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Experimental Ascaridiasis Induced Immunosuppression in WLH Chicks: Biochemical Parameters

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ABSTRACT:

This study was conducted to determine the effect of *Ascaridia galli* infection on immune system of White Leg Horn chicks. Impact on the immune system of the bird was studied in terms of biochemical parameters, i.e. blood sugar level, cholesterol level, urea level, acid phosphatase level, and alkaline phosphatase level in control group and in two other groups which were experimentally infected with 25 and 500 embryonated eggs of *A. galli.* Results obtained were statistically analyzed and presented in graphical form.

Keywords: WLH chicks, *Ascaridia galli*, immunosuppression

INTRODUCTION

Gastrointestinal nematodes are one of the most costly parasites in terms of production losses in ruminants and poultry (Gamble and Zarlenga;1986). Helminthiasis especially ascaridiasis is a concern for poultry industry globally as it leads to very high degree of pathogenicity.

A. galli infection in chicken is associated with many clinical symptoms such as loss of appetite and thus reduced body weight, ruffled feathers, drooped wings, retarded muscular and osteological development and increased mortality (Ackert, Herrick 1928, Dahl et al. 2002). Ascaridiasis also result in reduction of egg production. Indirect losses are due to suppression of immune system function which makes the chicken more susceptible to secondary infections. This study is a part of doctoral work of the first author. In this study, the effect of experimental ascaridiasis on different biochemical parameters of WLH chicks was observed, to assess overall effect on immunity of the bird.

MATERIALS AND METHODS

For the study day old 78 commercial WLH chicks, were selected from the stock available at the poultry farm. For biochemical studies these chicks were divided into three groups.

After labeling and grouping of all the chicks, the inocula with desired number of embryonated eggs required for a particular experiment were prepared and administered orally, directly into the oesophagus with a blunt 18 guage feeding needle, mounted on suitable graduated syringes. After infection, the chicks were kept free in spacious cages in the animal house provided with feed and water ad libitum. The control group c, were sacrificed on day zero of infection. Six birds of each group, T1- (each bird infected with 25 embryonated eggs of *A. galli*) and T2-(each bird infected with 500 embryonated eggs of *A. galli*) were sacrificed after 7, 14, 21, 28, 35 and 42 days of infection, for collection of blood. The blood collected was used for different biochemical studies.

All the biochemical studies were performed on the serum of control and infected groups of chicks.

The serum sugar was determined according to the Folin and Wu method (1920) adopted from Oser (1976). Total cholesterol in serum was determined according to the method of Zak and Epstein (1961). The serum urea was estimated according to the Di-acetyle monoxine method of Notesion (described by Nath, 1976). Total alkaline phosphatase in the serum was determined according to the modified Bondansky method (described by Oser, 1976). Phosphatase liberated was estimated according to Fiske

and Subbarow (1925) using aspectrophotometer at 473u (nm). Serum acid phosphatase level was determined as described by Oser (1976). The buffered acid phosphatase substrate of Shinowara, Jones and Rainhart was used for incubation.

The data obtained was analyzed statistically to get a clear picture of the effects of experimental ascaridiasis on different parameters taken into consideration.

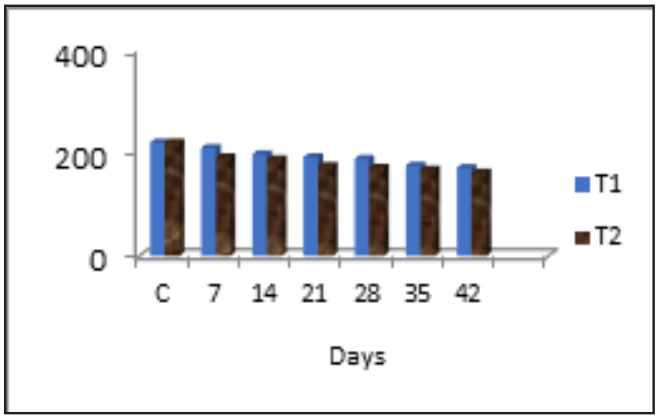

Fig. 1 : Blood Sugar Level

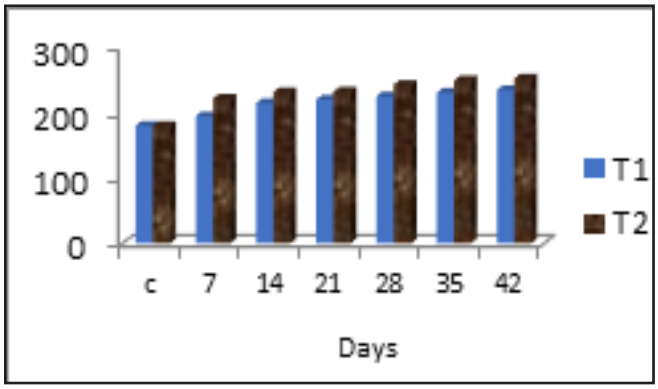

Fig. 2 : Cholesterol Level

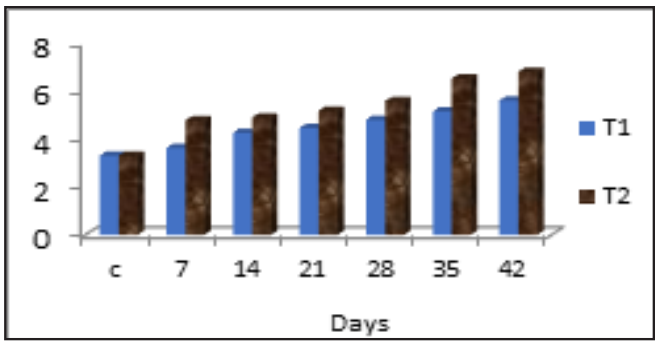

Fig. 3 : Urea Level

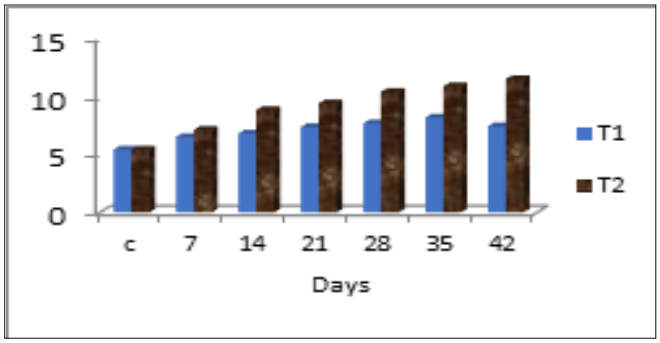

Fig. 4 : Acid Phos Level

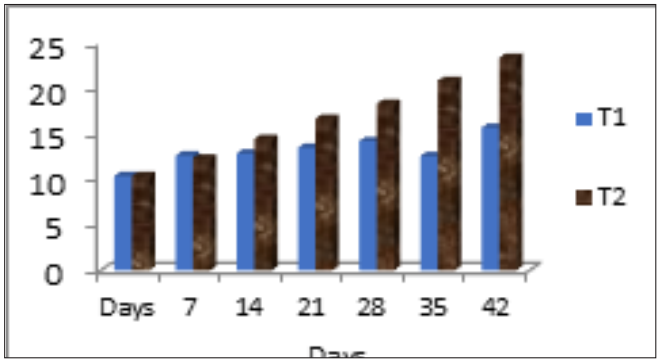

Fig. 5 : Alkaline Phos Level

Table-1 Biochemical responses in the serum of WLH chicks during experimental infection with 25 embryonated eggs of *A. galli*

S. No.	Parameters	Control (C)	Infected with 25 embryonated eggs (T1)					
			7 days P.I	14 days P.I.	21 days P.I.	28 days P.I.	35 days P.I.	42 days P.I.
1.	Sugar (mg/dl)	220.28 ± 0.0654	209.61* ±0.8688	197.55* ±0.0991	191.83* ±0.4152	188.53* ±0.1054	175.71* ±0.1600	171.03* ±0.5283
2.	Cholesterol (mg/dl)	180.38 ±0.0909	194.91* ±0.2414	215.05* ±0.1565	220.53* ±0.1173	225.35* ±0.2629	231.15* ±2.2125	235.16* ±0.2458
3.	Urea (mg/df)	3.31 ±0.2663	3.63** ±0.1054	4.26* ±0.0760	4.46* ±0.0802	4.80* ±0.0365	5.15* ±0.0619	5.61* ±0.0909
4.	Acid Phos. (IU/L)	5.40 ±0.2955	6.48* ±0.0945	6.78* ±0.0477	7.33* ±0.760	7.66 ±0.0666	8.16* ±0.0557	7.40* ±0.0600
5.	Alkaline Phos (IU/L)	10.36 ±0.2764	12.61** ±0.0703	12.83* ±0.0333	13.46* ±0.0614	14.18*** ±2.4494	12.55* ±0.0670	15.66* ±0.1115

Results are mean ± S.E. (n= 6) (Fisher's 't' test 1950)

*'p' value : * <0.01; ** <0.02; *** <0.10 (Control vs infected groups of chicks)*

Table-2 Biochemical responses in the serum of WLH chicks during experimental infection with 500 embryonated eggs of *A. galli*

S.No.	Parameters	Control (C_3)	Infected with 500 embryonated eggs (T2)					
			7 days P.I.	14 days P.I.	21 days P.I.	28 days P.I.	35 days P.I.	42 days P.I.
1.	Sugar (mg/dl)	220.28 ± 0.0654	191.66* ±0.7601	188.00* ±0.3651	175.00* ±0.9660	171.60* ±0.6688	168.00* ±0.3651	162.33* ±1.3581
2.	Cholesterol (mg/dl)	180.38 ±0.0909	222.00* ±0.6324	231.83* ±0.7031	232.66* ±0.9888	243.08* ±0.7485	250.00* ±2.2509	252.66* ±3.0184
3.	Urea (mg/df)	3.31 ±0.2663	4.78** ±0.307	4.90* ±0.0577	5.18* ±0.0477	5.58 ±0.1137	6.53* ±0.1563	6.81* ±0.1701
4.	Acid Phos. (IU/L)	5.40 ±0.2955	7.11* ±0.0477	8.80* ±0.0365	9.38 ±0.1495	10.36 ±0.1492	10.85* ±0.0991	11.46* ±0.4363
5.	Alkaline Phos (IU/L)	10.36 ±0.2764	12.28* ±0.0792	14.43* ±0.1173	16.65* ±0.2140	18.30* ±0.0894	20.80* ±0.2780	23.33* ±0.7601

Results are mean ± S.E. (n= 6) (Fisher's 't' test 1950)

*'p' value : * <0.01; ** <0.02; *** <0.10 (Control vs infected groups of chicks)*

RESULT AND DISCUSSION

Significant changes observed in the blood of *A. galli* infected birds as compared to their control during the present experiment were as follows.

Blood sugar level- The serum sugar level revealed a noteworthy fall in 25 embryonated egg treated group of birds. A highly significant fall (P<0.01) in sugar level between infected and control groups of chicks occurred between 7th and 42nd day. An overall fall from 220.28mg/dl to 171.03 mg/dl was observed during the present investigation (table-1). Infection of *A. galli* in WLH chicks with 500 embryonated eggs, showed a highly significant (P<0.01) fall in sugar level from first to sixth week (table-2). An overall deviation from 220.28mg/dl to 162.33mg/dl in sugar level was observed during the experiment (fig.1).

Blood cholesterol level-Serum cholesterol level continuously increased during 25 embryonated eggs of *A. galli* infection in birds. Highly significant elevation was (P<0.01) observed from first week to subsequent weeks. An overall rise from 180.38mg/dl to 235.26mg/dl was recorded in cholesterol level during the present study (table-1). During all days, in case of 500 embryonated eggs of infection of *A galli*, the rate of the cholesterol level was relatively more and highly significant (P<0.01) (table-2). An overall rise from 180.38mg/dl to 252.66mg/dl was recorded in the cholesterol level(fig.2).

Blood urea level-infection with 25 embryonated eggs of *A galli* in WLH chicks, revealed a rise in serum urea level during the investigation. No significant changes were observed at first week, post infection. Statistical analysis showed a significant (P<0.01) rise from second to sixth week after infection. An overall rise from 3.31mg/dl to 5.61mg/dl was recorded in blood urea level during the present investigation (table-1). Increase in level of blood urea was observed to be highly significant (P<0.01) in all days of experiment, treated with 500 embryonated eggs of *A. galli* of WLH chicks (table-2). An overall rise was observed from 3.3 mg/dl to 6.81/mg/dl in the blood urea level (fig.3).

Blood acid phosphatase level- The acid phosphatase activity of WLH chicks which were treated with 25 embryonated eggs, was found to increase during the experiment. Statistical analysis revealed highly significant (P<0.01) rise in acid phosphatase activity between control and infected groups of chicks. An overall rise was recorded from 5.40 IU/L to 7.40 IU/L (table-1). Statistically highly significant (P<0.01) rise was observed in acid phosphatase level in WLH chicks, treated with 500 embryonated egg of *A. galli* in between 7th day and 42nd day of experiment (table-2). An overall rise from 5.40 IU/L to 11.46 IU/L in acid phosphatase activity was recorded (fig.4).

Blood alkaline phosphatase level-Statistical analysis revealed significant rise in alkaline phosphatase level in chicks during first and second week (P<0.02), third week (P<0.01), fourth week (P<0.10) and fifth and sixth weeks (P<0.01) post infection in chicks treated with 25 embryonated eggs of *A. galli* (table-1) and highly significant rise, in 500 embryonated eggs treated group of *A. galli,* in blood alkaline phosphatase activity between control and infected groups of chicks (P<0.01) (table-2). An overall rise from 10.36 IU/L to23.33 IU/L was observed during the investigation (fig.5).

The chicks infected with low and high doses of embryonated egg of *A. galli* revealed a suppression of sugar level, whereas the cholesterol, urea, acid, and alkaline phosphatase activity showed significant rise in their concentration.

From the physiological point of view decreased plasma level in chicks was found after loss of plasma by extravasations or by renal excretion or when protein synthesis is impaired owing to malnutrition, vitamin deficiencies or diseases involving the digestive organs and liver (Oser 1976). The fall in the serum sugar level was attributed to the disturbance in the carbohydrate metabolism in *A. galli* infected chicks. This in turn leads to the mal absorption of sugar in the injured gastrointestinal tract of the infected chicks. A fall in serum sugar level was observed by Rani (1980) in WLH chicks during heavy infection of *A. galli.*

The increase in cholesterol level is suggestive of inhibited activity of the enzymes involved in anabolism of lipids in the host tissue.

Heavy infections may also be supposed to lead to intestinal obstruction, ultimately leading to increased blood urea level. The rise in blood urea level in the present investigation may also be attribute to the enhanced nitrogen metabolism brought about by the round worm, *A galli* leading to a high rate of the urea production.

The present investigation also revealed a highly significant rise in both serum acid and alkaline phosphatase activity in *A. galli* infected group of chicks. During the host-parasite interaction the energy metabolism of the host is disturbed and thus the elevation in the alkaline phosphatase level may be attributed to the increase in the activity of various isozymes in the intestine of the host.

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