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Efficacy of Albendazole Against Experimental *Raillietina tetraqona* Infection in Chickens

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Abstract: The efficacy of Albendazole against experimental *Raillietina tetragona* infection in poultry was evaluated in this study. Thirty six, one day-old male Lohmann layer chicks were purchased and reared at the premises of the Faculty of Veterinary Science, University of Khartoum, Sudan. The birds were randomly divided into three groups (twelves birds each group). All birds in each group were experimentally infected with the infective stage of the parasite at a dose rate of three cysticercoids administered orally. Three weeks post-infection, Group 1 was kept as infected untreated control birds, where as group 2 and 3 were treated with oral administration of Albendazole at dose rates of 2.5 mg and 25 mg per kg per day for 3-7 days, respectively. Seven days from the cessation of Albendazole treatment, all birds in the three groups were slaughtered. Necropsy findings were recorded and blood samples were collected for biochemical analysis. The scientific data presented in this study indicated that oral administration of Albendazole at a dose rate of 25 mg/kg/day for 3-7 successive days, provides an effective treatment against poultry cestodes. The efficacy of the drug was estimated to be 100% as judged by adult warms recovery, faecal eggs counts and by comparison of lesions in treated chicks and infected controls. It is recommended that Albendazole should be used as a drug of choice for effective treatment of *R. tetraqona* infection in susceptible birds.

Key words: Albendazole, *R. tetraqona*, poultry cestodes, chemotherapy

INTRODUCTION

There has been a growing awareness in the chemotherapy of cestode parasites in man and poultry over the last thirty years. A number of synthetic drugs have been manufactured in succession and used for the treatment of cestode infection. It is well documented that Niclosamide is effective against *Hymenolepis nana* infection in man (Salem and El Allaf, 1969). Albendazole and praziquantel have been shown to eliminate completely *H. diminuta* infection in rats when given at 800 and 250 mg/kg/day for 3 consecutive days and against adult *H. nana* in mice (Thomas and Gonnert, 1977; Schenone 1980). However, studies on the efficacy of Albendazole against chicken cestodes have not yet been fully investigated. *R. tetragona, R. Cesticillus and R. echinobothrida* are important chicken cestodes. In the Sudan, R. tetragona (Molin, 1958) is considered a common chicken cestode and is found in the small intestine. It also infects guinea fowls and pgeons and is of cosmopolitan distribution. Soulsby (1968) stated that R. tetragona is one of the largest of chicken tapeworms measuring up to 25 cm in length with a long thin neck and small scolex having about 100 min hooks, 6-8 micron long in one row on the restellum. The objective of the present study was to evaluate the efficacy of Albendazole as an effective treatment against experimental *R. tetragona* infection in susceptile birds.

MATERIALS AND METHODS

Experimental birds: Thirty six, one day-old male Lohmann layer chicks were purchased from the Sudanese African poultry Company, Bagair. Gazira State and reared at the premises of the Faculty of Veterinary Science, University of Khartoum, Sudan. The experimental birs were kept in enclosed facility, provided with starter ration with free access to water. The poultry house was illuminated at night and early morning throughout the orally infected with 3 cysticercoids per chick and then assigned at random to 3 groups (twelves birds each). Group 1 was kept as infected untreated controls. Albendazole (Avico, Amman, Jordan) thereby was started 3 weeks post-infection and the drug was given in drinking water for 3 consecutive days at a dose rate of 2.5 and 25 mg/kg/day for group 2 and 3, respectively. All chicks in group 1, 2 and 3 were slaughtered after 7 days from the cessation of albendazole treatment.

Infective materials: Cysticercoids of *R. tetragona* were obtained from the intermediate hosts, naturally-infected adult ants of the genus Tetramorium (*T. caespitum* and *T. semilaeve*) found in poultry farms around the Faculty of Veterinary Science at Shambat. The ants were brought to the laboratory of Veterinary parasitology in empty clean bottles, transferred to a mortar containing normal saline and were mechanically disintegrated to release cysticercoids from the intestines (Soulsby, 1968). The cysticercoids were counted individually under the dissecting microscope, placed in gelatin capsules and given at appropriate dose to chicks by the oral route.

Necropsy findings: At the end of the experiments all chickens were slaughtered. The tape worms were recovered from chicks' intestines and then counted individually. Specimens of intestines, liver, heart, kidneys and spleen were fixed in 10% formol-saline and processed for histopathological examination. Samples of blood were obtained from chicks at slaughtering. Total serum protein concentrations were measured using a commercial Kit (Arcomex, Arab Company for Medical Diagnostics, Amman, Jordan).

RESULTS

Clinical observations: No significant clinical manifestations were observed in chicks infected with *R. tetragona* or in chicks following oral therapy with Albendazole at 25 mg/kg/day for 3 successive days. Albendazole was well tolarated by the chicks and no mortalities were recorded among the experimentally infected birds.

Parasitological findings: Experimentally infected birds passed the first parasite egg after 19 days post infection. The infection became patent in all birds at day 21 post-infection. Adult *R. tetragona* in the intestines of infected and albendazole-treated chicks was recovered and counted at necropsy. The total number of worms present in the intestines of *R. tetragona*-infected chicks at 3 cysticercoids (group 1) was 36. In chicks treated with Albendazole at 2.5 mg/kg/day for 3 consecutive days (group 2), the total number of worms found in the intestine 7 days post-treatment was 22 (38.88% efficacy) in chicks treated with Albendazole at 25 mg/kg/day for 3 successive days (group 3), there were no adult worms in the intestines indicating 100% efficacy. The results are presented in (Table 1).

Pathological findings: In birds infected with R. tetragona at 3 cysticercoids/bird (group 1), The lesions were mainly seen in the intestines. These consisted of focal ersions on the intestinal epithelium, enteritis and accumulation of lymphocytes particularly around the scattered deeply located scolicial parts of the worm in the congested Lamina propria of the intestinal mucosa. The spleen, kidneys and heart showed no changes but the liver, in some instances, revealed fatty vacuolation of the hepatocytes and isolated lymphocytic. In chicks treated with albendazole at 2.5 mg/kg/day (group 2) or 25 mg/kg/day (group 3) for 3 successive days, the inflammatory changes in the intestine were less marked and persisted for 7 days after the cessation of treatment. Neither scolicial structure of the worm in the intestinal Lamina propria nor lesions in vital organs of albendazole-treated chicks were detected. The primary lesions of *R. tetragona* infection were confined to the intestine and comprised enteritis, erosion on the epithelium, lymphocytic infiltration and scolicial parts deeply situated in the intestinal lamina propria. Extra-intestinal findings were aggregates of lymphocytes in the hepatic parenchyma and between the cardiac muscle fibers. Lesions in treated chicks and infected controls were correlated with changes in the concentration of Serum Aspartate Transaminase (AST), total protein, phosphorus, cholesterol, uric acid and total lipid and in the values of erythrocytes (RBC), Packed Cell Volume (PCV), haemoglobin (hb), Mean Corpuscular Volume (MCV) and Mean Corpuscular Haemoglobin Concentration (MCHC). Albendazole was not toxic or lethal to thicks.

Biochemical tests: Changes in the concentration of inorganic phosphorus, uric acid, cholesterol, total lipid and total protein and in the activity of AST in the serum of R. tetragona-infected chicks (group 1) and albendazole-treated chicks at 2.5 mg/kg/day (group 2)

Table 1: Efficacy of Albendazole against *R. tetragona* infections in chicks

Group	No. of chicks per group	No of cysticer-coids per group	No of cysticer-coids per group	Age of infection (day)	Dose of drug (mg kg^{-1})	No of daily doses	Total no of worms per group	Efficacy (%)
1-Infected Controls	12	3	36	21	-	-	36	-
2-Albendazole (2.5 mg/kg/day)	12	3	36	21	2.5	3	22	38.88
3-Albendazole (2.5 mg/kg/day)	12	3	36	21	25	3	Nil	100

Table 2: Effect of Albendazole therapy on the concentration of serum constituents of chicks Infected with 3 cysticercoids/chick of *R. tetragona*

Group	Inorganic phosphorus	Uric acid	Cholesterol	Total lipid	Total protein Gm dl^{-1}	AST i.u
1-Infected controls	3.73±0.3	5.78±1.55	217.57±16.01	514.54±2.87	4.14±0.09	67.18±0.57
2-Albendazole	NS	+	++	NS	NS	++
2.5 mg/kg/day for 3 days	2.83±0.04	9.69±0.04	138.87±2.93	559.87±22.28	4.23±0.11	88.99 1.56
3-Albendazole	+	+	++	NS	+	++
2.5 mg/kg/day for 3 days	2.56±0.14	11.27±0.19	132.61±4.94	548.68±18.34	3.63±0.08	87.22±4.25

N.S = Not significant; + = $p<0.05$, ++ $p<0.01$

and 25 mg/kg/day (group 3) for 3 successive days. There was a significant increase in AST activity ($p<0.01$) and uric acid concentration ($p<0.05$) and decrease in cholesterol concentration ($p<0.01$) in albendazole treated chicks of groups 2 and 3. In albendazole-treated chicks of group 3, the concentration of total protein and inorganic phosphorus was lower ($p<0.05$) than groups 1 and 2. No significant differences in the concentration of total lipid between the infected controls (group 1) and albendazole-treated chicks at 2.5 mg/kg/day (group 2) or 25 mg/kg/day (group 3) for 3 consecutive days were observed. The results are presented in (Table 2).

DISCUSSION

The results of the present experiments indicate that chicks are susceptible to infection with *R. tetragona* and that the cestode produces lesions mainly in the intestine. It appears that at levels of infection, 2-6 cysticercoids/chick, the tapeworms can achieve their potential of egg laying and/or segment shedding within 3 weeks post-infection. These low levels of infection are not associated with any important signs of morbidity or death. As the adult tape worms were recovered from the intestinal contents with normal saline, it is assumed that they were free in the intestinal lumen or only partially embedded in the mucosa.

In this study the main lesions in *R. tetragona* infected chicks were enteritis, erosions on the intestinal epithelium and deeply-located parts of the worm scolex in the lamina propria with prominent lymphocytic nodules. The present experiments have also shown that the fecal egg counts and adult worm recovery as well as comparison of lesion between untrated infected controls and infected treated birds should be given special consideration for evaluation of an anticestodal drugs. It is known that in farm animals, anthelmintic studies are generally concerned with the assessment of drug activity in terms of the percentage reduction in worm burden at slaughter, whereas full reports deal mainly with treatment of disease outbreaks. Present investigations were carried out to evaluate the efficacy of albendazole against the worm burden in chicks. The treatment of *R. tetragona* infected chicks with albendazole at 2.5 and 25 mg/kg/day for 3 consecutive days showed efficacy of 38.8% and 100% in group 2 and 3, respectively.

In the present experiments, changes in serum constituents were in general within the normal ranges. The elevation in total protein concentration in the serum of chicks orally dosed with Albizia extract is not surprising. The absence of hypo-proteinaemia has been previously shown to occur in chicks fed 2% dietary Cassia Senna (Omer, 1990) and Lupinus termis (Mohamed, 1992) and decrease in serum total proten in has been osbserved in chicks fed low levels of dietary Ricinus communis or J. curcas (El Badwi, 1990; El Badwi *et al*., 1992 a, b) and Abrus precatorius (Omer, 1990).

It is suggested that the total serum protein levels represent the balance between the process of biosynthesis and catabolism or loss by haemorrhage or proteinuria. In the present study, decrease in the levels of serum cholesterol was recorded in checks treated with albendazole. It is well known that plasma cholesterol concentration is increased in a number of decrease state primarily liver disease, diabetes mellitus and hypothyroidism (Bush, 1970). Treatment with Albendazole caused an increase in the concentration of serum uric acid. It is probably that the livers of chickens produce hypoxanthine which is then oxidized to uric acid by xanthine oxidase. Increase in serum uric acid concentration was found in chicks fed with dietary selenium (Dafalla and Adam, 1986).

The scientific data presented in this study indicated that the efficacy of Albendazole, as an anticestodal drug, at a dose rate of 25 mg/kg/day for 3-7 successive days, was estimated to be 100% as judged by adult worm counts, faecal examination for egg counts or by comparison of lesions in treated chicks and non-treated infected controls.

CONCLUSION

Based on this study, it is recommended that Albendazole should be used as a drug of choice for effective treatment of *R. tetraqona* infection in susceptible birds.

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