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Original Research

Effect of Early Post-Hatch Feeding on the Liver and Muscle Glycogen Reserves and Gut Development of Commercial Broilers

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Abstract

An experiment was carried out to study the effect of early chick nutritional supplements (ECNS) with 600-day old straight run broiler chicks from a single hatch. The chicks were allocated to five treatments randomly each with four replicates of 30 chicks. The chicks were wing banded, individually weighed. Group 1 formed the control group (T1- without ECNS) and the chicks in the group 2 to 5 were fed with one of the following ECNS viz., Egg white protein-glucose based ECNS (T2), Corn-soybean and fish meal based ECNS without steaming (T3), Steamed corn-soyabean and fish meal based ECNS (T4), Commercial broiler pre-starter diet as ECNS (T5) immediately after hatch in the hatcher tray and continued till placing the chicks in the chick transport box. Chicks in the control group were subjected to fasting for 24 hours to simulate field conditions. The data on liver and pectoral muscle glycogen, jejunal and ileal histomorphometry of birds and the economics of feeding different ECNS were analyzed. The results of the study revealed that the ECNS feeding significantly (P<0.01) improved liver and muscle glycogen in day old chicks than those of fasted control. The gut morphology viz. villi height, width, crypt depth and villi surface area were significantly (P<0.01) improved in jejunum and ileum of early fed broiler chicks compared to fasted chicks. The net profit was increased in early post-hatch ECNS feeding groups. It could be concluded that ECNS feeding significantly improved the liver and muscle glycogen reserves and jejunal and ileal histo-morphometry which assures gut development in broilers.

Keywords: Broilers, Early Post-Hatch Feeding, Glycogen Reserves, Gut Development

Introduction

In fast growing commercial broiler chicken, the first seven days represents approximately 17 per cent of its growing period. The broiler chicks are held at hatchery without feed for 24-36 hours in order to complete hatchery operations like vaccination, packing and transport. Due to a wide "hatching window" the broilers spent 5-7 per cent of its life without any feed and water. During the transport from hatchery to farm, the broiler chicks losses its body weight at the rate of 4 g per 24 h duration due to dehydration, utilization of yolk and also due to utilization of glycogen reserves from pectoralis muscle (Bhanja *et al.*, 2009). Hence, post hatch fasting increases the weight loss (Bhanja *et al.*, 2009), makes the chicks more susceptible to disease causing organisms (Dibner *et al.*, 1996) and delay in the development of critical tissues (Halevy *et al.*, 2000). A good start leads to a uniform flock of chicks with a good 7th day weight which is positively correlated to the slaughter weight of the birds (Noy and Skalan, 2005).

Post hatch early feeding in broilers has an overall, long-term beneficial effects as it reduces transit weight loss, minimizes slow starters, eliminate ketosis, preserves glycogen reserves, improves appetite, growth performance, enhances immunity, improves livability, improves dressed weight and breast meat yield in broilers (Panda *et al*, 2013). Because of these beneficial effects of early feeding, the poultry nutritionist attempted several strategies to avoid the fasting of broilers at holding and transit period and adopted the concept of early chick nutrition. Keeping the beneficial factors in mind a broiler nutritional experiment was undertaken to sort out suitable ECNS and also to study their effect on liver and muscle glycogen reserves and gut development of commercial broiler chicken.

Material and Methods

A total of 600 day-old straight run broiler chicks from a single hatch, individually weighed, wing banded and randomly allotted into five treatments with four replicates of 30 chicks each. Control birds were subjected to fasting and not fed with any ECNS, (T_1), the treatment groups were provided with one of the ECNS viz., Egg white protein-glucose (EWPG) based ECNS (T_2), Corn-soybean and fish meal based ECNS without steaming (CSF WOS, T_3), Steamed corn-soyabean and fish meal based ECNS (CSF WS, T_4), Commercial broiler pre-starter diet as ECNS (CBPSD, T_5) to chicks immediately after hatch in the hatcher tray and continued till placing the chicks in the chick transport box. Control group (T1) was subjected to fasting for 24 hours to simulate field conditions. After reaching the farm the birds were fed with pre starter, starter and finisher feed from 0-7 d, 8-21 d and 22-42 d of age, respectively. The broiler chicks were provided with *ad libitum* feed and water during the entire experimental period.

Data on liver glycogen and histomorphometry of the small intestine were recorded from eight birds for each treatment. Glycogen content in the liver and muscle sample was estimated by Anthrone method as described by Seifter *et al*. (1949). Eight samples of the jejunum (between the duodenal loop and Meckel's diverticulum) and ileum between Meckel's diverticulum and ileo-cecal junction of 2 cm length were collected on sixth week were collected as per the method described by Miller carin (2007). After fixing the tissues in 10 per cent formalin, the tissues were embedded in paraffin. Serial tissue sections of 5 µm thick were cut by a microtome and were fixed on slides. The prepared tissue sections were stained with haematoxylin and eosin stain. The sections were examined in an Olympus BX 51 microscope fitted with a Pixe LINK microscopy camera under high power microscope (4X) and photomicrographs were taken for histomorphometric measurements. The intact villus and crypt were selected for each intestinal cross-section in triplicate for measurement. The height of the villus was measured from the tip to the villus-crypt junction. The crypt depth was measured by scaling the depth of the invagination between the two adjacent villi. Data recorded in this study were subjected to one-way analysis of variance (ANOVA) using the Statistical Package for Social Science (SPSS) version 17. Means of the different treatments were compared by Duncan multiple range comparison test (Steel and Torrie, 1981) with the level of significance at 5 per cent level.

Results and Discussion

Data on mean liver and pectoral muscle glycogen of day-old broiler chicken fed with various ECNS immediately after hatch are presented in Table 1. Liver glycogen in day old chicks was significantly ($P<0.01$) high in broiler chicks fed with EWPG ECNS (67.53 mg/g) than other ECNS fed chicks (62.53 to 57.36 mg/g) and the lowest liver glycogen (23.86 mg/g) in control. Highly significant ($P<0.01$) difference in pectoral muscle glycogen in day-old broiler chicken fed with various ECNS was observed than control (19.49 mg/g). Among the ECNS fed groups, highest value (25.35 mg/g) was recorded in CBPSD which was statistically comparable with CSF WS and the lowest value (22.21 mg/g) was observed in CSF WOS fed chicks. Foye *et al.* (2006) and Kornasio *et al.* (2011) reported that as birds advance in age, the glycogen level also increased in liver and pectoral muscles, more so in early fed group than the fast group. These observations match with present study; where ECNS fed group had significantly (P<0.01) higher liver and pectoral muscle glycogen level at day-old age.

Table 1: Effect of post-hatch ECNS feeding at day-old age on liver and pectoral muscle glycogen of broiler chicks after transit (Mean ±SE)

Treatments	Liver glycogen (mg/g) n=8	Pectoral muscle glycogen (mg/g) n=8	Net profit/ kg live weight (mg/g) (Rs)	BPEI
T1- Control (No ECNS)	$23.86^{d} \pm 0.41$	$19.49^{c} \pm 0.33$	9.19	92.84
T2-ECNS EWPG	$67.53^{a} \pm 0.65$	$23.24^{b} \pm 0.31$	9.63	102.45
T3-ECNS CSF WOS	$57.36^{c} \pm 0.64$	$22.21^{b} \pm 0.33$	10.49	99.18
T4-ECNS CSF WS	$62.53^{b} \pm 0.60$	$24.46^{ab} \pm 0.38$	10.95	101.51
T5-ECNS CBPSD	$61.12^{b} \pm 0.47$	$25.35^{a} \pm 0.41$	11.36	103.58
Significance	**	**	-	*

**Broiler Performance Efficiency Index; ** Highly significant (P<0.01); Mean values sharing any one common superscript in a column do not differ significantly*

The data on the effect of post-hatch ECNS feeding on histomorphometry jejunal and ileal of broiler chicken is presented in Table 2. Significantly (P<0.01) taller jejunal villi was observed in CSF WS (1560.17 µm) and CBPSD (1566.77 µm) when compared to other ECNS and control (1230.38 µm). The jejunal villi width was significantly (P<0.01) lesser in control and EWPG (110.39 and 119.98 µm respectively) than other ECNS fed chicks (130.24 to 155.40 µm). Chicks fed with CSF WS or CBPSD produced significantly (P<0.01) more crypt depth of 153.14 and 148.02 µm respectively than control (109.73 µm).

Table 2: Effect of ECNS feeding on jejunal and ileal villi height, width and crypt depth (Mean ± S.E, n=8)

Parameter Studied	Treatments					Significance
	T1	T2	T3	T4	T5	
	Control	EWPG	CSF WOS	CSF WS	CBPSD	
Villi height (µm)						
Jejunum	$1230.38^{c}\pm23.15$	$1321.55^{c}\pm39.32$	$1392.20^{bc}\pm60.26$	$1560.17^{a}\pm11.45$	$1566.77^{a}\pm15.83$	**
Ileum	$924.74^{c}\pm23.92$	$942.69^{bc}\pm18.45$	$938.68^{bc}\pm24.03$	$1024.27^{a}\pm13.16$	$994.03^{ab}\pm10.68$	**
Villi width (µm)						
Jejunum	$110.39^{c}\pm1.37$	$119.18^{c}\pm1.32$	$130.24^{b}\pm3.53$	$155.40^{a}\pm1.80$	$133.35^{b}\pm2.76$	*
Ileum	$105.15^{c}\pm1.68$	$108.93^{bc}\pm2.15$	$120.90^{ab}\pm2.09$	$114.32^{b}\pm3.10$	$122.94^{a}\pm1.31$	**
Crypt depth (µm)						
Jejunum	$109.73^{c}\pm1.53$	$127.20^{b}\pm4.12$	$140.47^{ab}\pm4.84$	$148.02^{a}\pm4.05$	$153.14^{a}\pm4.56$	**
Ileum	$100.47^{c}\pm1.49$	$103.15^{c}\pm2.47$	$119.75^{b}\pm3.61$	$133.12^{a}\pm5.48$	$133.31^{a}\pm2.21$	**

**Significant, ** Highly significant (P<0.01); Mean values sharing any one common superscript in a row do not differ significantly*

The net profit per kg live weight was Rs.9.19 in control and that in ECNS fed groups ranged from Rs 9.63 to 11.36. In ECNS fed broiler chicken, the broiler performance efficiency index (BPEI) was higher ranging from 99.18 (CSF WOS) to 103.58 (CBPSD). The EWPG fed chicks had the BPEI of 102.45 followed by CSF WS fed chicks with 101.51 BPEI. Mizra and Naji *et al.* (2011) recorded higher returns and production index in broilers with early symbiotic feeding. The improved net profit in ECNS fed chicks might be due to increased growth rate, reduced mortality, and improved gut health associated with more efficient absorption of nutrients.

Conclusion

Based on the results obtained from this study, it was concluded that the ECNS feeding significantly improved the liver and muscle glycogen reserves**,** and jejunal and ileal histo-morphometry which assures gut development in broilers.

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Conflict of Interests

There is no conflict of interest.

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