



BIOCHEMICAL EFFECT OF *COCCIDIA* INFESTATION IN LAYING HEN

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ABSTRACT

This study was performed to investigate the effect of *Coccidia* infestation on several biochemical parameters in laying hens. One hundred and twenty laying hens were assigned into two groups; the first one contained 20 chickens and kept as control group. The second group includes 100 chickens infested with *Coccidia*. Blood samples were collected by slaughtering of the birds. The obtained results revealed that, significant decreases in serum glucose, total protein, albumin, globulin, (A/G) ratio, total cholesterol, triglyceride, HDL, LDL, VLDL, SOD, iron, calcium and inorganic phosphorus in *Coccidia* infested hens as compared with control group. Furthermore ALT, AST, alkaline phosphatase, MDA and CAT were significantly increased in *Coccidia* infested hens on comparison with control group. From the obtained results it could be concluded that *Coccidia* infestation affecting laying hens caused a marked biochemical changes of some investigated blood parameters.

KEY WORDS: *Coccidia*- Laying hen- anti-oxidant- Minerals.

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1- INTRODUCTION

Poultry industry is one of the rapidly growing major segments of agriculture sector and has been showing a tremendous growth during the last few decades. Coccidiosis is one of the most common and expensive diseases in the poultry industry (Shirley *et al.*, 2007). It has major economic impacts on poultry by reducing performance and decreasing productivity (Zhang, 2013). Worldwide, coccidiosis causes more than 3 US\$ billion in damages each year (Herman, 2010).

Coccidia consist of a wide variety of single celled, parasitic animals in the subkingdom Protozoa of the phylum Apicomplexa, the subclass *Coccidia*, family *Eimeriidae*. As a group, the coccidia of the genus *Eimeria* are predominately host-specific; i.e., each species occurs in a single host species or a group of closely related hosts (Conway and McKenzie, 2007). There are seven commonly recognized species of chicken

Coccidia; *E. acervulina*, *E. brunetti*, *E. maxima*, *E. mitis*, *E. necatrix*, *E. praecox* and *E. tenella*. Each *Eimeria* species develops in a particular location within the chick digestive tract with some overlap seen between species (Allen and Fetterer, 2002).

Chicken with coccidiosis are characterized by dysentery, enteritis, emaciation, drooping wings, poor growth and low production (Awais *et al.*, 2012). With high rate of mortality and morbidity (Shirzad *et al.*, 2011). Coccidiosis causes severe enteritis/typhlytis with hemorrhages, tissue damage and some metabolic disturbances (Dede *et al.*, 2002). Biochemical serum analysis of coccidia infected chickens showed a significant increase in alanine amino transferase levels and there were also changes in total protein and cholesterol level in the serum (Patra *et al.*, 2009). The antioxidant status showed an increase in MDA in infected birds, compared to healthy chickens correspondingly, a decreased SOD activity

was observed in infected birds compared to controls. Furthermore, CAT activity in infected birds was higher than in healthy ones (Georgieva *et al.*, 2006). The lesions caused by *Eimeria* parasite disturb nutrient absorption, triggering several changes in carbohydrates, lipid, protein and macro and trace mineral metabolism (Witlock and Ruff, 1997).

Therefore, this aim of the present study was to investigate the effects of coccidia infestation on several biochemical blood parameters in laying hen.

2. MATERIAL AND METHODS:

The present study was carried out on one hundred and twenty laying hens have been adopted from 3-delta governorates (Kaluobia, Gharbia and Kafer El-sheikh) during the period extended from May to December 2012 for determination of the biochemical effects of *Coccidia* infestation on laying hens.

2.1. Experimental design

Chickens were divided into two groups:

Group (1): composed of 20 clinically healthy laying hens served as control.

Group (2): comprised 100 *Coccidia* infested laying hens showing bloody mucoid diarrhea, clinically examined and symptoms, morbidity and mortality were recorded. Postmortem examination for the dead ones in poultry laboratory was conducted and the gross lesions were recorded.

2.2. Blood samples and biochemical analysis:

Blood samples were collected from all study chicken by slaughtering of birds in dry, clean tubes. Serum was separated and processed directly for glucose determination, and then for subsequent biochemical analysis.

Serum Glucose, ALT, AST, ALP activity, Total Protein, Albumin, Globulin, Total Cholesterols, Triglycerides, HDL, LDL, VLDL, MDA concentration, SOD, CAT

activity, iron and calcium as well as inorganic phosphorus were assayed according to the methods described by (Kaplan *et al.*, 1984), (Reitman and Frankel, 1957), (Kind *et al.*, 1954), (Pagana and Pagana, 2010), (Abell, 1985), (Bablok *et al.*, 1988), (Gordon, 1977), (Friedewald *et al.*, 1972), (Bauer, 1982), (Esterbauer *et al.*, 1982), (Nishikimi *et al.*, 1972), (Asru, 1972), (Fernandez *et al.*, 1971), (Moorhead and Briggs, 1974), (Goldenberg, 1966), respectively.

2.3. Statistical analysis:

Statistical analysis of the results was carried out using student's T-test according to Kempthorne (1969).

3. RESULTS:

The present data in table (1) showed a significant decrease of serum glucose, total protein, albumin, globulin, (A/G) ratio, total cholesterol, triglyceride, HDL, LDL and VLDL in *Coccidia* infested chicken as compared with control group. Furthermore ALT, AST and alkaline phosphatase were significantly increased in *Coccidia* infested hens on comparison with control group.

Table (2) showed significant increase in MDA and CAT activity in *Coccidia* infested chicken as compared in control group. While SOD, iron, calcium and inorganic phosphorus in infested group as compared with control group.

4. DISCUSSION:

Avian coccidiosis is a major parasitic disease of industry concern worldwide. It is caused by at least seven distinct species of *Eimeria apicomplexan* protozoa that infect the intestinal mucosa with serious consequences. Afflicted birds exhibit various clinical manifestations, i.e., nutrients malabsorption, inefficient feed utilization, impaired body weight gain, and in severe cases, mortality. Additionally, pre-exposure to certain species of *Eimeria* has been strongly implicated in promoting

Biochemical effect of *Coccidia* infestation in laying hen

Table 1: Effect of coccidian infestation on serum glucose, liver function and lipid profile in laying hen.

Blood Parameter	Control Group	Infested group
Glucose	219.80±1.75	177.56±1.23*
ALT	25.7±0.27	90.3±1.4**
AST	85.00±1.46	137.41±2.15*
Total Protein	5.45±0.21	3.81±0.30*
Albumin	2.34±0.19	1.29±21*
Globulin	3.11±0.17	2.52±0.20*
(A/G) Ratio	0.75±0.01	0.51±0.02**
ALP	154.9±0.95	233.1±14.7**
Total cholesterol	217.12±2.08	139.51±1.99*
T.G	266.75±3.93	±2.13*171.50
HDL	31.19±0.17	±0.11*20.93
LDL	29.30±0.17	±0.12*20.51
VLDL	53.35±1.11	±0.88*34.31

Non - significant difference at $p > 0.05$

*: significant difference at $p < 0.05$

** : highly significant difference at $p < 0.01$

Table 2: Effect of coccidian infestation on serum antioxidant and some elements in laying hen.

Blood Parameter	Control Group	Infested group
MDA	10.56±0.17	19.71±0.21*
SOD	3487±8.65	2512±56.2**
CAT	1218±15.15	2092±9.9**
Fe	169.80±3.15	±2.18*105.75
Ca	8.33±0.20	6.15±0.32*
Inorganic P	5.58±0.17	4.01±0.21*

Non - significant difference at $p > 0.05$

*: significant difference at $p < 0.05$

** : highly significant difference at $p < 0.01$

necrotic enteritis (Williams, 1999).

Avian coccidiosis is thought to be the one of the most expensive infectious diseases of poultry. Thus far, chemoprophylaxis and anticoccidial feed additives have controlled the disease but situation has been complicated by the emergence of drug resistant strains against commonly used drugs (Masood *et al.*, 2013).

In this study *Coccidia* infestation in laying hen exhibited a significant decrease in serum glucose level as compared with control group. The recorded significant decrease in serum glucose level could be attributed to anorexia as confirmed by the opinion of (Freeman, 1970) who suggested that, anorexia and intestinal tract inflammation inhibit glucose absorption, using up liver glycogen reserves, and in severe infections, hypoglycemia is due to inhibition of liver glycogenolysis. These results are nearly similar to those observed by (Freitas *et al.*, 2008) who reported that the infested birds with coccidiosis presented hypoglycemia, which remained during most of the experimental period. Also, (Patra *et al.*, 2009) showed that, the infected birds presented hypoglycemia. These results came in agreement with the finding of (Freitas *et al.*, 2008) who reported that infected animals presented hypoglycemia at the end of the experimental period, possibly from mobilization of organic reserves to replace deficits in hepatic glycogen stores due to infection.

Infestation with coccidian parasites in laying hen showed highly significant increase in serum ALT and serum AST level as compared with control group. Similarly, (Patra *et al.*, 2010) and (Mondal *et al.*, 2011) reported that, Liver function test of the infected broiler chicken with *Eimeria spp.* showed a significant increase in the serum ALT, AST. They suggested that, Significant damage of cell lining of the caecal wall along with their inflammation and severe blood loss causing tissue loss from the body may attribute to increased AST activity.

Increases in serum AST and ALT activities were due to hepatocellular damage (Cam *et al.*, 2008).

Infestation with coccidia parasites in laying hen exhibited a significant decrease in serum total protein level, serum Albumen, serum Globulin level and (A/G) ratio as compared with control group (Mondal *et al.*, 2011) suggested that, Fall in total plasma protein (hypo-proteinemia) in the coccidia infected birds might be due to acute stress that leads to cortisol secretion and catabolism of protein. Similarly, to (Kaneko *et al.*, 1997) Acute hemorrhage causes large loss of plasma protein followed by rapid movement of interstitial fluid without protein into the plasma compartment to induce acute hypo-proteinemia. (Patra *et al.*, 2009) State that, Marked hypo-proteinemia may be contributed by nutrient mal absorption, liver changes and marked hemorrhagic enteritis.

Infestation with coccidian parasites in laying hen revealed a highly significant increase in serum ALP as compared with control group. Our results agreed also with (Dkhal *et al.*, 2012). On the contrary (Patra *et al.*, 2010) reported that ALP level was significantly reduced in the affected birds which are indicative of damages to the bone marrow with severe growth depression as ALP is known to rise during active growth .

Our study show that infestation with coccidian parasites in laying hen exhibit a highly significant decrease in serum Cholesterol level , a significant decrease in serum tri-glyceride level , significant decrease in HDL,LDL and VLDL level as compared with control group. Anorexia may be a major reason for declined triglyceride level in the coccidia affected birds (Allen and McMurtry, 1984). Another factor that may have contributed to lipid metabolism disorder was the clinical anemia presented by the infected birds during the first two weeks post-infection (Freitas *et al.*, 2008). Furthermore, Freitas *et al.* (2006)

concluded that this reduction in serum lipids was associated with a significant increase in hepatic fat while assessing pathological changes.

Infestation with *Coccidia* parasites in laying hen Exhibit a highly significant increase in serum MDA level as compared with control group. On other hand it shows a highly significant decrease in serum SOD level as compared with healthy control group. While serum CAT level in infested hen is highly significant increase than control. Eimeriosis lead to oxidative stress in the organism of infected chicks expressed by alterations of antioxidant enzymes and increased MDA. The elevated MDA blood concentrations in infested chickens could be attributed to increased ROS production, resulting in lipid peroxidation. The higher blood MDA in infected birds is probably due to the oxidative stress occurring after infection (Koinarski *et al.*, 2005). The reduced SOD activity may be due to the inactivation by

interaction with oxygen radicals. Increased CAT activity may be a compensatory mechanism to get rid of excess peroxides (Georgieva *et al.*, 2011).

The mean value of serum iron, calcium and inorganic phosphorus level in the *Coccidia* infested group was decreased significantly on comparison with the mean value recorded in the control clinically healthy group. This variation may be due to disturbed absorption for electrolytes yielding from coccidian infestation. This reduction in plasma electrolytes, in association with blood losses, affects the compensatory hematopoiesis such that low hematocrit and low hemoglobin concentrations are observed (Turk, 1986).

In conclusion, present results suggest that eventually *Coccidia* provoked the lipid peroxidation and increased oxidative stress and imbalance in the antioxidant status in the infected chickens.

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التأثيرات الكيميائية الحيوية للإصابة بالكوكسيديا في الدجاج

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الملخص العربي

أجريت هذه الدراسة للوقوف على مدى تأثير الإصابة بمرض الكوكسيديا على المتغيرات الكيميائية الحيوية في الدجاج البياض. وقد أجريت على 120 دجاجة بياض تم تقسيمهم الى مجموعتين. المجموعة الأولى تحتوي على عدد 20 دجاجة وقد استخدمت كمجموعة ضابطة. والمجموعة الثانية تحتوي على عدد 100 دجاجة مصابة بالكوكسيديا. وتم تجميع العينات عن طريق الذبح. وقد أوضحت الدراسة ما يلي نقص معنوي في مستوي الجلوكوز، البروتين الكلي، الألبومين، الجلوبيولين، نسبه (الألبومين/الجلوبيولين)، الكوليسترول الكلي، ثلاثي الجلسريدات، الكوليسترول عالي الكثافة، الكوليسترول منخفض الكثافة، الكوليسترول منخفض الكثافة جداً، السوبر أوكسيد ديسميوتيز، الحديد، الكالسيوم و الفوسفور الغير عضوي في الدجاج المصاب مقارنة بالمجموعة الضابطة. كما اتضح أيضاً زياده معنويه في مستوي ألانين أمينو ترانس فيراز، أسبرتات أمينو ترانس فيراز، الفوسفاتيز القاعدي، ال- مالون داى ألدهيد، الكتاليز مقارنة بالمجموعة الضابطة. طبقاً لنتائج هذه الدراسة يتضح لنا أن الإصابة بمرض الكوكسيديا في الدجاج البياض يؤثر بشكل واضح على المتغيرات الكيميائية الحيوية لديهم.

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