

18 July 1986; Revised 20 December 1986

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HYPER OR HYPOPROTEINEMIA DUE TO HELMINTHIASIS IN POULTRY

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AVIAN diseases, like certain viral, bacterial and protozoan infections were observed to affect the serum proteins and their fractions. Squibb *et al*¹ reported hyperproteinemia in diseases like coryza and cholera and hypoproteinemia due to Newcastle disease. Rajendran *et al*² observed hyperproteinemia, due to increase in both the albumin and globulin levels, in visceral lymphomatosis and fowl pox and because of the fall in both albumin and globulin levels, hypoproteinemia, in caecal cocci-

diosis and erythroleucosis. In Ranikhet disease, the depletion in albumins was compensated by increase in globulins and hence the total protein level did not alter². The present report is an attempt to elucidate the effect of various gastro-intestinal helminthic infections (field cases) on the total protein, albumin and globulin levels and albumin to globulin (A/G) ratio in the domestic fowl, *Gallus domesticus*.

The blood and viscera (intestine along with its associated glands) of 167 cockerels and 149 pullets, including both healthy (uninfected) and helminth-infected (natural infection) fowls, were examined. The birds were between 3 and 4 months in age and weighed 450-800 g. The birds were sacrificed and about 5 ml of the blood was collected from each bird, from the jugular vein, into empty vials. The viscera from each bird was collected in separate polythene bags. The coagulated blood was centrifuged for 5-10 min at 3000 rpm to separate the serum. From each of the serum samples, the total protein³ and albumin⁴ levels were estimated. Making use of these data, the globulin level and the A/G ratio were calculated.

The intestines were thoroughly examined for the presence of helminthic worms. The different types of helminths that infected the fowl were the tape worms, *Raillietina tetragona*, *R. echinobothrida*, *R. cesticillus*, *Cotugnia digonopora*, *Choanotaenia infundibulum*, *Hymenolepis carioca* and the round worm, *Ascaridia galli*. The worm infestation was categorized into 4 types i.e. single, double, triple and quadruple infections, after taking into account the number of different species of worms involved in infecting the same fowl⁵.

The values of total protein, albumin and globulin levels and A/G ratio in cockerels and pullets are given in tables 1 and 2 respectively.

In healthy fowls:

The results indicate a slightly higher level of total proteins in pullets than in cockerels. This was due to the increase in both albumin and globulin fractions, but the rise was more marked in globulins and hence a drop in the A/G ratio of the pullet. The total protein levels obtained in cockerels and pullets were more or less in complete agreement with earlier findings⁶⁻¹⁰. The values of albumin and globulin levels were in closer agreement with those of Perik *et al*⁷. The values of A/G ratio obtained in cockerels and pullets in the present study are considerably higher than those reported by earlier investigators^{2,7,11,12}.

Table 1 Values of total protein, albumin and globulin levels and albumin to globulin (A/G) ratio of serum in healthy (uninfected) and helminth-infected (field cases) cockerels of 3-4 months age

Infection	Total protein (g%)	Albumin (g%)	Globulin (g%)	A/G ratio
NONE -- Healthy (18)	4.23 ± 0.62	2.54 ± 0.47	1.68 ± 0.70	2.05 ± 1.54
SINGLE INFECTION¹:				
RT (17)	5.45 ± 1.06	2.97 ± 0.58	1.36 ± 0.48	2.44 ± 0.94
RE (7)	3.87 ± 0.59	2.54 ± 0.13	1.33 ± 0.41	2.13 ± 0.74
RC (3)	3.80 ± 0.24	2.61 ± 0.14	1.18 ± 0.14	2.23 ± 0.20
CI (2)	3.00 ± 0.20	2.22 ± 0.13	0.77 ± 0.08	2.88 ± 0.12
HC (3)	3.90 ± 0.37	2.45 ± 0.14	1.45 ± 0.51	1.92 ± 0.67
AG (12)	4.56 ± 0.84	2.72 ± 0.63	1.84 ± 0.66	1.75 ± 0.75
DOUBLE- INFECTION²:				
RT+RE (6)	4.75	3.66	1.09	4.38
RE+AG (9)	4.90	3.35	1.55	2.35
RT+CD (4)	4.08	2.90	1.18	4.82
RT+HC (3)	4.77	3.15	1.62	2.11
RT+AG (20)	4.48	3.19	1.30	3.24
AG+HC (6)	4.17	2.89	1.28	2.63
CD+AG (4)	4.43	2.86	1.56	1.92
RE+HC (2)	4.10	3.05	1.05	3.63
RC+AG (1)	4.80	3.45	1.35	2.56
RE+RC (2)	5.25	3.60	1.65	2.19
	4.57 ± 0.39	3.21 ± 0.30	1.36 ± 0.22	3.08 ± 1.00
TRIPLE INFECTION³:				
RE+CD+HC (1)	3.30	3.00	0.30	10.00
RC+CD+AG (1)	5.70	3.60	2.10	1.71
RT+RE+HC (3)	4.53	3.08	1.25	5.27
RE+AG+HC (3)	3.60	2.15	1.45	2.24
RT+CD+HC (1)	3.30	3.00	0.30	10.00
RT+CD+AG (11)	4.52	3.30	1.22	3.72
RT+RE+AG (5)	4.36	2.92	1.42	2.56
RC+AG+HC (2)	4.25	3.15	1.10	3.71
CD+AG+HC (1)	4.60	3.30	1.30	2.54
RE+RC+AG (1)	3.80	3.45	0.35	9.86
RE+CD+AG (2)	4.05	2.85	1.20	3.59
RT+AG+HC (6)	4.34	3.25	1.07	7.14
RT+RC+AG (5)	4.66	3.45	1.21	4.41
MEAN	4.23 ± 0.65	3.12 ± 0.37	1.10 ± 0.51	5.13 ± 3.08
QUADRUPLE INFECTION⁴:				
RT+CD+AG+HC (3)	4.67	2.80	1.88	1.96
RT+RE+CD+HC (1)	3.00	3.00	0.00	3.00
RT+RC+CD+HC (1)	5.50	3.75	1.75	2.14
RT+RC+AG+HC (1)	4.20	2.40	1.80	1.33
RT+RE+RC+AG (1)	4.10	2.30	1.80	1.28
RT+RE+CD+AG (2)	4.15	3.08	1.08	2.83
RT+RE+AG+HC (6)	4.33	3.06	1.28	3.18
	4.28 ± 0.75	2.91 ± 0.49	1.37 ± 0.68	2.25 ± 0.78

Figures in parentheses indicate the number of fowls possessing such infection. Infection with 1. one 2. two 3. three 4. four different species of worms affecting the same fowl. RT = *Raillietina tetragona*; RE = *Raillietina echinobothrida*; RC = *Raillietina cestitillus*. CD = *Cotugnia di gonopora*; HC = *Hymenolepis cartoca*; CI = *Choanotaenia infundibulum*. AG = *Ascaridia galli*.

In diseased fowls:

albumins and depletion in globulins resulted in the elevation of A/G ratio.

In Cockerels:

Raillietina echinobothrida infection: Hypoproteinemia resulted due to hypoglobulinemia. But the albumin level remained normal and hence a slight increase in A/G ratio was noticed.

Raillietina tetragona infection: The total protein level remained almost normal but the increase in

Table 2 Values of total protein, albumin and globulin levels and albumin to globulin (A/G) ratio of serum in healthy (uninfected) and helminth-infected (field cases) pullets of 3-4 months age

Infection	Total protein (g%)	Albumin (g%)	Globulin (g%)	A/G ratio
NONE-- HEALTHY (7)	4.61 ± 1.15	2.76 ± 0.48	1.85 ± 0.84	1.72 ± 0.53
SINGLE INFECTION ¹ :				
RT (10)	4.70 ± 0.97	2.73 ± 0.46	1.98 ± 0.71	1.53 ± 0.52
RE (8)	4.88 ± 0.76	2.83 ± 0.40	2.17 ± 0.61	1.49 ± 0.64
RC (2)	3.90 ± 0.10	2.62 ± 0.08	1.27 ± 0.03	2.06 ± 0.02
AG (15)	4.80 ± 1.20	2.88 ± 0.56	1.93 ± 1.00	1.95 ± 1.06
DOUBLE INFECTION ² :				
RC+CD (2)	5.00	3.53	1.48	2.60
RT+HC (4)	4.63	2.73	1.90	1.44
RE+AG (7)	5.20	2.91	2.29	1.50
RT+CD (3)	4.37	3.37	1.00	3.38
RT+RE (8)	4.93	2.66	2.26	1.40
RT+AG (14)	5.53	2.91	2.62	1.35
RT+RC (2)	4.90	3.08	1.83	1.69
RE+RC (1)	3.30	3.00	0.30	10.00
CD+HC (2)	5.10	3.08	2.03	1.54
AG+HC (4)	6.40	2.81	3.61	0.82
CD+AG (3)	4.70	2.85	1.85	2.29
MEAN	4.91 ± 0.76	2.99 ± 0.27	1.92 ± 1.20	2.54 ± 2.58
TRIPLE INFECTION ³ :				
RT+RC+CD (2)	4.95	2.80	2.15	1.388
RT+RE+AG (11)	5.70	3.05	2.65	1.28
RT+RC+AG (6)	4.45	3.00	1.45	3.02
RT+AG+HC (5)	4.96	3.51	1.45	3.44
RT+CD+AG (6)	5.03	3.12	1.92	2.31
RE+CD+AG (1)	6.30	2.85	3.45	0.83
RT+CD+HC (1)	4.90	3.15	1.75	1.80
RC+CD+AG (1)	5.00	3.30	1.70	1.94
RT+RE+RC (3)	4.87	3.05	1.82	2.01
RE+CD+HC (1)	5.80	3.00	2.80	1.07
MEAN	5.20 ± 0.56	3.08 ± 0.21	2.11 ± 0.65	1.91 ± 0.84
QUADRUPLE INFECTION ⁴ :				
RT+RE+RC+AG (2)	5.30	3.30	2.00	1.65
RT+RE+RC+CD (1)	5.00	3.00	2.00	1.50
RE+RC+AG+HC (1)	4.60	3.10	1.50	2.07
RT+RC+AG+HC (1)	7.10	4.00	3.10	1.29
RT+CD+AG+HC (5)	5.56	3.03	2.53	1.59
RT+RE+AG+HC (5)	5.76	3.15	2.61	1.31
RC+CD+AG+HC (1)	4.60	3.15	1.45	2.17
RT+RC+CD+AG (1)	4.70	3.20	1.50	2.13
RT+RE+CD+AG (1)	4.10	3.00	1.20	2.50
MEAN	5.19 ± 0.89	3.21 ± 0.31	1.99 ± 0.64	1.80 ± 0.43

Figures in parentheses indicate the number of fowls possessing such infection. Infection with 1. one 2. two. 3. three 4. four different species of worms affecting the same fowl. RT = *Raillietina tetragona*; RE = *Raillietina echinobothrida*; RC = *Raillietina cesticillus*; CD = *Cotugnia digonopora*; HC = *Hymenolepis carioca*; CI = *Choanotaenia infundibulum*; AG = *Ascaridia galli*.

Raillietina cesticillus infection: Hypoproteinemia resulted due to hypoglobulinemia. But the albumin level remained normal and thereby the A/G ratio was considerably elevated.

Choanotaenia infundibulum infection: Hypoproteinemia resulted due to the depletion of both

albumins and globulins, but more markedly in globulins and hence A/G ratio was elevated.

Hymenolepis carioca infection: Hypoproteinemia resulted due to the fall in both albumin and globulin levels, but more markedly in albumins and hence a slight reduction in A/G ratio was noticed.

Ascaridia galli infection: Hyperproteinemia resulted due to the increase in both albumin and globulin fractions, but more markedly in globulins and hence A/G ratio was reduced.

Double infection: Hyperproteinemia resulted due to hyperalbuminemia and the globulin level registered a drop thereby causing an elevation in A/G ratio.

Triple infection: The total protein level remained normal but the increase in albumins and depletion in globulins resulted in the elevation of A/G ratio.

Quadruple infection: The total protein level remained normal but the increase in albumins and depletion in globulins resulted in the elevation of A/G ratio.

In Pullets:

Railletina tetragona infection: The total protein and albumin levels did not alter but the globulin fraction increased and hence the A/G ratio registered a drop.

Railletina echinobothrida infection: Hyperproteinemia resulted due to the increase in both albumin and globulin fractions, but more markedly in globulins and hence A/G ratio registered a drop.

Railletina cesticillus infection: Hypoproteinemia resulted due to the depletion in both albumin and globulin fractions, more markedly in globulins and hence the A/G ratio was elevated.

Ascaridia galli infection: Hyperproteinemia resulted due to the increase in both albumin and globulin fractions, but more markedly in albumins and hence the A/G ratio was elevated.

Double infection: Hyperproteinemia resulted due to hyperalbuminemia, but the globulin level remained normal and hence A/G ratio was elevated.

Triple infection: Hyperproteinemia resulted due to the increase in both albumin and globulin fractions, but more markedly in albumins and hence the A/G ratio was elevated.

Quadruple infection: Hyperproteinemia resulted due to the increase in both albumin and globulin fractions, but more markedly in albumins and hence a slight elevation in A/G ratio was noticed.

To summarize, in healthy (uninfected) fowls, the pullets possess higher levels of total protein than cockerels. This was due to the higher quantity of both albumins and globulins, but the increase was more marked in globulins and hence the A/G ratio of pullets was lower than cockerels. In infected cockerels, hyper or hypoproteinemia was observed. The A/G ratio was elevated because of the depletion in globulins (hypoglobulinemia) and increase in

albumins (hyperalbuminemia). In infected pullets, mostly hyperproteinemia resulted due to the increase in both albumin and globulin fractions, but more markedly in albumins and hence the A/G ratio was elevated.

4 August 1986, Revised 29 September 1986

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PLACENTA OF RHINOCEROS (*RHINOCEROS UNICORNIS* L)

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THE knowledge of reproductive organs and their accessories is important in the study of the reproductive biology of a particular species of animal. The placenta is the transitory reproductive organ, developed in the uterus of the mammal after conception, which facilitates the supply of nutrition from