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Efficacy of anticoccidial drugs and their impacts on growth performance on caecal coccidiosis in broiler chicken

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Abstract

Coccidiosis is a fatal disease of poultry. In order to combat caecal coccidiosis of broiler, this study was designed to evaluate the comparative efficacy of sulfaclozine, toltrazuril and amprolium. 50 pcs of day old broiler chick were randomized and divided into five groups. The chicks of group T₀ kept as non-infected, non-medicated control. The group T_i were kept as infected non treated and other three groups such as T₁, T₂, T₃ were treated with sulfaclozine, toltrazuril and amprolium at a dose rate of 10 mg/kg body weight orally, respectively on day 21 and 24 of age. In chicks of group T₁, sulfaclozine was given at rate of 10mg/kg body weight orally. Similarly chicks of group T₂ were treated with toltrazuril 10 mg/kg and group T₃ were treated with amprolium at the rate of 10 mg/kg body weight orally, respectively. After treatment, the efficacy, body weight, morbidity and mortality were studied. From the present research treatment there were sharp decline of OPG counts in all groups. But the decline was very significant (P<0.05) in Group T₃ which was 1.37±0.002 thousand. This study also suggested that the mean initial weight of chicks for all groups were almost similar, which was 37 g and above as recorded on day 1. The pre-infection body weight values at day 10 recorded for all groups were almost similar which was more than 217 g. Significant (P<0.01) increase of body weight was recorded on day 21 following which the highest increase (780.21±1.29 g) was seen in Group T₀ chicken (healthy control). After treatment (on day 24), there were significant increase in body weight of all groups used for therapeutic trial with the maximum mean weight gain in Group T₃ (790.83±2.10g) which was the nearest value to Group T₀ (healthy control). The clinical signs of caecal coccidiosis appeared on day 15 and became severe on day 21. A total of 6 chicks died during the experimental period from Group T_i (untreated affected group) and found 60% mortality. Only 3 birds died in Group T₁ treated with sulfaclozine and 2 birds died in group T₂ treated with toltrazuril and 2 birds died in group T₃ group treated with amprolium.

Keywords: Anticoccidial drugs; Oocyst per gram (OPG); Growth performance; Caecal coccidiosis; Broiler chicken

1. Introduction

Poultry farming has now become a prospective industry in Bangladesh and many landless farmers are found to involve with poultry rearing in Bangladesh [3]. A total of 7 million people are engaged in this sector [22,23] and contributes 51% of total meat production in Bangladesh [18,19]. There are about 110,800 small and large scale poultry farms in this country [2]. There are several constraints of poultry industries in Bangladesh including outbreak of infectious diseases causing economic loss and discouraging poultry rearing [5]. Coccidiosis is a common and fatal disease in poultry. Intestinal coccidiosis, caused by various species of *Eimeria*, is an economically important (estimated to be 2 billion dollars a year) disease of poultry [28]. *Eimeria tenella* is the most important species, as it causes caecal coccidiosis in chickens [25]. In Bangladesh a number of drugs are available for the treatment and prevention of coccidiosis. Anticoccidial drugs remain important for a long time, although resistance development could limit their use [26]. Anticoccidial therapeutic agents must fulfill some main criteria including a high level of efficacy against all

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developmental stages of pathogenic *Eimeria* species infecting poultry and at the same time, they shouldn't interfere with the immune response of the host during and after treatment of coccidial infections at therapeutic dosages [7]. Toltrazuril is a symmetrical triazinetrione compound and 2.5% oral solution has been shown to be effective against all species of *Eimeria* infecting chickens [16]. It is active against all intracellular developmental stages including those of schizogony and gametogony [16]. Chemoprophylaxis with toltrazuril enhances immunity against poultry coccidiosis [8]. It has been proved that therapeutic medication with toltrazuril protects the birds from clinical coccidiosis [20]. There are other different therapeutic and prophylactic agents for coccidiosis in different species. Among these vitamin-K added to a deficient diet reduces mortality due to *Eimeria tenella* or *Eimeria necatrix* [21], sulfaclozine and amprolium may reduce the deleterious effects of coccidiosis in broilers [24] and dietary supplementation with oyster mushroom powder enhances anti-inflammatory activity which is mediated through the inhibition of NF- κ B and AP-1 signaling [11]. Therefore this research work was conducted to reveal the comparative efficacy of toltrazuril, amprolium and sulfaclozine against caecal coccidiosis in broiler and the effect of the above medicinal combination on body weight gain, oocyst per gram (OPG) and morbidity and mortality pattern.

2. Materials and methods

The experiment was designed and conducted in a broiler farm at Das para, Khadimnagar, Sylhet collaboration with the Department of Pharmacology and Toxicology, Faculty of Veterinary, Animal and Biomedical Sciences, Sylhet Agricultural University, Sylhet during the period from July to December, 2020 to study the therapeutic and comparative efficacy of toltrazuril, amprolium, and sulfaclozine against caecal coccidiosis in broiler chicken.

2.1. Management of the experimental chicks

The following procedures were adapted during the experimental period. The selected farmer got all the veterinary facilities including consultancy about vaccination, prevention of disease and therapy of infected birds.

2.2. Brooding

The experimental chicks were brooded in two brooders provided with temperature of $35\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ at 1st week of age and then gradually decreased the temperature at the rate of $2.5\text{ }^{\circ}\text{C}$ per week up to 24 days of age. Temperature was corrected by adjusting the height of the heat source, i.e. the electric bulb used for heating. The birds were reared in coccidia free condition as the utensils were sprayed with ammonia earlier. Strict biosecurity was maintained.

2.3. Feeding and drinking

The chicks were given feed twice a day in the morning and in the afternoon, and water ad libitum. During the 1st week feed was supplied on large brown paper and water in waterer. After 1st week the feeders were provided. Feeders and waterers were cleaned daily. After 10 days when the chicks were placed in cages then water was given in beakers.

2.4. Housing, feeding and management of experimental birds

The experimental poultry house was properly cleaned, washed and then dried up. The room was fumigated with formaldehyde and with ammonia before introduction of chicks. The feeder, waterer and cages were cleaned with water and then fumigated with ammonia. 50 pcs Cobb-500 of day old chicks were included in this study. The chicks were collected from Kazi Hatchery, Gazipur. Vaccination of chicks with BCRDV was performed on day 2 and 19. The broiler chicks were provided with standard broiler starter and grower ration (Champion Starter and Champion Grower, Quality Feeds Ltd.) according to the age. The starter feed was given from day 1 to day 10 and the grower feed was given from day 11 up to the end of the experiment. The feed was stored in a dry and coccidia free area. The chicks ($n = 50$) at the age of day 10 were divided into 5 equal groups (group T_0 , T_1 , T_2 , and T_3). The chicks were reared in separate cages. Group T_0 was kept as a control group without induction of infection and treatment group T_1 was infected and untreated and the next 3 groups (Group T_1 to T_3) were used for therapeutic trial.

2.5. Induced Coccidiosis infection in bird

A single oocyst derived strain of *Eimeria tenella* as a field isolate was used in this experiment which was collected from a chicken affected with caecal coccidiosis. For the production of fresh oocysts, each seven days old chicks ($n=10$) was infected with 104 sporulated oocysts a volume of 0.5 to 1 ml with water and each prepared dose was administered orally to every chick of Group T_1 , T_2 and T_3 on day 10 and 15. The oocysts were cleaned from the faeces by adopting the method described by [21] with required modifications.

2.6. Therapeutic trial

For chemotherapy 5 groups are made as followings Group T₀ is considered as control without infection and no medicine was given to it, Group T_i is control with infection but untreated, Group T₁ is treated with sulfaclozine at the dose 10mg per kg of body weight, Group T₂ is treated with toltrazuril at the dose 10mg per kg of body weight, and Group T₃ is treated with amprolium at the dose 10mg per kg of body weight orally, respectively. After the treatment fecal sample is collected at different days and examined for coccidiosis to check the efficacy.

Table 1 Therapeutic agents used to study therapeutic and prophylactic potentials of caecal coccidiosis in broiler chicken

Sl. No.	Therapeutic agent	Trade name	Company Name	Source
1.	Toltrazuril	Cox-Zero®	Eon Pharmaceuticals Ltd.	Local market
2.	Amprolium	Coccinil-20®	Techno drugs Ltd.	Local market
3.	Sulfaclozine	Nava Cox®	Navana Pharmaceuticals, Ltd	Local market

Table 2 Groupings according to treatment of caecal coccidiosis in broiler chicken

Groups	Drugs	Dose
Group (T ₀)	Control without infection	N/A
Group (T _i)	Control with infection but untreated	N/A
Group (T ₁)	Treated with Sulfaclozine	10mg/kg bwt, orally
Group (T ₂)	Treated with Toltrazuril	10mg/kg bwt, orally
Group (T ₃)	Treated with Amprolium	10mg/kg bwt, orally

2.7. Recording of daily weight, recovery and mortality rate, and Counting of caecal oocyst

Chicks were weighed individually from the day of starting (day 1) till the end of the experiment (day 24) every day at morning. The average mean individual weight was calculated from these values. In response to the treatment the recovery and mortality rate were recorded up to the end of the experiment. Caecal oocyst was counted by using Mc Master Technique at 21 days and 24 days.

2.8. Counting of caecal oocyst by McMaster Technique

McMaster Technique was performed to determine the quantity of coccidian oocyst. At first 56 ml saturated salt solution and 4 g sample (litter) was taken in a beaker. After stirring, filtering the solution and filtered solution was placed in both chamber of the McMaster slide. Then waiting 15 minutes to stable the solution and placed under microscope for examine (4x). Finally focused the McMaster chamber and counting the oocyst at (10x).

Calculation: Number of total oocyst in 2 chambers x 50

2.9. Statistical analysis

The data were analyzed statistically between control and treated groups of calves by student t test (paired sample). The control and treatments would be randomly arranged into Completely Randomized Design (CRD) and compare the normal differences between averages by Duncan Multiple Range Test (DMRT). Significant means were compared using the Duncan's multiple range tests [6].

3. Results and discussion

The main clinical signs observed in the infected chicks due to coccidiosis were depression, anorexia, brown watery diarrhea, emaciation, rough hair coat, pendulous and distended abdomen and hepatomegaly noted on abdominal palpation, progression weakness and death. Diarrhea, emaciation, and rough hair were due to infection of the intestine before the penetration of the sporozoites to the mucosa of small intestine and passing via the hepatic portal system to

the liver to start the hepatic form. Three drugs were used for the treatment of coccidiosis and one group was control which is infected. The drugs are used namely sulfaclozine, toltrazuril and amprolium.

Table 3 Therapeutic and prophylactic efficacy trial of toltrazuril, amprolium and sulfaclozine in broiler in term of oocyst per gram (OPG) count in faeces

Groups	OPG Day 21 (thousands ± SE)	OPG Day 24 (thousands ± SE)
Healthy Control (T ₀)	0.00±0.00	0.00±0.00
Infected control (T _i)	50.55 ^b ±2.368	64.44 ^a ±1.38
Sulfaclozine (T ₁)	52.71 ^a ±1.796	14.43 ^b ±0.03
Toltrazuril (T ₂)	51.65 ^a ±2.112	1.58 ^b ±0.38
Amprolium (T ₃)	49.46 ^a ±1.33	1.37 ^b ±0.002

^b=Significant at 5 percent level (P<0.05), ^a=Significant at 1 percent level (P<0.01)

In Group T₀, OPG counts remained "0" throughout the experimental period (healthy control). The initial mean OPG of chickens for other therapeutic trial groups were almost similar, which was 50 thousand (P<0.01) and above recorded on day 21. From the present research treatment there were sharp decline of OPG count in all groups but the decline was very significant (P<0.05) in group T₃ which was 1.37±0.002 thousand (Table 3). Many antibiotics have been used for the treatment and prevention of coccidiosis in broiler [27]. Coccidiosis is susceptible to several antibiotics including ionospheres, amprolium, sulphonamide, ethopabate, clodol and quinolones. [12] stated that the therapeutic efficacy of sulphachlorpyrazine and toltrazuril against experimentally induced *Eimeria tenella* infection was compared in battery and floor pen raised broiler chickens. [13] stated that the effect of toltrazuril and amprolium was evaluated in broiler chicken experimentally infected with caecal coccidiosis. In the amprolium treated birds the OPG was lesser than infected controls and mean body weight was lower than toltrazuril treated birds but cumulative feed efficiency was similar in both treatments. [17] stated that they could completely inhibit the oocysts shedding and repaired lesions of intestine in infected groups one week after treatment. Both drugs were effective in controlling coccidia [15].

Table 4 Therapeutic and prophylactic efficacy trial of sulfaclozine, toltrazuril, amprolium in broiler in term of body weight gain

Groups	Weight in g at day 1 (Mean ± SE)	Weight in g at day 10 (Mean ± SE)	Weight in g at day 21 (Mean ± SE)	Weight in g at day 24 (Mean ± SE)
Healthy (T ₀) non treated	37.94 ^d ±0.15	225.24 ^c ±0.97	780.21 ^b ±1.29	982.79 ^a ±3.349
Infected non treated (T _i)	37.87 ^d ±0.38	217.44 ^c ±1.69	613.59 ^b ±1.91	643.97 ^a ±1.649
Sulfaclozine (T ₁)	37.72 ^d ±0.56	219.74 ^c ±1.65	610.34 ^b ±0.03	720.57 ^a ±0.002
Toltrazuril (T ₂)	37.91 ^d ±0.47	221.24 ^c ±1.38	668.00 ^b ±0.03	800.03 ^a ±0.04
Amprolium (T ₃)	37.26 ^d ± 0.68	220.73 ^c ±1.50	670.47 ^b ±0.03	790.83 ^a ±0.04

^b=Significant at 5 percent level (P<0.05), ^a=Significant at 1 percent level (P<0.01)

This study also suggested that the mean initial weight of chicks for all groups were almost similar which was 37 g and above as record on day 1. The pre infection body weight values at day 10 were recorded for all groups almost similar that more than 221 g significant. Increase body weight was recorded on day 21 following artificial infection in which the highest increase (780.21±1.29g) was seen in group T₀ chicken (healthy control). After treatment on day 24 there were significant increase body weight in all groups used for therapeutic trial with the maximum mean weight gain. In group T₂, the body weight was recorded 800.03±2.10g which was closely similar to T₀ (healthy control). The clinical sign of caecal coccidiosis appeared on day 20 and become severe on day 21 (Table 4). In the amprolium treated birds the mean body weight was lower than toltrazuril treated birds but cumulative feed efficiency was similar in both treatments. [9] stated that body weight gains of *Eimeria tenella* infected chickens were significantly improved and caecal lesions were prevented by feeding either decoquinate or maduramycin. The treated group with amprolium revealed great improvement in its performance parameters including feed intake, body weight gain, and relative growth rate

with reduction in oocysts count as well as macroscopic and microscopic lesion score. This results are in a great accordance with [14] who found that amprolium when administered on days 14 and 19 in the drinking water at 10 mg/kg of body weight have equal to the non-infected birds in performance. Amprolium most completely eliminated all coccidial lesions and dramatically reduced oocysts shedding. The treatment with amprolium successfully controlled the coccidiosis after 2 days with no relapse of infection. Amprolium can thus be used for supplemental control with in fed anticoccidials or as a primary anticoccidial with non-medicated feed. [15] found that all amprolium treatments resulted in birds with good weights at all weight periods.

Table 5 Efficacy of sulfaclozine, toltrazuril and amprolium on morbidity and mortality percentage in broiler due to coccidiosis

Groups	No. of Chicks Examined	No. of Chicks Infected	% Morbidity	No. of Deaths	% Mortality
Healthy non Treated (T ₀)	10	0	0	0	0
Infected non Treated (T _i)	10	10	100	6	60
Sulfaclozine (T ₁)	10	10	100	3	30
Toltrazuril (T ₂)	10	10	100	2	20
Amprolium (T ₃)	10	10	100	2	20

A total of 6 chicks died during the experiment period from group T_i (untreated affected group) and found 60% mortality. Only 3 birds died in group T₁ treated with sulfaclozine. Only 2 birds died in group T₂ treated with toltrazuril. Only 2 birds died in Group T₃ treated with amprolium (Table 5). The result of the present study indicated a high variation among treated and non-treated group the mortality rate in untreated group up to 60% while in treated group varies from 20-30%. These findings are in accordance with [1]. [10,4] evaluated the efficacy of the anticoccidial drugs by the total oocysts output per g of fecal dropping, mortality percentage, body weight gain, lesions score at 5 days post infection. The result showed that the mortality rate reached 20% (amprol plus), 15% (toltrazuril), 15% (clazuvet) and 5% (clopidol), while it reached 30% in infected non treated control groups. Amprolium controlled coccidiosis when treatment was started at the time of first clinical signs, but cannot be used to prevent high mortality in diseased birds with severe lesions in the caeca; hence an early diagnosis is of great importance.

4. Conclusion

The present research showed that mortality rates less in group toltrazuril and amprolium treated birds and other groups of bird. The body weight was increased treated with toltrazuril, amprolium and sulfaclozine against coccidiosis in broiler birds. The mortality rate was decreased treated with toltrazuril and amprolium against coccidiosis than sulfaclozine. So, from the above discussion among the three anticoccidial drugs toltrazuril, amprolium showed more efficacy in compare with sulfaclozine treated groups in broiler. However, the present study is preliminary for efficacy studies of anticoccidials which may help the future researchers to explore the details pharmacokinetic and toxic effects for wide therapeutic uses in Bangladesh for the treatment of coccidiosis in broilers.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there is no conflict of interests.

References

- [1] Alnassan AA, Shehata AA, Kotsch M, Schrodi W, Kruger M, Dauschies A and Bangoura B (2013). Efficacy of early treatment with toltrazuril in prevention of coccidiosis and necrotic enteritis in chickens. *Avian Pathol.* 42(5):482-490.
- [2] Anon (2019). Report of BRAC on Avian Influenza Prevention Program. November 2005- August 2006, P-1.
- [3] Anonymous (1999). The fifth five year plan. Planning commission, Ministry of planning, Government of the people's Republic of Bangladesh.
- [4] Bera KD, Bhattacharya DP, Dhara A, Kumar S and Das SK (2010). Evaluation of economic losses due to coccidiosis in poultry industry in India. *Agricultural Economic Research Review*, 23:91-96.
- [5] Das P, Rajib M, Noor M and Islam MR (2005). Retrospective analysis on the proportional incidence of poultry diseases in greater Mymensingh district of Bangladesh. In: proceeding of 4th International Poultry Show and Seminar. The World Poultry Science Association, Bangladesh branch, P. 35-39
- [6] Duncan DB (1955). Multiple range and multiple F tests. *Biometrics*, 11:1-42.
- [7] El-Banna HA, El-Bahy MM, El-Zorba HY and El-Hady M (2005). Anticoccidial efficacy of drinking water soluble diclazuril on experimental and field coccidiosis in broiler chicken. *Journal of Veterinary Medicine* 52:287-291.
- [8] Grief G (2000). Immunity to coccidiosis after treatment with toltrazuril. *Parasitology Research* 86:787-790.
- [9] Guo FC, Suo X, Zhang GZ and Shaen JZ (2007). Efficacy of decoquinate against drug sensitive laboratory strains of *Eimeria tenella* and field isolates of *Eimeria* species in broiler chickens in China. *Vet. Parasitol.*, 147:239-245.
- [10] Hamed HR and Eladi T (2011). Proceeding of the 4th scientific conference of animal wealth research in the Middle East and North Africa. *Foreign Agricultural Relations (FAR)*, Egypt, p 499.
- [11] Jedinak A and Sliva D (2008). *Pleurotus ostreatus* inhibits proliferation of human breast and colon cancer cells through P53-dependent as well as p53-independent pathway. *International Journal of Oncology* 33:1307-1313.
- [12] Laczay P, Voros G and semjen G (1995). Comparative studies on the efficacy of sulphachlorpyrazine and toltrazuril for the treatment of *Caecal coccidiosis* in broilers. *International Journal of Parasitology*, 25(6):753-760.
- [13] Lakkundi JN, Jagannath MS, Souza DPE (2002). Effect of toltrazuril and amprolium on body weight and feed efficiency of broiler chicken experimentally infected with *Eimeria tenella*. *Indian Journal of Animal Sciences*, 72(10):835-837.
- [14] Mathis GF, Froyman R, Irion T and Kennedy T (2003). Coccidiosis control with toltrazuril in conjunction with anticoccidial medicated or no medicated feed. *Avian Dis.*, 47:463-469.
- [15] Mathis GF, Froyman R, Irion T and Kennedy T (2004). Coccidiosis control by administering toltrazuril in the drinking water for a 2- day period. *Veterinary Parasitol.*, 121:1-9.
- [16] Mehlhorn H, Schmahl G and Haberkorn A (1988). Toltrazuril effective against a broad spectrum of protozoan parasites. *Parasitology Research* 75:64-66.
- [17] Payam HK, Seyed SRS, Gita AA and Mohammad R (2009). Comparative investigation of efficacy of two sulphonamides on broiler coccidiosis infected by Iranian *Eimeria* spp in Iran. *Iranian Journal of Applied Animal Science*, 12(4):75-79.
- [18] Raha SK (2019). Broiler industry in Bangladesh: some issues. In: proceeding of 5th International Poultry Show and Seminar. The World Poultry Science Association, Bangladesh Branch, P. 1-9.
- [19] Rao NS (1988). Vitamin A deficiency in poultry. *Poultry Adviser* 21:47-48.
- [20] Ramadan A, Abo El-Sooud K and El-Bahy MM (1997). Anticoccidial efficacy of toltrazuril and halofuginone against *Eimeria tenella* infections in broiler chickens in Egypt. *Research in Veterinary Science* 62:175- 178.
- [21] Riley JF (1980). Drug resistance in coccidia. *Advance in Veterinary Science and Comparative Medicine* 24: 99-100.
- [22] Saleque MA (2019). Pattern of poultry diseases in breeding farm and poultry units in Bangladesh. Presented in the World Poultry show and seminar, Dhaka, Bangladesh. P 7-10.
- [23] Saleque MA (2019). Poultry industry in Bangladesh: current status and its future. *Poultry Business Dictionary*. Poultry Khamar Bichitra, P 25.

- [24] Sanei MM, Rahbari S, Mansouri B and Kiaei SMM (2009). The effect of sulfaclozine 30% (Esb3) on experimental coccidiosis in broiler cockerels. *Scientific-Research Iranian Veterinary Journal* 5:62-66.
- [25] Shirley MW and Millard BJ (1986). Studies on the pathogenicity of seven attenuated lines of *Eimeria* given as a mixture to chickens. *Avian Pathology*.15:629-638.
- [26] Stephen Rommen (1997). Studies so resiatance anticoccidials *Eimeria* species field isolates and pure *Eimeria* strains. *Veterinary Parasitology*, P 23.
- [27] Vijay K, Pradeep S, Pawan K, Verma I, Mehtab SP, Anu C and Vijayta G (2013). Anticoccidial drugs used in poultry. *Science International* 1(7):261-265.
- [28] Zhang Z and Zeng M (2005). Researches advance of drug resistance in chickens coccidian. *Chinese Journal of Veterinary Parasitology* 13:29-36.