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Effect of *Spirulina* feeding on serum protein level in Infectious Bursal Disease vaccinated chickens

Pravesh Kumari, Pooja Kundu, Sushma Kajal and G Narang

Abstract

Infectious bursal disease is an acute, highly contagious viral infection of chickens manifested by inflammation and subsequent atrophy of the bursa of Fabricius and various degrees of immunosuppression. A number of vaccination strategies have been applied in the field to control IBD. Live commercially available hot strains of vaccines for IBD lead to varying levels of immunosuppression which increases the bird's vulnerability to various infections. A study was conducted to observe the effect of *Spirulina* feeding on serum protein level in Infectious bursal disease (IBD) vaccinated broiler chickens. One hundred and two day old chickens were reared up to 38th day of age. At the age of 10 days, chickens were divided randomly into four groups (groups A (33), B (27), C (21) and D (21) having different number of chickens. From 10 to 20 days, feed of all the chickens of group B and D was supplemented with probiotic *Spirulina* at the dose rate of 1.0% of feed (i.e. 1.0 g/ 100 gm of feed) whereas all chickens of group A and C were given feed without *Spirulina* supplementation. All the chickens of group C and D were vaccinated with IBDV intermediate plus strain vaccine at the age of 17 days whereas no vaccine was given to the chickens of groups A, and B. There were significant higher values of serum total protein and albumin in *Spirulina* fed group. Serum total protein concentration was significantly low in IBD vaccinated group. Feeding *Spirulina* in IBD vaccinated group chickens increased the serum total protein concentration and it becomes almost equal to control group chickens. *Spirulina* supplementation was able to slightly reduce the effect of IBD vaccine on total protein and albumin level. It indicates that *Spirulina* supplementation at 1.0 percent level in feed from 10 to 20 days of age along with IBD vaccine helped in reducing the effect of hot strain of vaccines.

Keywords: Infectious bursal disease vaccine, broiler chickens, albumin, serum protein

1. Introduction

Infectious bursal disease (IBD) commonly known as Gumboro disease produces deleterious effects in poultry and the economic impact of IBD is difficult to assess due to the multi-factorial nature of the losses involved. Surveys conducted in Northern Ireland revealed a 14% reduction in income from broiler flocks affected by subclinical IBD when compared with uninfected flocks. 11% reduction in yield was reported for poultry flocks with evidence of IBD over an average grow-out period of forty-two days; in comparison to non-exposed flocks. 10% loss in profit in the 991 IBDV-infected flocks surveyed was due to weight loss and reduction in feed conversion efficiency in comparison to non-infected flocks^[9].

IBD is an acute, highly contagious viral infection of chickens manifested by inflammation and subsequent atrophy of the bursa of Fabricius and various degrees of immunosuppression. Clinically the disease is seen only in chickens older than 3 weeks. The feathers around the vent are usually stained with faeces containing plenty of urates. Intra-follicular hemorrhages in bursa of Fabricius may be found and pin point hemorrhages on the skeletal muscles are usually prominent. The virus infects dividing IgM+ B lymphocytes and the main site of viral replication is the bursa of Fabricius, where B cells are produced^[12, 14]. Infectious bursal disease virus (IBDV) can also infect macrophages^[5, 6, 14]. Infection spread orally via contaminated feed and water^[16].

Infectious bursal disease virus (IBDV) belongs to genus *Avibirnavirus* under the *Birnaviridae* family is a double-stranded RNA (dsRNA) virus having non-enveloped bi-segmented virion. It has two serotypes IBD virus serotype-1 and IBD virus serotype-2. IBD virus serotype-1 is an important pathogen of chickens^[11, 19]. Serotype-2 viruses are immunologically distinct from serotype-1 viruses since vaccination with serotype-2 viruses did not confer protection against serotype-1^[19]. Antibody has been detected but no clinical disease has been reported in chickens or turkeys as a result of infection with IBD virus serotype-2^[8]. IBD virus remains infectious for a very long period of time and has resistance to commonly used disinfectants^[13].

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Vaccination plays an important role in the successful control of the disease but vaccination failure due to appearance of variant or newer strains of the virus in the recent times has also been reported [10]. Moreover, various attenuation levels of commercially available live vaccines for IBD lead to varying levels of immunosuppression increasing the bird's vulnerability to various infections.

Spirulina; a blue-green algae, is rich in essential amino acids, minerals, essential fatty acids and antioxidant [17]. *Spirulina* has been reported to have numerous health benefits, including antioxidant, immunomodulatory, anti-inflammatory, anticancer, anti-viral and anti bacterial activity due to presence of phycocyanin and beta-carotene [4]. *Spirulina* strongly induces antioxidant enzyme activity, help to prevent lipid peroxidation and DNA damage and scavenges free radicals [1]. In addition to these *Spirulina platensis* also stimulate immunity and synthesis of blood cells [7, 15]. However, no such report regarding the interaction of *Spirulina* with IBD or its vaccine could be traced in the literature. Keeping in view the above facts, the present study has been planned to study the effect of *Spirulina* feeding on Infectious Bursal Disease Vaccine.

2. Materials and Methods

2.1 Experimental design

One hundred and two chicks were purchased. At the age of 10 days, chicks were divided randomly into four groups (groups A, B, C and D) having different number of chicks as detailed in the table 1. From 10 to 20 days, feed of all the chicks of group B and D was supplemented with probiotic *Spirulina* at the dose rate of of 1% of feed (i.e. 1 g/ 100 gm of feed) whereas all chicks of group A and C were given feed without any *Spirulina* supplementation. All the chicks of group C and D were vaccinated with IBDV intermediate plus strain vaccine (M.B. strain) at the age of 17 days whereas no vaccine was given to the chicks of groups A and B. Serum was collected for total serum protein and albumin estimation from six chicks of different groups at different days of age (doa) as mentioned in table 1.

Table 1: Design of experiment

Groups	Treatment	Day of age (doa) for sampling
A (33)	Control	10, 17, 24, 31, 38 doa
B (27)	Spirulina (10-20 doa)	17, 24, 31, 38 doa
C (21)	Vaccination alone	24, 31, 38 doa
D (21)	Spirulina (10-20 doa) + Vaccination (at 17 doa)	24, 31, 38 doa

Table 2: Mean total serum protein concentration (g/dl) in different experimental groups at different intervals (Mean ± S.E.)

Groups	Mean value of total serum protein of broiler chicks (g/dl)			
	Days of age(doa) / Days Post vaccination (DPV)			
	17doa/0DPV	24doa/7DPV	31doa/14DPV	38doa/21DPV
A	3.16 ^a ±0.01	4.00 ^b ±0.04	3.92 ^b ±0.01	4.10 ^b ±0.07
B	3.55 ^b ±0.01	4.15 ^b ±0.03	4.74 ^c ±0.01	4.20 ^b ±0.01
C	-	3.50 ^a ±0.01	3.26 ^a ±0.01	3.30 ^a ±0.02
D	-	3.96 ^{ab} ±0.09	4.00 ^b ±0.03	4.02 ^{ab} ±0.01

a, b, c: Means with unlike superscript in the column differ significantly (P ≤ 0.05)

2.2 Total serum protein (TSP) concentration

Total serum protein concentration was analyzed as per the method of Tietz [18] using single step reagent by semi-automatic biochemistry analyzer.

2.3 Serum albumin concentration

Serum albumin concentration was analyzed as per the method of Doumas *et al.* [2] using single step reagent by semi-automatic biochemistry analyzer.

2.4 Statistical analysis

The data for various parameters were subjected to statistical analysis using analysis of variance technique through Posthoc-Duncan LSD Alpha (0.05).

3. Results

3.1 Total serum protein concentration

Mean total serum protein concentration of chicks in different experimental groups at different intervals are presented in table 2 and depicted in figure 1. Mean total serum protein in *Spirulina* fed group (group B) was found to be higher at all the intervals and it was significantly (P ≤ 0.05) higher at 17DOA/0DPV and 31DOA/14 DPV as compared to control group (group A) chicks. In the IBDV vaccinated group (group C) chicks, serum total protein concentration was found to be significantly (P ≤ 0.05) lower as compared to control group (group A) throughout the experiment. However total serum protein concentration of chicks of group D was comparable to group A chicks throughout the experiment even after vaccination. Amongst vaccinated groups (group C and D) serum total protein concentration was found to be significantly (P ≤ 0.05) higher in group D (IBDV vaccinated with *Spirulina* fed) only at 14 DPV, although it was higher also at other intervals but without statistical difference.

3.2 Serum albumin concentration

Mean serum albumin concentrations of different experimental groups are given in table 3 and figure 2. Mean serum albumin concentration in *Spirulina* fed group (group B) was found to be higher at all the intervals as compared to all other groups and it was significantly (P ≤ 0.05) higher at significantly (P ≤ 0.05) higher 17 doa/0DPV and 31 DOA/14 DPV as compared to control group (group A) chicks. The albumin concentration in chicks of group C was significantly (P ≤ 0.05) lower than control group A at 14 DPV only. The albumin concentration in chicks of group C and D were comparable to each other at all intervals. The albumin concentration in group D (IBDV vaccinated with *Spirulina* fed) chicks was found to be almost equal to the control group (group A) throughout the experiment.

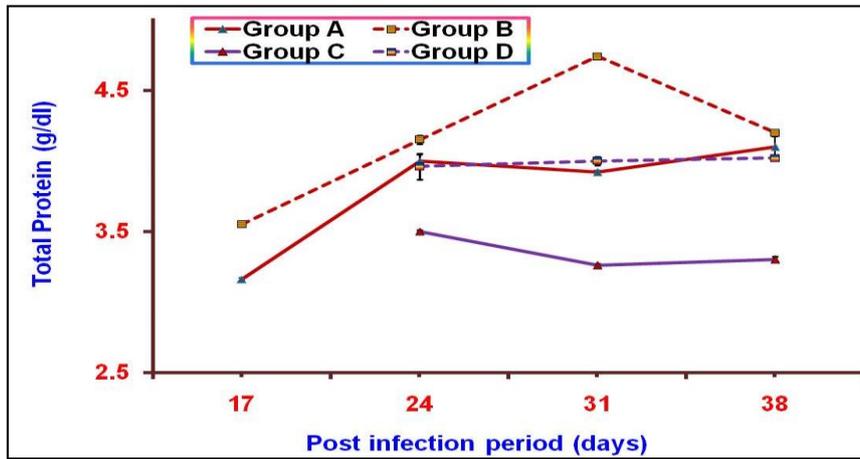


Fig 1: Mean serum total protein concentration (g/dl) of broiler chicks in different experimental groups at different intervals

Table 3: Mean serum albumin (mg/dl) concentration in different experimental groups at different intervals (Mean ± S.E.)

Groups	Mean value of serum albumin of broiler chicks (g/dl)			
	Days of age(doa) / Days Post vaccination (DPV)			
	17doa/0DPV	24doa/7DPV	31 doa/14DPV	38doa/21DPV
A	1.01 ^a ±0.01	1.13 ^{ab} ±0.005	1.09 ^b ±0.06	1.13 ^{ab} ±0.01
B	1.36 ^b ±0.04	1.26 ^b ±0.01	1.22 ^c ±0.01	1.25 ^b ±0.06
C	-	0.96 ^a ±0.05	1.02 ^a ±0.04	1.02 ^a ±0.04
D	-	1.04 ^a ±0.03	1.05 ^{ab} ±0.02	1.07 ^a ±0.06

a, b, c: Means with unlike superscript in the column differ significantly (P ≤ 0.05)

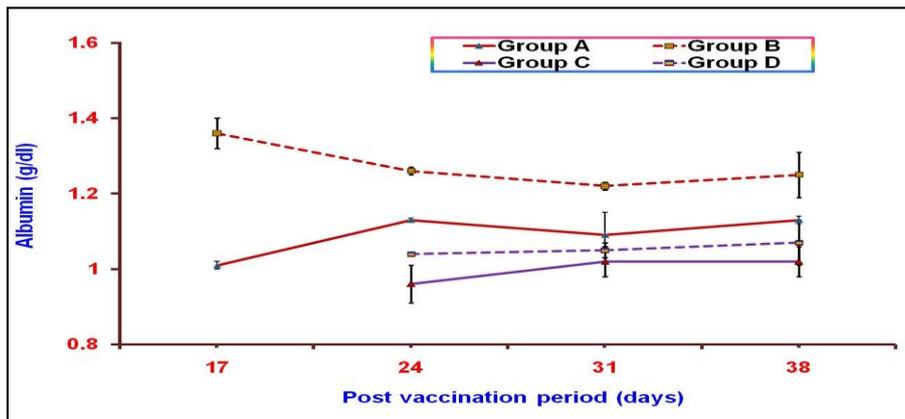


Fig 2: Mean serum albumin concentration (g/dl) of broiler chicks in different experimental groups at different intervals

4. Discussion

Serum biochemical studies reveals that in Spirulina fed group B chickens, total serum protein concentration was found to be significantly higher at 17 and 31doa and at other intervals non-significant increase was observed. Due to IBD vaccination the total serum protein concentration was significantly lower in vaccinated group C as compared to control group A throughout the experiment. Spirulina supplementation in group D helped to maintain higher levels of the total serum protein concentration (comparable to group A chickens) as compared to group C (vaccination only). It indicated that Spirulina acted as a hepatoprotective agent. Farag M.R. *et al.* [3] observed that Spirulina is considered as a promising nutrient source due to its high protein content (65% to 70% dry matter), great amount of vitamins, minerals and a wide variety of natural carotene and xanthophyll phytopigments. Zeweil H. *et al.* [20] also reported the hepatoprotective effect of Spirulina in heat stress condition in broiler chickens.

There was significant increase in serum albumin concentration in group B chickens as compared to group A at

17 and 31doa although it was higher at other intervals also. On other hand there was significantly lower concentration of serum albumin in IBDV vaccinated group C as compared to control group A at 14 DPV. At other intervals, non-significant lower concentration was observed in group C as compared to control group. A non significant lower albumin concentration was observed in group C as compared to group D throughout the experiment. It indicated that *Spirulina* acted as a hepatoprotective agent. Zeweil H. *et al.* [20] indicated that *Spirulina* and vitamin E supplementations decreased the adverse effect of heat stress on growth performance and blood total protein, albumin, globulin of Chickens.

5. Summary and Conclusion

There were significant higher values of serum total protein and albumin in *Spirulina* fed group. Serum total protein concentration was significantly low in IBD vaccinated group. Feeding *Spirulina* in IBD vaccinated group chickens increased the serum total protein concentration and it becomes almost equal to control group chickens.

Supplementation of *Spirulina* at 1.0 percent level in feed from

10 to 20 days of age along with IBD vaccine helped in reducing the effect of hot strain of vaccines.

6. References

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