Anticoccidial Effects of *Camellia sinensis* (Green Tea) Extract and Its Effect on Blood and Serum Chemistry of Broiler Chickens

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**A B S T R A C T**  
Current experiment was accomplished to evaluate anticoccidial effects *Camellia sinensis* extract in broiler chickens. Broiler chicks (n=72) were divided into six equal groups. First three groups received *Camellia sinensis* extract (CSE) @ 40 gm/kg, 50 gm/kg and 60 gm/kg of basal diet till at the end of experiment (40 days). Group D was treated with reference drug Toltrazuril® (1ml/liter of water) with basal diet. Group E served as infected, non-treated control group. Group F served as normal control group which received only basal diet. Anticoccidial activity of *Camellia sinensis* extract was evaluated by various parameters such as feed conversion ratio, mortality rate, Oocysts per gram of feces (OPG), lesion, and oocyst score and organ weight. Data on hematological parameters and serum chemistry were also collected. *Camellia sinensis* extract reduced *Eimeria* infection in expressions of reduced mortality (%), OPG, lesion and oocyst scores and improved FCR in broiler chickens which were non-significantly different to Toltrazuril® (P>0.05). The green tea extract also improved hematology and serum chemistry of infected chickens which were significantly different to infected group (P<0.05). It was concluded from experiment that *Camellia sinensis* can serve as alternative candidate against poultry coccidiosis.


INTRODUCTION

Poultry Coccidiosis is one of the major infectious diseases, which is transmitted by *Eimeria* (protozoa) having different species effecting production efficiency of chickens (Blake and Tomley, 2014; Chapman, 2014). It causes huge economic losses all around the world (Blake and Tomley, 2014; Chapman, 2014). The disease is clinically recognized disease by high mortality, blood in feces and poor weight gain. Sporulation of *Eimeria* oocysts in soil is rapid that is why once outbreak, its prevention is reported to be difficult. Coccidiosis is mostly treated with synthetic anticoccidial drugs but this approach is facing a serious threat of development of resistance in *Eimeria* strains (Abbas et al., 2008, 2011; Grandi et al., 2016). So, to control this severe disease in poultry different alternative options and protocols are effectively used in different countries of world (Liaqat et al., 2016). Among, other available options, different compounds obtained from botanicals have shown excellent and admirable anticoccidial and other therapeutic effects in poultry and livestock (Abbas et al., 2017a, 2017b, 2018, 2019; Idris et al., 2017; Khater et al. 2018; Mahmood et al., 2018; Fayyaz et al., 2019; Ahmad et al., 2019). Different botanicals such as *Trachyspermum ammi* (Abbas et al., 2019), *Bet vulgaris* (Abbas et al., 2017a), *Saccharum officinarum* (Awais et al., 2014; Abbas et al., 2015) and *Ageratum conyzoides* (Nweze and Obiwulu, 2009) have shown excellent activity against coccidiosis. Different plants contain antioxidant compounds, which have anticoccidial and therapeutic effects (Masood et al., 2013;
Awaad et al., 2016). Camellia sinensis commonly known as ‘green tea’ is distributed throughout Pakistan and India (Jang et al., 2007; Izzreen and Mohd-Fadzelly, 2013). It has been proven to possess various therapeutic activities like antiparasitic, antioxidant and immuno-modulatory properties in poultry (Chen et al., 2008; Abbas et al., 2017a & b).

Based on the various therapeutic and beneficial effects of C. sinensis, current experiment was conducted to check its anticoccidial efficacy against coccidiosis in chickens.

**MATERIALS AND METHODS**

**Plant material:** Camellia sinensis leaves were obtained locally from Faisalabad. Leaves were dried, converted to powdered form and aqueous methanolic extract of C. sinensis was prepared using Soxhlet apparatus following method described by Abbas et al. (2017). The extract was dried in freeze drier and stored at 4°C until further use.

**Parasite:** Eimeria parasite was collected from naturally infected intestines of broiler chickens from outbreak cases and local poultry farms in Faisalabad. Inf ective material was preserved and sporulated in potassium dichromate (2.5%) using the standard guidelines as provided by Ryley et al. (1976).

**Experimental design:** Experimental design was approved by research and ethics committee of the Department of Parasitology, University of Agriculture Faisalabad. Briefly, 72 broiler chicks were procured and kept at experimental station of department of Parasitology following proper managemental practices. After one week of acclimatization all chickens were divided into six equal groups randomly. At two weeks of age all groups except F (normal control) were infected with 50,000 oocysts of Eimeria species. C. sinensis extract was given in feed at different doses (4, 5 and 6%) in basal diet. First three groups received C. sinensis extract (CSE) @ 40 gm/kg, 50gm/kg and 60gm /kg of basal diet till the end of experiment (40 days). Group D was treated with reference drug Toltrazuril® (1ml/liter of water) with basal diet. Group E served as infected non-treated control group. Group F served as normal control group which received only basal diet. The basal diet was comprised of soybean and corn meal.

**Evaluation of Anticoccidial activity:** Anticoccidial potential of Camellia sinensis extract (CSE) was evaluated on the basis of parameters such as lesion score (Johnson and Reid, 1970), oocyst score (Hilbrich, 1978), Oocysts per gram of feces (OPG), mortality rate, feed conversion ratio and organ weight (Abbas et al., 2017).

**Feed conversion ratio:** Feed conversion ratio (FCR) was calculated by following formula:

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\text{Feed conversion ratio} = \frac{\text{Mean Feed Consumption in Kgs}}{\text{Mean Weight gain in Kgs}}
\]

**Organ weight:** On last week of experiment lymphoid organs including liver, spleen, kidney, intestine and gizzard were removed surgically from selected chickens after slaughtering and organs were weighed.

**Hematology and serum chemistry:** Blood and serum samples were collected at 40th day (last week) of experiment. Blood samples were collected in EDTA coated tubes by slaughtering chicks and were stored at 4°C. Collected blood samples were analyzed for Packed Cell Volume (microhematocrit method), hemoglobin level (Sahl’s apparatus). RBCs and WBCs counting were done by method as described by Natt and Herrick (1952). Serum chemistry of different serum enzymes was done with the help of different commercial kits (Merck, Germany).

**Statistical analysis:** Statistical analysis of collected data was done by Duncan’s Multiple Range test. Variance among groups was determined by using ANOVA technique.

**RESULTS**

**Lesion and oocyst score:** Mean lesion and oocysts score values are shown in Table 1 and Table 2. Groups treated with Camellia sinensis extract (CSE) exhibited reduced lesion score and oocysts score which were significantly similar with reference drug Toltrazuril® (P>0.05).

**Oocysts per gram of feces (OPG):** Oocysts per gram of feces values are given in Table 3. C. sinensis administered group also exhibited lower OPG values which were non-significantly different to reference drug Toltrazuril® (Table 3).

**Feed conversion ratio and mortality rate:** Better feed conversion ratio was observed in CSE treated groups (Table 4) (P<0.05). Mortality rate was significantly different in CSE treated groups (P<0.05) (Table 5).

**Organ weight:** Organ weight values of CSE treated group were non-significantly different to reference drug Toltrazuril® as shown in Table 6 (P>0.05).

**Hematology and Serum chemistry:** Mean hematological values and serum enzyme values of different group were improved in CSE treated groups (P>0.05) as shown in Table 7 and Table 8, respectively.

**DISCUSSION**

Many botanicals and their products have been reported to have shown diverse biological effects in birds and ruminants as proven by different studies (Abbas et al., 2017, 2018). In current study in vivo anticoccidial effects of C. sinensis extract were measured in terms of different parameters such as lesion, oocyst scores, oocysts per gram of feces (OPG), feed conversion ratio, mortality rate and such type of anticoccidial parameters have also been evaluated in recent studies (Hong et al., 2016; Gadelhaq et al., 2018). C. sinensis showed remarkable and comparable anticoccidial effects on all of the tested parameters when compared with reference drug Toltrazuril® (P≥0.05). C. sinensis also improved blood profile and serum chemistry of infected chickens. Wang et al. (2008) has reported similar types of anticoccidial effects of grape seed extract in broiler chickens. In another study, Bidens pilosa a flowering plant have shown anticoccidial effects against Eimeria in chickens (Yang et al., 2015).
Plants and their products have provided better results in terms of controlling coccidiosis in chicken as compared to commercially available anticoccidial drugs (Gandi et al., 2016). Antioxidant compounds in different plants have played important role in increasing the immunity and protection level against coccidiosis (Awaad et al., 2016). Leaves of Carthamus tinctorius commonly known as sunflower have shown to enhance cellular and humoral immunity against poultry coccidiosis (Lee et al., 2009).

In another study (Nweze and Obiulu, 2009), Ageratum conyzoides (billy goat weed) extract was administered orally in broiler chicks. Oral administration of Ageratum conyzoides extract showed positive effect in terms of improved hematological parameters such as red and white blood cell count. *Trichitemum cestivum* or wheat bran polysaccharides (arabinoxylans) have shown immunomodulatory effects against *Eimeria* infection in chicken (Akhtar et al., 2012). Furthermore, it produced positive effect on organ weight and reduced severity of *Eimeria* infection. Saccharium officinarum extract has shown to improve immune response and act as biological modifier in broilers (Awais et al., 2014). Abbas et al. (2017) has reported the immunomodulatory potential of *Camellia sinensis* crude powder against experimental coccidiosis in chickens. *Camellia sinensis* powder induced cellular and humoral immune response in infected chickens. *Camellia sinensis* crude powder showed positive effects against coccidiosis. Similar type of anticoccidial effects of green tea were previously reported by Jung et al. (2007). Abbas et al. (2019) has reported similar type of anticoccidial effects of *Trachyspermum ammi* (Ajwain) in broiler chickens. Supplementation of *Trachyspermum ammi* reduced *Eimeria* infection and improved blood and serum profile of infected broiler chicks.

Dkhil et al. (2019) have reported anticoccidial, anthelmintic and antioxidant effects of *Salvadora persica* extract in mice which were experimentally infected with *Eimeria*. *Salvadora persica* extract produced anthelmintic and health protective effects in infected mice. *Salix babylonica* extract produced excellent anticoccidial effects in rabbits suffering from natural *Eimeria* infection. *Salix babylonica* extract reduced coccidiosis infection in rabbits (Rivero-Perez et al., 2019).

Conclusions: Results of current study have confirmed that treatment of *Camellia sinensis* showed excellent anticoccidial effects in broiler chickens and also improved hematological parameters and serum chemistry of infected chickens. It was concluded that *Camellia sinensis* can serve as alternative to synthetic anticoccidial drugs. An advantage of using natural plants like *Camellia sinensis* is to lower risk of synthetic drug resistance. Moreover, there are no residual effects of such natural products on poultry.
meat and are beneficial for human consumers thus having no adverse effects on their health.

Authors contribution: XZ, XL and CN assisted in execution of experiment and final proof reading of manuscript. AA and RZA performed and collected data of experiment. MAZ analyzed the data.

REFERENCES


