

Effect of Early Post-Hatch Feeding on Immunity of Commercial Broilers

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ABSTRACT

Early feeding plays a crucial role in the rapid growth and immune system development of newly hatched chicks, improving their disease resistance significantly. A total of 144 day-old chicks were randomly assigned to four treatment groups, each consisting of 9 birds per replicate and 4 replicates per group. In the control group, chicks were provided with water and pre-starter feed immediately upon their arrival at the farm from the commercial hatchery. In the T₁ group, feed and water were supplied 12 h after arrival, while in the T₂ group, they were offered 24 h post-arrival. In the T₃ group, feed and water were made available immediately after hatching on the farm. The average log₁₀ values of HI antibody titers, along with the mean percentages of heterophils, lymphocytes, monocytes, eosinophils, and basophils, did not show statistically significant differences in blood samples collected on days 7, 21, and 42 across the Control, T₁, T₂ and T₃ groups. Similarly, the results of the haematological analysis, including differential leukocyte counts, indicated no significant variations among the four groups. Histo-morphological examination of the spleen, thymus, and bursa of Fabricius revealed a normal tissue structure on days 7, 21, and 42 across all experimental groups.

Keywords: Broilers, Early post-hatch feeding, Immunity.

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INTRODUCTION

In hatcheries, it is a common practice to remove all chicks once most have hatched. However, this approach often leaves early-hatched chicks without access to feed for extended durations. Additional hatchery processes such as sex determination, vaccination, packaging, and transportation further prolong the delay in feeding (Batal and Parsons, 2002). Extended periods without post-hatch feeding can lead to dehydration and energy depletion, which adversely affect the chicks' health. Delayed feeding has been linked to lower weight gain, increased mortality rates, weaker vaccination responses, slower development of the gastrointestinal and immune systems, reduced disease resistance, and long-term performance challenges (Panda *et al.*, 2015). Timely access to feed is essential for the rapid development of the immune system in newly hatched chicks. Transitioning from yolk sac nutrients to external feed sources facilitates the structural and functional maturation of the gut (Geyra *et al.*, 2001). Nutrients provided by feed play a crucial role in the growth of both primary and secondary lymphoid organs (Dibner and Richards, 1998). The mucosal immune system, in particular, requires oral feeding to develop efficiently (Bar Shira *et al.*, 2005). A lack of adequate feed leaves chicks highly vulnerable to infections, which increases early mortality due to reduced disease resistance (Mast and Goddeeris, 1999; Yunis *et al.*, 2000; Juul-Madsen *et al.*, 2004). Early feed deprivation can compromise systemic immune function by causing metabolic disruptions and hampering the development of lymphoid organs (Panda *et al.*, 2015). The thymus, a critical primary lymphoid organ, is particularly affected by feed deprivation, leading to rapid reductions in cell numbers and weight gain (Klasing, 2007). Therefore, providing feed promptly after

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hatching is essential for ensuring the optimal growth and immune system development of broiler chicks. This study evaluated the effect of early post-hatch feeding on immunity of commercial broilers.

MATERIALS AND METHODS

The trial was carried out during February and March 2024 with approval from the Institutional Animal Ethics Committee of the Veterinary College, Anand, Gujarat, India (Approval No. 416/AN/23). The experimental birds were housed and managed at the Veterinary College, Anand, where all sample analyses were also conducted. The birds were randomly assigned to one of four treatment groups: Control, T₁, T₂

and T₃. Each group consisted of 36 birds, divided into four replicates of 9 birds each.

Treatment Groups

A standardized experimental feed was prepared for all groups following the BIS (2007) guidelines for broilers. The feed included pre-starter (0-7 days), starter (8-21 days), and finisher (22-42 days) diets, which were provided according to the birds' daily nutritional requirements. In the control group, chicks were provided with water and pre-starter feed immediately upon their arrival at the farm from the commercial hatchery. In the T₁ group, feed and water were supplied 12 h after arrival, while in the T₂ group, they were offered 24 h post-arrival. In the T₃ group, feed and water were made available immediately after hatching on the farm.

Antibody Titre against ND Vaccine

The impact of early post-hatch feeding on immune response was assessed using standard protocols. Blood samples were collected on the 7th, 21st, and 42nd days of age to measure antibody titres against the Newcastle Disease Vaccine (NDV).

Haematology (DLC) and Serum Protein Profile

Blood samples were obtained from one bird per replicate in each treatment group on the 7th, 21st, and 42nd days. Thin blood smears were immediately prepared on clean, grease-free slides, air-dried at room temperature, and fixed in alcohol. These smears were then stained with Field's stain, dried, and examined under a microscope using an oil immersion objective (100X) to perform differential leukocyte counts. Serum samples on days 7, 21, and 42 were used to measure total protein, albumin, and globulin levels.

Histological Examination of Immune Organs

Throughout the study, one bird per replicate from each treatment group was ethically sacrificed on the 7th, 21st, and

42nd days. The thymus, spleen, and bursa of Fabricius were collected for histological analysis and preserved in 10% formalin. Tissue samples were sectioned into 4-5 micron slices using an automatic microtome (Leica, Germany) and stained with Hematoxylin and Eosin (H&E) following the method of Luna (1968) for microscopic evaluation.

Statistical Analysis

Data from the Completely Randomized Design were analyzed following the methods described by Snedecor and Cochran (2014). The mean values of replicates within each treatment group were statistically analyzed using SPSS software version 20.

RESULTS AND DISCUSSION

Antibody Titre against NDV Vaccine

The HI log₁₀ values (Mean ± SE) for the ND vaccine across different groups at weeks 1, 3, and 6 are presented in Table 1. The mean log₁₀ HI antibody titres on the 7th, 21st, and 42nd day showed no significant differences among the four groups. Martins *et al.* (2023) also reported no significant variation in serum IgY titres against the NDV vaccine between groups subjected to fasting (with or without feeding) and those supplemented with CLA (0% or 0.025%). Similarly, Alireza *et al.* (2022) found no significant differences in antibody titres between groups receiving early or delayed supplementation within the first 24 h of life. Kadam *et al.* (2009) observed no significant differences (p>0.05) in antibody titres against the ND vaccine among Control and Polyherbal-supplemented groups (6 and 8 grams) on days 7, 21, and 35. In contrast, Arulnathan *et al.* (2019) reported significantly higher (p<0.05) HI antibody titres against the NDV vaccine in early feed-supplemented groups compared to the Control group.

Table 1: Determination of antibody titre against ND vaccine of experimental broilers under feeding experiment

Age	Treatment groups				CD	SE
	Control	T1	T2	T3		
Day 7	4.50 ± 0.29	4.25 ± 0.25	4.25 ± 0.25	4.75 ± 0.48	NS	0.16
Day 21	5.75 ± 0.48	6.25 ± 0.25	6.00 ± 0.71	6.75 ± 0.48	NS	0.25
Day 42	7.50 ± 0.50	7.75 ± 0.48	6.75 ± 0.48	6.50 ± 0.65	NS	0.27

Haematological Findings

Table 2 presents data on DLC counts. The mean percentages of heterophils, lymphocytes, monocytes, eosinophils, and basophils did not exhibit any statistically significant differences in blood samples taken on the 7th, 21st and 42nd days among the Control, T₁, T₂, and T₃ groups. These results aligned with the findings of Madej *et al.* (2024), who similarly observed no significant differences in the percentages of heterophils and lymphocytes between the

HatchCare hatcher group and the standard hatcher chambers group at 7 days of age. However, unlike the current study, Tamboli *et al.* (2018) reported a significantly higher (p<0.05) percentage of heterophils in groups supplemented with early feed compared to those receiving delayed feed. Sarlak *et al.* (2016) found that early feed supplementation resulted in significantly higher (p<0.05) heterophil counts and significantly lower (p<0.05) lymphocyte counts compared to delayed feed supplementation groups.

Biochemical Findings

The data on serum protein, albumin, globulin levels and A:G ratios (Table 3) revealed no significant differences among the Control, T₁, T₂, and T₃ groups at any of the intervals, except for albumin, which differed on day 7. Adeleye *et al.* (2018) observed significant differences ($p < 0.05$) in albumin levels. Similarly, Rizk and Ibrahim (2014) reported significantly higher ($p < 0.05$) levels of total protein, albumin and globulin in early-fed groups compared to groups subjected to feed deprivation. Abousekken *et al.* (2017), Mustafa (2021), Hassan *et al.* (2023) and Madej *et al.* (2024) however reported no significant differences ($p < 0.05$) in total protein and albumin levels between early and delayed feeding groups.

Histopathological Findings

Selected birds were sacrificed on the 7th, 21st and 42nd day of the experiment to obtain bursa of Fabricius, thymus, and spleen for histopathological analysis. During necropsy, no notable gross changes were observed in the bursa of Fabricius, thymus, or spleen of any experimental birds. Histopathological examination revealed normal tissue architecture in the bursa of Fabricius sections from the Control, T₁, T₂, and T₃ groups. Similarly, the thymus and spleen sections from all four groups also showed normal tissue architecture, as illustrated in Figure 1. Consistent with these findings, Madej *et al.* (2024) reported a normal architectural structure in the spleen, thymus, and bursa of Fabricius in birds from both HatchCare hatchers and standard hatchers.

Table 2: Differential leucocyte counts of experimental broilers on days 7, 21 and 42 of feeding experiment

Age	DLC	Treatment groups				SE	CD
		Control	T ₁	T ₂	T ₃		
7 Days	Heterophils (%)	32.25 ± 0.32	31.5 ± 0.72	33.38 ± 1.43	35.55 ± 1.50	0.63	NS
	Lymphocytes (%)	66.66 ± 1.60	70.72 ± 0.91	70.36 ± 2.68	68.79 ± 2.22	0.97	NS
	Monocytes (%)	4.70 ± 0.65	4.21 ± 0.59	4.81 ± 1.09	4.80 ± 0.74	0.36	NS
	Eosinophils (%)	1.67 ± 0.37	1.56 ± 0.43	2.07 ± 0.21	1.61 ± 0.39	0.17	NS
	Basophils (%)	0.74 ± 0.32	0.57 ± 0.07	0.46 ± 0.04	0.45 ± 0.11	0.08	NS
21 Days	Heterophils (%)	32.25 ± 0.32	31.50 ± 0.72	33.38 ± 1.43	35.55 ± 1.50	0.63	NS
	Lymphocytes (%)	62.03 ± 0.36	62.33 ± 1.44	61.42 ± 1.96	61.75 ± 1.56	0.66	NS
	Monocytes (%)	3.33 ± 0.17	3.20 ± 0.56	3.31 ± 0.24	3.52 ± 0.13	0.15	NS
	Eosinophils (%)	2.33 ± 0.09	2.43 ± 0.11	2.13 ± 0.26	2.46 ± 0.22	0.09	NS
	Basophils (%)	0.81 ± 0.26	0.88 ± 0.17	0.90 ± 0.28	1.10 ± 0.19	0.11	NS
42 Days	Heterophils (%)	37.33 ± 0.35	36.76 ± 3.06	37.07 ± 2.53	36.71 ± 1.78	0.98	NS
	Lymphocytes (%)	57.15 ± 0.45	59.02 ± 2.63	60.70 ± 2.22	56.40 ± 2.40	1.04	NS
	Monocytes (%)	3.40 ± 0.14	3.66 ± 0.40	3.67 ± 0.32	3.80 ± 0.22	0.13	NS
	Eosinophils (%)	2.43 ± 0.27	1.83 ± 0.23	2.21 ± 0.32	2.02 ± 0.41	0.15	NS
	Basophil (%)	1.00 ± 0.14	0.82 ± 0.06	1.41 ± 0.28	1.02 ± 0.34	0.12	NS

Table 3: Serum protein profile of experimental broilers on days 7, 21 and 42 of feeding experiment

Age	Parameter	Treatment groups				SE	CD
		Control	T ₁	T ₂	T ₃		
7 Day	Total protein	4.81 ± 0.10	4.69 ± 0.05	5.11 ± 0.09	5.33 ± 0.62	0.16	NS
	Albumin	3.16 ^{ab} ± 0.22	3.37 ^a ± 0.15	2.69 ^b ± 0.09	2.80 ^b ± 0.17	0.10	0.5
	Globulin	1.65 ± 0.29	1.32 ± 0.19	2.42 ± 0.09	2.52 ± 0.74	0.23	NS
	A/G ratio	2.25 ± 0.66	2.74 ± 0.47	1.12 ± 0.07	1.47 ± 0.48	0.27	NS
21 Day	Total protein	4.58 ± 0.08	4.76 ± 0.07	4.83 ± 0.10	4.53 ± 0.11	0.05	NS
	Albumin	2.94 ± 0.29	3.49 ± 0.18	2.93 ± 0.10	3.40 ± 0.18	0.11	NS
	Globulin	1.65 ± 0.22	1.27 ± 0.22	1.90 ± 0.20	1.13 ± 0.28	0.13	NS
	A/G ratio	1.92 ± 0.35	3.31 ± 1.09	1.62 ± 0.26	3.81 ± 1.13	0.43	NS
42 Day	Total protein	5.22 ± 0.07	5.20 ± 0.24	5.10 ± 0.18	5.07 ± 0.18	0.08	NS
	Albumin	2.93 ± 0.15	3.13 ± 0.16	2.65 ± 0.19	3.02 ± 0.11	0.08	NS
	Globulin	2.30 ± 0.19	2.07 ± 0.17	2.45 ± 0.32	2.04 ± 0.27	0.12	NS
	A/G ratio	1.32 ± 0.18	1.54 ± 0.16	1.19 ± 0.29	1.58 ± 0.26	0.11	NS



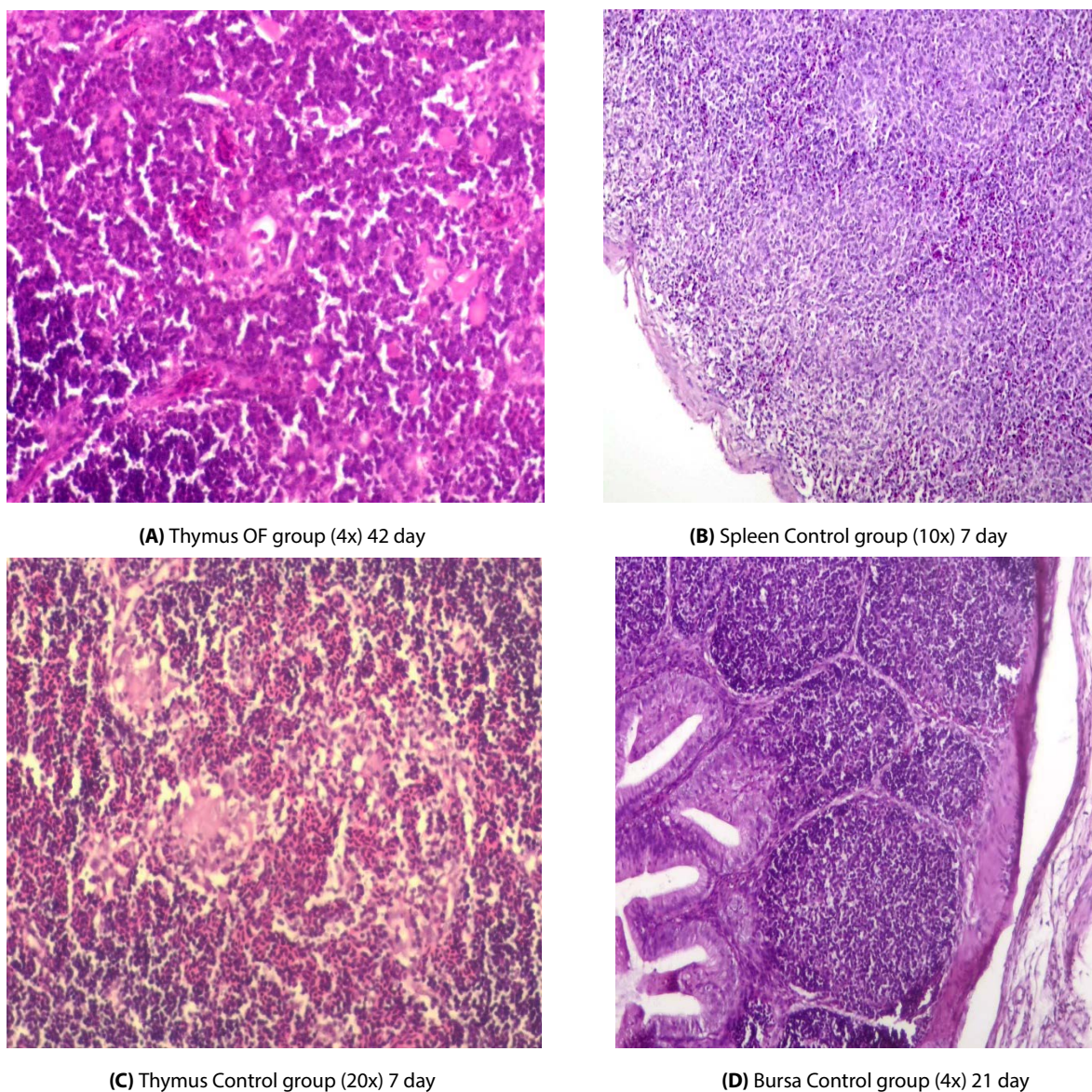


Fig. 1: Histomorphological observation of spleen, thymus and bursa of Fabricius

CONCLUSION

Early post-hatch feeding leads to normal levels of globulin and albumin to globulin ratio. Histopathological examination of bursa of Fabricius, spleen and thymus were found to be of normal architecture. Looking to this we concluded that early or delay post-hatch feeding and watering had no any adverse effect on immunity in broiler birds.

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