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Influence of Herbal Early Chick Nutritional Supplement on the Growth Performance, Serum Biochemicals and Immune Response of Broiler Chicken

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Abstract: The experiment was conducted on 150 day-old straight-run "Vencob" broiler chicks for a period of 6 weeks. Day old chicks were randomly divided into three groups I, II and III to evaluate effect of early chick nutritional polyherbal supplement AV/NNC/17 (supplied by Ayurvet Ltd. Baddi, India) on the performance of broilers. The control group I was given basal diet 48 h after hatch. The group II and III were treated with 6 g and 8 g of AV/NNC /17 paste per chick immediately after hatching during transportation period/day till 48 h and then switched over basal diet up to the age of marketing. The overall results of the study indicated that the early chick nutritional supplement AV/NNC/17 @ 6g and 8 g/chick has significant effect upon early growth, gain in weekly weight, feed efficiency and carcass traits between treatment and control indicating an overall beneficial effect of polyherbal product in initial 48 hours of life. In addition to these parameters, immune response, intestinal morphogenesis, intestinal development and gut health are also recorded to improve significantly in treatment groups.

Key words: Early chick nutrition, broiler performance, polyherbal

INTRODUCTION

Usually in commercial hatchery, chicks that hatch early remain in the hatcher, until a large portion of the egg population has hatched out. Similarly, once the hatch is pulled, other procedures such as sexing, sorting, vaccination, packing and transportation further prolongs the fasting period experienced by the chicks (Batal and Parsons, 2002). During this period residues accumulated in the yolk sac provides immediate post hatch energy and protein for maintenance and growth. The absorption of essential nutrients and maternal antibodies from the yolk sac are critical for survival during the early stages. The residual yolk is usually used up within 4 days after hatching (Noy and Sklan, 1999), But recent studies indicated that residual yolk is used up more quickly in chicken that have access to feed immediately after hatch than those fasted for first 48 h (Panda and Reddy, 2007; Juul-Madsen *et al.*, 2004). The reason is that the antiperistaltic movement, which moves the yolk from the yolk stalk to duodenum, appears to be stimulated by the presence of feed in the gut (Panda and Reddy, 2007). The dependence of chicks on residual yolk sac during the first few days post hatch limits the growth potential of modern broilers (Henderson *et al.*, 2008). Also, the delay in the access to feed and water has been documented to increase susceptibility to pathogens and weight loss leading to poorly starting flocks with reduced weight gains (Noy

and Sklan, 1999; Dibner *et al.*, 1998). Holding hatchlings without feed and water for more than 24 h had lasting negative effects on the broiler performance (Tarvid, 1992; Knight and Dibner, 1998; Noy and Sklan, 2001; Batal and Parsons, 2002; Juul-Madsen *et al.*, 2004). The newly hatched chicks need to transit from dependence on the yolk to exogenous nutrients after hatch (Sklan and Noy, 2000) because the digestive organs are not developed at hatch and the source of nutrients determine their maximum availability to the chick (Libum, 2002). Early feeding has a great effect in triggering the right momentum of growth in broiler hatchlings. The previous studies by various scientists showed that the nutrient supply to chick as early as possible can increase the intestinal mechanical activity, faster intestinal development, greater assimilation of feed, development of immunity and thereby overall growth performance. The concept of providing the chicks with additional nutrient source in early stages is termed as early chick nutrition. However, today with our intensive growing system we are losing potential growth if we do not make feed available immediately after hatch. In view of above the present study was undertaken to evaluate the effect of new polyherbal AVNNC/17 [supplied by M/S Ayurvet Ltd Baddi (H.P.), India], an early chick nutritional supplement on performance of the broiler chicken.

MATERIALS AND METHODS

Experimental design: The experiment was conducted on 150 day-old straight-run "Vencob" broiler chicks for a period of six weeks at an organized poultry farm, Shirval Veterinary College, Maharashtra, India. The delivery of day old broiler chicks was directly taken from the hatchery immediately after hatch. In the hatchery, the day old chicks were randomly divided into three groups, 1 control (I) and 2 treatments (II, III) and transferred into 3 different chick boxes to evaluate effect of early chick nutritional supplement AV/NNC/ 17 in improving overall growth performance. The feeding of AV/NNC/17 was initiated immediately after hatch and continued during the transport till brought to the farm and until completion of 48 h of post hatch to the treatment groups II and III in 2 different doses of 6 and 8 g/chick/day for 2 days. The group I was the control. Basal diet with similar composition was fed to the chicks in all the 3 groups after 48 h of hatch (Table 1). The chicks were reared in deep litter system under standard managerial practices and environmental conditions. Body weight was recorded on day 1st, day 2nd and at weekly intervals till 6th week of experimental trial. Average weekly body weight gain, feed consumption and feed efficiency was also recorded. Blood was collected after 3rd and 5th week of experimental trial for estimation of serum calcium and phosphorus by method of Oser (1976) and haemagglutination inhibition titre against new castle disease virus. To study the carcass parameters, 6 birds from each group were randomly selected and carcass yield and dressing percentage were recorded.

Method of Administration to group II (for one chick):

Paste was prepared by thoroughly mixing 3 g AV/NNC/17 with 3 mL of water. To group II, paste of AV/NNC/17 was administered @6 g/chick in chick box during the transportation. After arrival of chicks in farm the remaining paste was fed to the chicks for first day. On 2nd day same dose of AV/NNC/17 (6 g/chick) was offered. The basal diet was offered from third day.

Method of Administration to group III (for one chick):

Paste was prepared by thoroughly mixing 4 g AV/NNC/17 with 4 mL of water. To group III, paste of AV/NNC/17 was administered @8 g/chick in chick box during the transportation. After arrival of chicks in farm the remaining paste was fed to the chicks for 1st day. On second day same dose of AV/NNC/17 (8 g/chick) was offered. The basal diet was offered from 3rd day.

Serum calcium and inorganic phosphorus: From each group 6 birds were selected randomly at 3rd and 5th weeks of age for estimation of serum calcium and serum inorganic phosphorus. About 1 mL of blood was collected from each bird through wing vein in a clean, sterilized and labeled vial. Allowed to get coagulated and

the separated serum was subjected for estimation of calcium and inorganic phosphorus (mg/dL). Estimation was carried out by the standard methods described by Oser (1976).

NDV titres (Immune response): All birds were vaccinated against NDV on 7th day. Haemagglutination Inhibition test was carried out on serum samples of each group. HI titers were recorded on 7th, 14th, 21st, 28th and 35th day to observe the effect of early chick nutritional supplement on immune response.

Histomorphological study of intestine: Six representative birds from all the groups (I-III) were taken for recording the biometrical and histological observations. These were sacrificed on 2nd, 4th and 42nd day of age. Immediately after decapitation, the small intestine of all birds were collected and cleared from fascia and other tissue debris. Weight of small intestine and villous length were recorded.

Statistical analysis: The data obtained on various parameters were subjected to the statistical analysis as per the Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Live body weight: Body weight of chicks was recorded on day 1 and day 2 followed by at weekly intervals (Table 2 and 3). On second day, chicks of treated group (II and III) gained 12.32 and 13.26% more live weight than control (I). Husseiny *et al.* (2008) reported that Arbor Acre broiler chicks fed diet for first 48 h post-hatch exhibited significantly higher body weight, which is in agreement with the present study. Halevy *et al.* (2000), Noy and Sklan (1999) and Thaxton and Parkhurst (1976), postulated that early intake of carbohydrates is essential for growth initiation. The average weekly live body weight data of the chicks from day old to sixth week reveals that group II and III weighed 123.39 g (6.43%) and 103.37 g (5.44%) significantly ($p < 0.05$) higher than group I. Further comparison of different treatment means indicated that chicks in group II and III had significantly higher final body weight than control group. However, the difference between the 2 treatments (II and III) was non significant. Similarly, Noy and Sklan (1998) demonstrated that providing chicks with an exogenous nutrient source immediately after hatch significantly increased body weight. Dibner *et al.* (1998) also reported significantly heavier body weights in broiler chicks fed with the hatchery nutritional supplement compared to fasted chicks. The results of the present study are in concomitance with the above workers. This also indicates that residual yolk is used up more quickly in chicken that have access to early chick nutritional supplement immediately after hatch and thereby better assimilation of the nutrients (Panda and Reddy, 2007;

Table 1: The experimental design showing the different doses of AV/NNC/17

Group	Treatment details	Dose (kg/tonne feed)	No. birds
I	Basal diet (without supplementation of AV/NNC/17) will be given 48 h after hatch (Control)	No treatment	50
II	AV/NNC /17 immediately after hatching during transportation period till 48 h as per the dosage regimen and then the chicks will be given basal diet afterwards.	6 g paste/chick during transportation and 6 g paste/chick for the next 24 h in the farm.	50
III	AV/NNC /17 immediately after hatching during transportation period till 48 h as per the dosage regimen and then the chicks will be given basal diet afterwards.	8 g paste/chick during transportation and 8 g paste/chick for the next 24 h in the farm.	50

AV/NNC/17 is a coded herbal preparation containing Carbohydrate, Protein, Calcium and some of the growth promoting and immunomodulating herbs. This preparation was supplied by Ayurved Ltd., Baddi, Himachal Pradesh, India

Table 2: Day old and 2nd day Live weights (g) of the chicks

Day	Groups		
	I	II	III
Day old	44.1	44.6	44.6
2nd day	42.54	47.78 ^a	48.18 ^a

The means with different superscript differs significantly (p<0.05), C.D. 2.013

Juul-Madsen *et al.*, 2004). The birds treated with early chick nutritional supplement in groups II and III during the post hatch period for 48 h did not experienced the loss in live body weight. The improvement in overall growth and performance can be attributed to individual herb constituents of AV/NNC/17 viz. *Terminalia chebula*, *Terminalia bellerica*, *Spirulina*. This report also coincides with findings of Noy and Sklan (1999) who reported that delaying access to feed, hatchlings becomes more susceptible to increased weight loss. Thus, it might be concluded that the early chick nutritional supplement reduces the weight loss in birds during post hatch handling of chicks inclusive of transportation period.

Feed consumption: It is evident from results that the average feed consumption of group I was numerically higher than treatments (Table 3). The data on average weekly feed consumption subjected to statistical analysis was non-significant among 3 groups. This suggested that feeding of different doses of early chick nutritional supplement has non-significant effect on feed consumption of broiler chicken. Thus, in spite of significantly higher average live weight in birds in AV/NNC/17 supplemented groups at the end of 6th week, the average feed consumption of treated and control groups was almost comparable. However, it was found that chick treated with early chick nutritional supplement for 1st 48 h during the post hatch period exhibited numerically increased feed consumption in group II and III up to the end of 3rd week. Rapid development of the gastrointestinal tract allows ingestion of sufficient exogenous feed to replace the yolk sac as the major nutrient source within 48-72 h after hatch (Pinchasov and Noy, 1993). This might conclude

that birds treated with early chick nutritional supplement had comparatively efficient nutrient utilization than the control group resulting into higher live weight. Also the constituent herbs *Aegle marmeloos* and *Vitis vinifera* of polyherbal formulation are scientifically studied for improving gut function and villous development. Thus, the feed entering the gastrointestinal tract is consistently and efficiently digested, with no accumulation of unabsorbed nutrient (Riesenfeld *et al.*, 1980).

Feed conversion ratio: The data on average weekly feed conversion ratio is depicted in Table 3. Average feed conversion ratio for groups I, II and III were 1.88, 1.74 and 1.73, respectively. In the present study, it was found that increased feed consumption and higher live weight during first three weeks of age resulted in better feed conversion ratio among treated groups. The data on the average feed conversion ratio subjected to statistical analysis revealed a non-significant difference among the various groups which are in agreement with Noy and Sklan (1998) who also reported similar findings. The present study indicates that the early chick nutritional supplement in broilers might have positive effect on feed efficiency of broilers during the first few weeks after post hatch period.

Immune response: Statistical analysis of average weekly titres revealed significance (p<0.05) rise in the antibody titers in treatment group II and III compared to control group I, recorded at weekly intervals for 5 weeks (Table 6). The results reveal potent efficacy of polyherbal early chick nutrition supplement (AV/NNC/17) in enhancing immune response in broilers. Active constituents of AV/NNC/17 namely; *Phyllanthus emblica*, *Terminalia chebula* and *Terminalia* have been scientifically well proven for potent adaptogenic, immunomodulating and immunopotentiating properties. The results of our study corroborates with the findings of Panda and Reddy (2007) who reported that antibody titer (recorded on day 21) against Newcastle Disease vaccination was significantly higher in chicks allowed access to feed immediately after hatch.

Table 3: Avg. weekly live weights, gain in weights, feed intake and feed efficiency of broilers from different groups

Parameter	Avg. weekly live weights (g)			Avg. weekly gain in weights (g)		
	I	II	III	I	II	III
Day old	44.10	44.60	44.60	-	-	-
I	128.03	140.74	150.51	83.93	96.14	105.91
II	317.60	332.31	350.41	189.57	191.57	199.9
III	616.92	646.14	655.41	299.32	313.83	305.00
IV	1014.17	1043.32	1041.50	397.25	397.18	386.09
V	1455.03	1526.11	1467.61	440.86	482.79	426.11
VI	1918.53	2041.92	2022.90	463.50	515.81	555.29
Mean	784.91 ^a	825.02 ^b	818.99 ^b	312.405	332.887	329.717

Parameter	Avg. weekly feed consumption (g)			Avg. weekly feed conversion ratio		
	I	II	III	I	II	III
Day old	-	-	-	-	-	-
I	128.92	130.58	141.21	1.54	1.36	1.33
II	317.59	332.31	350.41	1.68	1.73	1.75
III	464.05	481.77	491.9	1.55	1.54	1.61
IV	765.11	629.46	626.2	1.93	1.58	1.62
V	890.17	923.62	864.98	2.02	1.91	2.03
VI	1168.5	1184.59	1113.66	2.51	2.30	2.01
Mean	613.722	598.060	621.578	1.88	1.74	1.73

The means with different superscript differs significantly (p<0.05). C.D = 28.7

Table 4: Average carcass yield, dressing percentage and livability of different groups

Parameter	Group I	Group II	Group III
Live weight at 6th week of age	1985.00	1975.00	2298.00 ^a
Carcass weight (g)	1385.00	1436.00 ^a	1664.00 ^{a,b}
Dressing percentage	69.77	72.71 ^a	72.41 ^a
Per cent livability up to 6th week	94%	96% ^a	100% ^a

The means with different superscript differs significantly (p<0.05), C.D. 2.013

Table 5: Mean serum calcium and inorganic phosphorus (mg/dl) values of different groups of broiler chicken

Parameter	Age in weeks	Group I	Group II	Group III
Serum calcium (Mg/dL)	3rd	9.04	10.4	11.54
	5th	10.4 ^a	11.52 ^b	11.978 ^b
Serum inorganic phosphorus (Mg/dL)	3rd	6.17	6.67	6.82
	5th	6.88	7.18	7.52

The means with different superscript differs significantly (p<0.05), C.D. = 1.076

Serum calcium and inorganic phosphorus: Significant difference in serum calcium values among both the treatments compared to control was recorded after 5th week. However, the values were statistically non-significant for serum calcium and phosphorus at 3rd week of age. The mean values for serum calcium and inorganic phosphorus are depicted in Table 5. The results of our study indicated that the serum inorganic phosphorus level was not influenced but well maintained by early chick nutrition. However, a significant improvement in serum calcium was observed which can be one of the contributory factors of significantly better growth, performance and carcass traits in treated groups.

Carcass yield and dressing percentage: The average carcass weights (g) of broilers for different groups were 1385, 1436 and 1664 g for group I, II and III, respectively

(Table 4). The average values of dressing percentage were 69.77, 72.71 and 72.41 for group I, II and III, respectively. The statistical analysis of data revealed a significant difference among control and treated groups. Halevy *et al.* (2000) and Mozdziaik *et al.* (1996) reported reduction in meat yield observed 48 h after early post hatch starvation which was attributed to reduction in muscle size due to starvation induced inhibition of satellite cell proliferation. Noy and Sklan (1998) observed the percentage of breast meat was increased by 7.9% by early nutrition in broiler chicken. In our study, early chick nutritional supplement (AVNNC/17) increased the carcass yield and dressing percentage numerically which might be due increase in the satellite cell proliferation and thereby muscle size. The results also reveal the synergistic action of herbs and other constituents of AV/NNC/17 e.g., carbohydrate, protein and vitamins (vit. A, D₃, E) in improving carcass traits in broilers.

Table 6: Average values of HI titers for NDV from 7-35th day

Days	Group I	Group II	Group III
7 th	13	26	30
14 th	28.7	60	64
21 st	48.75	112	120
28 th	13	20	22
35 th	6.5	13	16
Mean	21.99 ^a	46.20 ^b	50.40 ^b

The means with different superscript differs significantly ($p < 0.05$), C.D. = 21.214

Histomorphological studies of Intestine: The values for biometrical and micrometrical observations were significantly increased in group III followed by group II than in group I as observed on 2nd, 6th and 42nd day of experimental trial. The overall results of the study indicated that the feeding of AV/NNC/17 has significant effect upon intestinal morphogenesis, villous growth and development and on overall histomorphology of small intestine of birds. This may be attributed to the synergistic action of certain herbs responsible for stimulation development of intestinal epithelium, crypts and tissue. The constituent herbs *Aegle marmeloës* and *Vitis vinifera* of AV/NNC/17 are scientifically well known for villous growth, enterocyte differentiation and improving gut function.

Livability: The percent livability was 94, 96 and cent percent from group I, II and III, respectively (Table 4). It was observed that the percent livability was significantly highest in the treatment group III followed by group II and Control group I. Zehaya Uni (1998) reported that early feeding contributes to the earlier development of immune response. Similarly, Panda and Reddy (2007) reported that early chick nutrition can boost up the immune system in broilers. The results of the present study indicated that the early chick nutritional supplement for 48 h of post hatch period exerted an immunopotentiating response in broiler chicken.

Conclusion: The supplementation of AV/NNC/17 containing synergistic herbs alongwith carbohydrate, protein source has prevented the early posthatch energy deficit in chicks so that yolk can be utilized for initiating intestinal growth and development It can be concluded that a balanced nutrition in chicks during early 24-48 h is important to achieve efficient yolk utilization, better immune response and for overall efficient growth and performance in birds. Supplementation of polyherbal early chick nutritional supplement AV/NNC/17@ 6g and 8 g/chick to chicks during first 48 h has revealed not only short term but a long term and significant impact on body weight gain, FCR, dressing percentage, livability and immune parameters such as HI titre in addition to improvement in intestinal health and early morphogenesis.

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