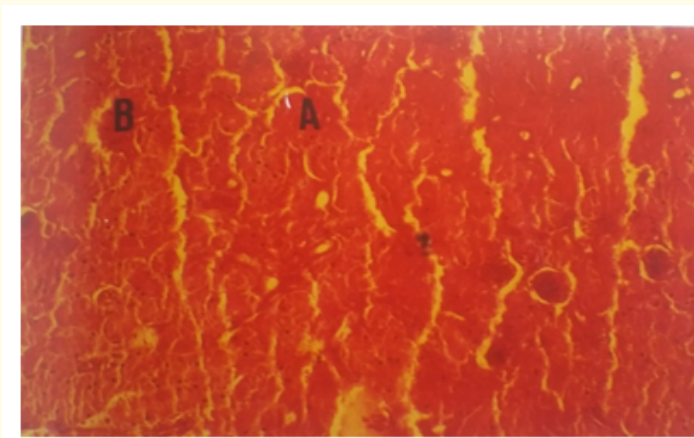


Figure 3: Kidney cells of chicks fed on seed kernel powder, note tubular nephrosis A and glomerular congestion B.

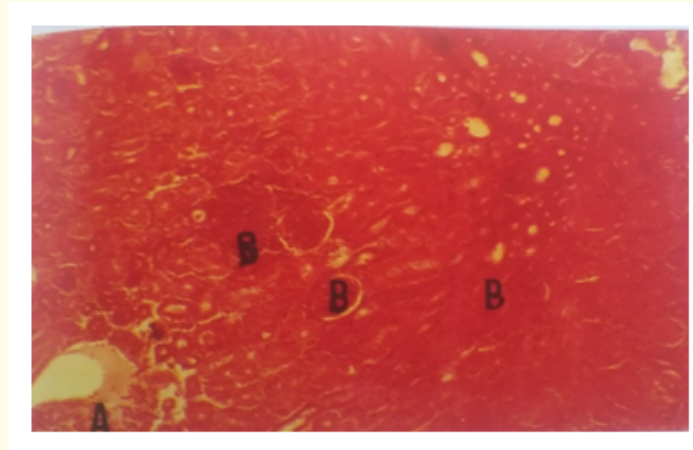


Figure 4: Kidney cell of chicks fed on seed kernel powder, note tubular nephrosis A, and cell infiltration B.

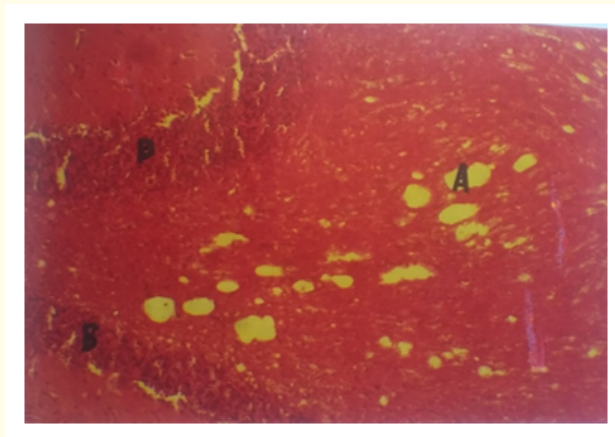


Figure 5: Brain cell of chicks fed on Neem seed kernel powder, note fatty degeneration A and gliosis and cell infiltration B.

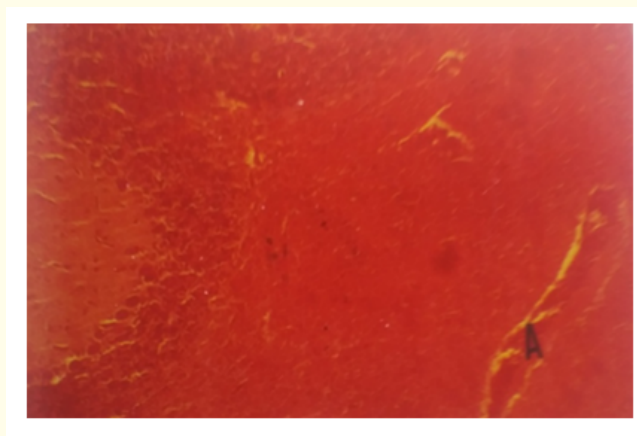


Figure 6: Brain cellof chicks fed on Neem seed kernel powder, note the perivascular cuffing A.

The histopathological changes in kidney cells of chicks fed on 0.5% and 15% of Neem seed kernel powder there is congestion, tubular nephrosis and cell infiltration (Figure 3 and 4), all these changes are reversible.

In brain cells of chicks fed on 0.5% and 15% of Neem seed kernel powder there was a perivascular cuffing at lower concentration (05%) and fatty degeneration, gliosis and cell infiltration at 15% concentration (Figure 5 and 6).

For chicks dipped in two concentrations (0.5% and 15%) of Neem oil there was no effect on body gained weight (0.003 and 0.001) as compared to the control (0.621), table 2.

Neem Oil Conc. (%)	Initial Body Weight (Kg)	Average Weight of Chicks After Feeding (Kg)	Weight Gained (Kg)
0.0	0.109	0.730	0.621
0.5	0.103	0.106	0.003
15	0.117	0.118	0.001

Table 2: The effect of dipping on chicks in Neem oil.

For chicks dipped in Neem water extract (1.5% and 15%,) there was no effect on body weight gain (0.301 and 0.241) as compared to the control (0.531), table 3.

Neem Seed Kernel Powder Water Extract Con. (%)	Initial Body Weight (Kg)	Average Weight of Chicks After Feeding (Kg)	Weight Gained (Kg)
0.0	0.717	1.248	0.531
0.5	0.971	1.272	0.301
15	0.821	1.062	0.241

Table 3: The effect of dipping on chicks in Neem seed kernel powder water extract.

The post mortem examination of chicks dipped in Neem seed water extract showed no changes in the internal organs. All histopathological changes were reversible. For liver cells of chicks dipped in Neem seed water extract there was necrosis, hyperemia, cell infiltration, focal necrosis and congestion (Figure 7 and 8).

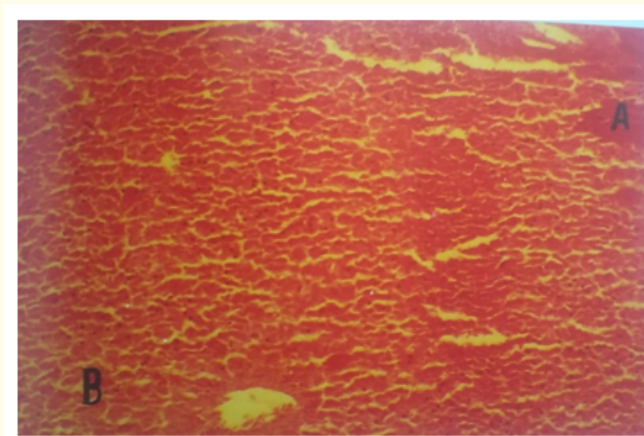


Figure 7: Liver cells of chicks dipped in Neem seed water extract. .Note congestion A and necrosis B H and E (x40).

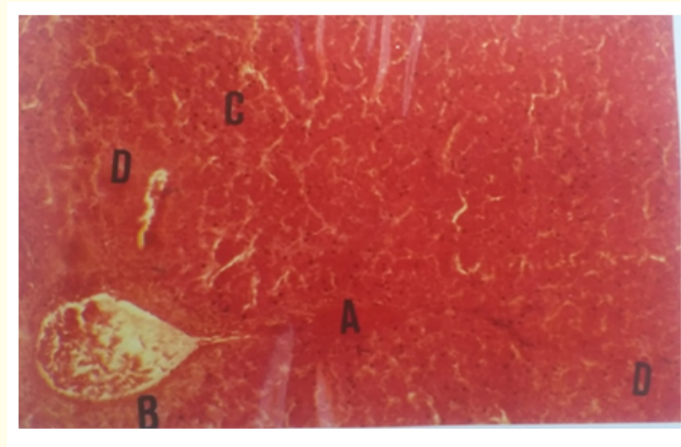


Figure 8: Liver cells of chicks dipped in Neem seed water extract. .Note hyperemia A cell infiltration B focal necrosis C and congestion D H and E (x40)..

For kidney cells of chicks dipped in Neem oil there was hyperemia, congestion all over the cells, tubular nephrosis and infraction (Figure 9 and 10).

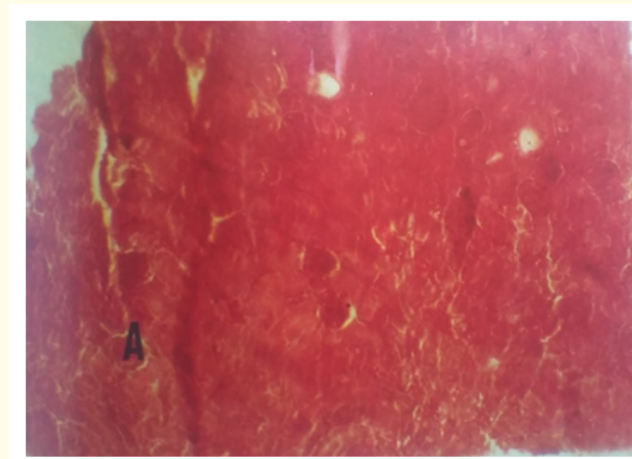


Figure 9: Kidney cells of chicks dipped in Neem oil, Note hyperemia and congestion all over the cells, tubular nephrosis A H and E (x40).

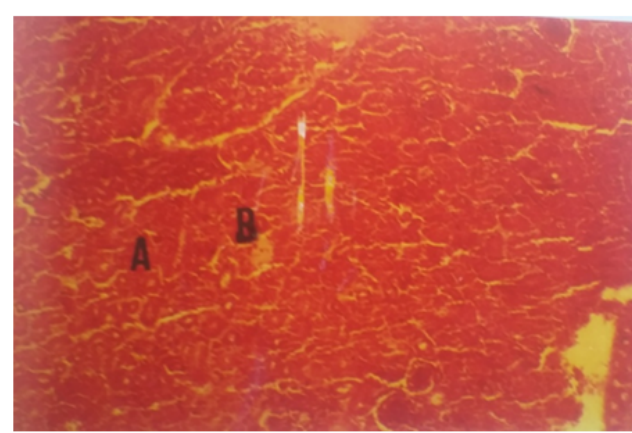


Figure 10: Kidney cells of chicks dipped in Neem oil, Note, tubular nephrosis A and infraction B H and E (x40).

For brain cells of chicks dipped in Neem oil there were necrosis, gliosis, and congestion (Figure 11).

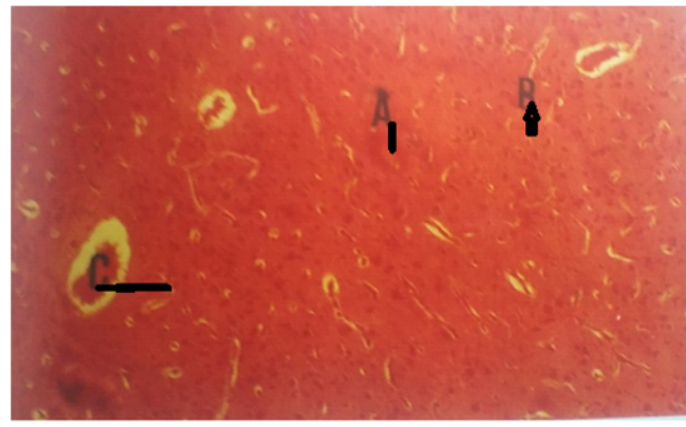


Figure 11: Brain cells of chicks dipped in neem oil, note, necrosis A and gliosis B and congestion C.

Chicks dipped in both Neem oil or Neem water extract showed no clinical signs and no post-mortem changes in the internal organs.

Discussion

In this study, chicks fed on 0.5% and 15% Neem seed kernel powder of the basic diet for a week period showed no clinical signs, but there is an increase in body weight. The gain in weight for the control was 0.241 gm for a week's time while the gain in weight for chicks fed on 0.5% was 0.417g and 0.945g for 15% concentration. This indicates that feed utilization was promoted as the as the concentration of the Neem seed kernel powder increased. In agreement with our findings, de-oiled Neem cake serves as a significant source of poultry feed. Extracted seed materials when used in feed mixture for various types of laying poultry have been comparable to peanut as a food-stuff [9,10]. Acid (HCL) and alkali (5% KOH) treatment of Neem cake improved the growth and feed efficiency of broiler chicks compared to controls [11].

Feeding brown hisex chicks on ripe ground Neem fruit at concentration of 2%, 5% and 10% of the basic diet for four weeks from their 5th to 35th day of age. The result was a decrease in body weight gain and in efficiency of feed utilization [12]. This was in contradiction with our results. This may be due to the difference in concentration and feeding period.

Botanicals have used since ancient civilizations for medicinal and pesticidal purposes [13-16]. Neem oil has pesticidal effect [4,17-19]. Some other plants and supplements controlled coccidiosis in chickens and improved growth performance parameters [20,21].

Histopathological changes in liver cells of chicks fed on 0.5% and 15% of Neem seed kernel powder vary from haemorrhage and/ or congestion to liver cell degeneration, parenchyma degeneration and cell infiltration. There is also haemosiderosis. In kidney cells there is congestion, tubular nephrosis and cell infiltration. In brain cells there is a perivascular cuffing at lower concentration (05%) and fatty degeneration, gliosis and cell infiltration at 15% concentration. All these changes are reversible recommending the safety of neem products as insecticide, acaricide and feed additive [4]. Also, Osman (2001), fed brown hisex chicks on Neem seeds at 2%, 5% and 10%, concentration of ground Neem seeds. Toxicity of 2.5 and 10% Neem ripe and 2.5% unripe fruit and 1% combination of ripe fruit plus leaf or unripe fruit plus leaf was studied on brown hisex chicks for a period of six weeks, followed by two weeks' recovery period [22]. The lesions

observed included fatty changes and necrosis of hepatocytes and epithelial cells of the renal proximal convoluted tubules, lymphocytic nodules, shrinkage of the glomerular tufts and wide spread of congestion and/ or haemorrhage. Compared to Bovan chicks fed 1% dietary propoxur died within 10 days [23]. Chicks dipped in both Neem oil or Neem water extract showed no clinical signs and no post-mortem changes in the internal organs. The weight of chicks in case of Neem water extract decreased. The gain in weight was 0.531 gm, for the controls, 0.310 gm for 0.5% and 0.241 gm for 15% concentrations. From these results it is clear that the gain in weight in chicks dipped in Neem oil decreases as the concentration increases. The gain in weight in chicks dipped in Neem oil also decreases' as the concentration increased. It was 0.61gm for the controls, 0.003 in 0.5% concentrations and 0.001 for 15% concentration. This indicated that feed utilization was affected by dipping with both Neem water extract and Neem oil. The clinical signs and decrease in weight were very clear in case of dipping with propoxure chemical [23].

On usage of Neem seed water extracts, the Histopathological picture of liver cells varies between congestion and/or haemorrhage to necrosis of the cells. the kidney and brain cell were not affected. Dipping with Neem oil, affected the liver cells showing hyperemia, cell infiltration, haemosiderosis and focal necrosis. In kidney cells, there were haemorrhage and/or congestion, necrosis and inflammatory cells. In brain cells there was congestion and necrosis. Bovan chicks dipped in 1% propoxure showed severe pathological changes in comparison to those showed in dipping with Neem seed water extract and Neem oil [23].

Conclusion

The increasing demand of safe, cheap and effective pesticides and feed additives of plant origin is urgently needed. The Neem seed kernel powder fed to chicks increase the body weight as the concentration increase. Neem oil and Neem seed kernel water extract (2.5% and 15%) induced no clinical signs or post-mortem changes in chick's internal organs (liver, kidney and brain) when fed or dipped with them; however, some Histopathological changes seen may be reversible. The severity of such histopathological changes were minimal when compared with those induced by chemical pesticides.

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