Anticoccidial Activity of *Allium Sativum* and *Aloe Vera* in Broilers

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**A b s t r a c t**

Avian coccidiosis is the most costly and wide-spread parasitic disease in the poultry industry, and has been mainly controlled by the use of different chemotherapeutic agents. Due to the emergence of drug-resistant strains, alternative control strategies are needed. In this study, the protective effects of *Allium sativum* or *Aloe vera* aqueous extracts were investigated in broiler chickens following experimental infection with mixed Eimeria species. The obtained results showed that, fecal oocyst shedding decreased significantly in all of the treated groups that were supplemented with either aqueous extract of *Allium sativum* or *Aloe Vera* alone or in combination as compared to the infected non-treated control group. Furthermore, the medicated groups showed significantly lower intestinal lesions compared with those infected non-treated ones. No significant differences were found in body weight gain or loss between the *Allium sativum* or Aloe vera-supplemented birds either alone or in combination and non-infected control group. In addition, Feed conversion rate (FCR) was improved in birds supplemented with either *Allium sativum* or *Aloe Vera* compared with non-infected control group.

The findings of this study suggest that aqueous extract of *Allium sativum* and *Aloe vera* could be used as alternative treatment for controlling avian coccidiosis.

Key Words: Coccidiosis, *Allium Sativum*, Aloe Vera

**INTRODUCTION**

Coccidiosis of chickens is one of most economically important diseases affecting the poultry industry. It caused by seven species of intracellular protozoan parasites of the genus Eimeria. Eimeria typically invades cells of the intestinal epithelium and causes destruction of the infected cells resulting in reduction of feed conversion, body weight gain, egg production, and increased both morbidity and mortality rates [1, 2]. Currently, this disease has been mainly controlled by any of these regimes, the use of anticoccidial drugs in feed, by vaccination using live strains of Eimeria in the intensively reared poultry settings [2-
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4. The increasing resistance of avian coccidia to the anticoccidial drugs and the increasing public concern about drug residues in chicken meat [3, 5,6], has stimulated the search for new methods of control.

Therefore, several studies have been undertaken to identify various dietary supplements and probiotics to control Eimeria infections [7-10]. All these herbs posses a number of chemical substances for the use in poultry [11].


Approximately 99–99.5% of the Aloe vera plant is composed of water. The remaining 0.5–1% of the plant consists of solid components harboring over 75 biologically active compounds. These compounds are known to have a broad range of pharmacological activities, including wound healing, anti-inflammatory, anti-arhritic, anti-oxidative, anti-diabetic, and anti-tumorogenic effects [14, 15]. Additionally, Aloe vera plant is known to have anti-microbial properties, including anti-bacterial, anti-fungal, anti-viral, and anti-parasitic properties[14-16].

The objective of the present study is to evaluate the anticoccidial prophylactic efficacy of aqueous mixed extract mixture of Garlic (*Allium sativum*), and *Aloe vera* in comparison with standard anticoccidial drug (Toltrazuril).

**Materials and Methods**

**Drugs**

*Toltrazuril* solution (. Baycox®,2.5%) obtained from BAYER, Germany. It was administered in a concentration of 25 ppm in drinking water.

**Preparation of aqueous the extract mixture**

Fresh Garlic bulbs and Aloe vera leaves were collected from local market. 500 grams of each plant was trodden into small pieces with the help of metallic grinder, then transferred to a non-metallic jar. Add one liter of hot boiling water to the minced plant and kept at room temperature overnight [17]. The obtained aqueous extract was mixed with the drinking water

**Experimental design**

A total of 300, 1-day-old Hubbard broiler chicks obtained from a private poultry farm (Giza, Egypt) were used in the experiment. Birds were allocated based on a random block design into 6 groups each of 50 birds housed in a separate cage of 5 m2 . Group A and B were serving as a control infected non-treated and a non-infected nontreated groups respectively. Group C was treated with 25 ppm Toltrazuril, group D, treated with 100 ppm aqueous extract of *Allium sativum*, group E treated with 100 ppm aqueous extract of *Aloe Vera* while Group F was received mixed extract of both 50 ppm *Allium sativum* and 50 ppm Aloe Vera. All treatment was mixed with drinking water and continued for five consecutive days started from the 3th day to the 7th day post infection. Birds in groups A , C, D, E and F were challenged orally with 150 000 mixed Eimeria sporulated oocysts on the 20th day of their age. Birds were fed on anticoccidial free commercial broiler-chick feed, as
described in table 1 and tap water was provided for consumption ad libitum. Standard hygienic measures against infectious diseases were applied. Vaccination program was carried out using Hitchner B1 strain (eye drops – at the 7th day of age) and at 18th day Lasota strain in drinking water against Newcastle disease. Gumboro vaccination was applied at the 6th, 11th and 18th days of age. method at the seventh day of age. At the 18th day of age, Lasota vaccine against Newcastle disease was used in drinking water.

**Table-1. composition of basal diet.**

<table>
<thead>
<tr>
<th>Ingredient and composition</th>
<th>Starter ration (From day 1 to day 20)</th>
<th>Finisher ration (from day 21 to day 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow corn (%)</td>
<td>64.3</td>
<td>72.2</td>
</tr>
<tr>
<td>Soybean meal (44% CP)</td>
<td>27.5</td>
<td>21.5</td>
</tr>
<tr>
<td>Fish meal (72% CP)</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Lime stone (%)</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>Dicalcium phosphate (%)</td>
<td>1</td>
<td>1.2</td>
</tr>
<tr>
<td>Vitamins and minerals (%)</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>DL. Methionine (%)</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Sodium chloride (%)</td>
<td>0.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

**Coccidial infections**

The challenged oocysts was obtained from the department of parasitology, Faculty of veterinary medicine Cairo university. The oocysts were isolated from the intestines of naturally infected chickens. It was separated by using sieving and sedimentation techniques [18]. The collected oocysts were allowed to sporulate at room temperature in 2.5% potassium dichromate solution. The sporulated oocysts were cleared and counted per 1 ml of the solution using the McMaster technique as described by [19]. The different species of Eimeria present in the used inoculums were identified according to the technique of [18] (using the difference in size after measuring of 100
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They were identified as Eimeria acervulina (4.5%), E. maxima (29.5%), E. necatrix 2 (2.5%), E. tenella (60.0%) and E. brunette (3.5%). The collected sporulated oocysts were used for induction of experimental infection at the 20th day old.

**Evaluation of the tested extracts efficacy**

Fresh faecal droppings were collected daily from the 3rd to the 10th day post-experimental infection, when only few or no oocysts could be detected in faecal dropping (related to oocyst shedding curve of the control group). The mean number of oocysts per gram faeces for each group was counted by the Mc-Master technique according to[18].

The efficacy was calculated in comparing the total number of shed oocysts, number of dead birds and the mean body weight gain at the end of the experiment (10 d.p.i.) in the medicated and control non-medicated groups throughout the whole period of the experiment.

Five birds were removed at random from each group for post mortem examination at the 7th post infection day. Lesion scores were determined by macroscopic examination of the duodenum, intestine, and caeca of each bird. Birds with no evident lesions were given a score of 0, while a score of 4 referred to the severely affected birds [19].

A faecal score was recorded for each group of birds (5–10 d.p.i.). Faecal score was calculated by observing the faeces voided each day; a rating of 1 indicating normal faeces, through 5, denoting the presence of severe diarrhoea and/or a profuse amount of blood [20].

The curative capacity of the tested plant extracts were determined by comparing the mean number of oocysts shed, body weight gain, lesion and faecal scores as well as daily number of dead birds in treated and non-treated control groups. Moreover, the efficacy of tested plant extracts were compared with the standard anticoccidial drug (Toltrazuril) in drinking water.

**Statistical Analysis:**

Data obtained were analyzed by analysis of variance and means separated by Duncan’s multiple comparison test as provided by the SAS statistical analysis program (SAS, 1989). The obtained data were recorded as mean ± S.E.M.

**RESULTS**

Findings pertaining to mortality percent, total oocyst count, lesion and fecal sores, amount of feed consumed, final body weight and feed conversion rates are presented in table 2 and 3.

Table 2 showed that addition of the reference anticoccidial drug (toltrazuril, G C) had succeed in decreasing the total oocyst count (P ≥ 0.05 to be 3.1) in comparison with the control infected non treated birds (G A, 45.5). the same findings were also obtained in groups D, E and F. Addition of 100ppm aqueous extract of either *Allium Sativum* or *Aloe Vera* had decreased significantly the total oocyst count to be 4.4 (G D) and 4.2 (G E). In addition, addition of 50 ppm of both extract (G F) decreased

significantly the total oocyst count to be 3.8.

The experimental infected chicks with mixed Eimeria species induced severe coccidiosis in non medicated chicks and led to high mortality reached to (36%). Addition of 100ppm aqueous extract of either Allium Sativum or Aloe Vera alone or combination of both extract (GF) reduced mortality to be 2 and 4 and 2% respectively (Table 2).

Oral supplementation of bird in drinking water with extract of either Allium Sativum or Aloe Vera either alone or in combination and infected with mixed Eimeria spp showed a significant decrease in lesion score (G D: 0.41, G E: 0.52 and G F:0.37 respectively) compared with infected non treated group (G A: 3.6) and those treated with reference drug (G C: 0.61) Concerning the fecal sore records, the results of G D and F were the best 1.2 and 1.15 then those in groups C and E (1.5 and 1.6) compared with those of group A (4.6). these results were also cleared the lesion scores findings in group C, D, E, and F which were significantly than group A (Table 2). In addition, results of table 2 were clinically evident by results of Table 3. The results obtained in table (3) revealed that the maximum body weight with least FCR (2260 g and 1.63) was seen in group F. the final body weight were nearly similar in groups C, D and E (2130, 2160 and 2120 g respectively) compred to 1940 g in group B and 1690 g in group A.

Discussion

Oocysts are highly infectious, and easily transferred by animals, insects, dust, contaminated feed, water, and equipment [1, 21, 22]. Coccidiosis causes severe economic losses in the poultry industry and it has been controlled by the use of chemotherapeutic agents and or vaccination using live strains of Eimeria. However, because of the emergence of drug-resistant parasite strains due to the use of prophylactic medications, alternative approaches need to be developed. This study investigated the anticoccidial effect of Allium Sativum and Aloe vera aqueous extract either alone or in combination in broilers chickens since previous studies have indicated a broad range of therapeutic properties for Aloe vera [14, 15] and for Allium Sativum [23, 24].

Eimeria, is an intracellular parasite, must adhere to and invade the intestinal epithelial cells in order to replicate. Gut-adapted microorganisms may compete for adhesion and invasion of cells. In our study and after challenging the chicks with mixed Eimeria specially in group A. Birds showed severe form of coccidiosis represented by a high mortality rate (36%), fecal score was 4.6 (meaning severe watery diarrhea with obvious amount of voided blood in litter). High number of the total oocyst reaching 45.5 and a lesion score of 3.6. We aimed to investigate the anticoccidial effect of Allium Sativum and Aloe Vera aqueous extract either alone or in combination in broilers. The mortality % decreased significantly being 4 % in groupes C and E but only 2 % in group D and F. This indicated that Aloe Vera induced similar mortality % as that induced by the

reference anticoccidial drug (toltrazuril). Best results (2%) was obtained in groups D (treated with 100 ppm *Allium Sativum* aqueous extract) and group F (treated with 50 ppm of both extracts of either *Allium Sativum* and *Aloe Vera*) as compared with infected non treated group. Addition of aqueous extract of both tested plant either alone or in combination significantly decreased the total oocyst count, lesion score and improved fecal score. These findings were similar or better than those obtained in group treated with standard anticoccidial drug.

Supplementation with aqueous extract of *Allium sativum* and or *Aloe vera* resulted in significantly lower gut lesion scores and reduced fecal oocyst shedding as compared to the infected non treated group. Taken together, the results of this study suggest that both extracts can inhibit invasion and/or replication of Eimeria species in the gut tissues of chickens. The excellent anticoccidial activity of the tested extracts either alone or in combination may be attributed to their effects on the intracellular stages of the infected Eimeria specially at the 2nd shcizogony stage (late stages of a sexual cycle) as well as those of the sexual stage of Eimeria at the lumen of the intestine. However, the mode of action remains to be determined.

In previous studies, *Aloe vera* treatments displayed tonic effects on the intestinal tract by benefiting microflora and reducing bowel putrefaction, resulting in reduced inflammation [14, 25]. Additionally, Waihenya et al., 2002 reported that the guts of Aloe secundiflora-supplemented chickens were lined with a layer of Aloe material and that the chickens had fewer clinical signs and decreased mortality rates after Salmonella infection [26]. Dutta et al., 2008; Maphosa et al., 2010 also reported that Aloe ingredients also possess anti-parasitic properties in vitro and in vivo [27, 28]. Furthermore, a crude aqueous extract of Aloe ferox displayed ovicidal and larvicidal effects on Haemonchus contortus [28]. In addition, Boudreau and Beland, 2006 reported that, Aloe has been found to contains several beneficial ingredients, including vitamins, minerals, organic acids, and carbohydrates and also to include a few cautionary accounts of harmful effects that could influence body weight gain in Aloe-supplemented chickens [15].

Improvement in growth performance and feed efficiency of broiler chickens supplemented with aqueous extract of either *Allium sativum* and or *Aloe Vera* obtained in the present study may be attributed to the antimicrobial activity of the testes extracts and maintenance of beneficialmicrobial population [29], improving feed intake and digestion [30], and altering bacterialmetabolism [31]. The results further showed that as a growth promoter, Aloe vera compared favorably very well with antibiotic growth promoter. These results appear to confirm the observations made by Mehala and Moorthy, 2008 [32].

The suitability of aqueous extract of either *Allium Sativum* or *Aloe Vera* for administration via drinking water and its good efficacy after only 5 days of treatment shows that the tested extracts are highly appropriate for use in prophylaxis, therapy and intermittent treatment of Eimeria infected chickens. In addition, the performance data, lesion scores, and oocyst counts showed that a 5-day treatment with both extracts either alone or in combination successfully controlled the coccidiosis with no relapse of infection. The findings of this study suggest that *Allium Sativum* and *Aloe vera* could be a safe and beneficial for to treat coccidiosis.
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**Conclusion:**
The obtained findings of the present study suggested that aqueous extract of *Allium sativum* and *Aloe vera* could be used an alternative treatment for controlling avian coccidiosis when added in drinking water in concentration of 100ppm daily for 5 consecutive days.

**References**


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**Table (1):** Anticoccidial capacity of aqueous extract of *Allium Sativum* and *Aloe Vera* alone or in combination in comparison with reference drug in broiler chickens artificially infected with different *Eimeria spp*

<table>
<thead>
<tr>
<th>Group No.</th>
<th>Treatment</th>
<th>Total oocyst No. (<em>X</em> 10³ / g)</th>
<th>Fecal score</th>
<th>Lesions score</th>
<th>mortality %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Control infected non-treated</td>
<td>45.5 ± 3.47 a</td>
<td>4.6 ± 0.27 a</td>
<td>3.6 ±0.28 a</td>
<td>36</td>
</tr>
<tr>
<td>B</td>
<td>Control non-infected non-treated</td>
<td>0.0 ± 0.0</td>
<td>1.0 ± 0.0</td>
<td>0.0± 0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>C</td>
<td>25 ppm Toltrazuril during the 5&amp;6day post infection</td>
<td>3.1 ± 0.18c</td>
<td>1.5 ± 0.01 b</td>
<td>0.61±0.02b</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>100 ppm aqueous extract of <em>Allium sativum</em> bulb</td>
<td>4.4± 0.41b</td>
<td>1.2 ± 0.29 c</td>
<td>0.41±0.01c</td>
<td>2</td>
</tr>
<tr>
<td>E</td>
<td>100 ppm aqueous extract of <em>Aloe vera</em></td>
<td>4.2 ± 0.24 b</td>
<td>1.6 ± 0.02 b</td>
<td>0.52±0.05 b</td>
<td>4</td>
</tr>
<tr>
<td>F</td>
<td>50 ppm aqueous extract of <em>Allium sativum</em> + 50 ppm <em>Aloe vera</em></td>
<td>3.8 ± 0.11 c</td>
<td>1.15 ± 0.01 c</td>
<td>0.37±0.03 c</td>
<td>2</td>
</tr>
</tbody>
</table>

Values within a column with no common superscript letters are significantly different (*P* ≥ 0.05).

Lesion score was determined by macroscopic examination of the duodenum, intestine, and caeca of bird. The score was 0 when no evident lesions were detected while a score of 4 referred to the severely affected bird.

Faecal score was calculated by observing of the faeces voided each day; a rating of 1 indicating normal faeces through 5, denoting the presence of severe diarrhoea and/or a profuse amount of blood.
Table 2. Effect of aqueous extract of Allium Sativum and Aloe Vera on amount of feed consumed, final body weight and FCR of the in broiler chickens artificially infected with mixed Eimeria spp (N = 60).

<table>
<thead>
<tr>
<th>Group No.</th>
<th>Treatment</th>
<th>Amount of feed consumed/bird (g)</th>
<th>Final body weight (g)</th>
<th>FCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Control infected non-treated</td>
<td>3640</td>
<td>1690 ± 17.53 c</td>
<td>2.15 ± 0.11 a</td>
</tr>
<tr>
<td>B</td>
<td>Control non-infected non-treated</td>
<td>3630</td>
<td>1940 ± 18.41 b</td>
<td>1.87 ± 0.47 b</td>
</tr>
<tr>
<td>C</td>
<td>25 ppm Toltrazuril during the</td>
<td>3740</td>
<td>2130 ± 19.37 b</td>
<td>1.755 ± 0.09 b</td>
</tr>
<tr>
<td>D</td>
<td>100 ppm aqueous extract of Allium sativum bulb</td>
<td>3660</td>
<td>2160 ± 17.54 c</td>
<td>1.69 ± 0.11 c</td>
</tr>
<tr>
<td>E</td>
<td>100 ppm aqueous extract of Aloe vera</td>
<td>3740</td>
<td>2120 ± 14.57 b</td>
<td>1.76 ± 0.15 b</td>
</tr>
<tr>
<td>F</td>
<td>50 ppm aqueous extract of Allium sativum + 50 ppm Aloe vera</td>
<td>3690</td>
<td>2260 ± 15.61 a</td>
<td>1.63 ± 0.14 c</td>
</tr>
</tbody>
</table>

Values within a column with no common superscript letters are significantly different (P ≥ 0.05).