



Productive Consequences of Fasting Neonatal Chicks of Different Genetic Constitutions for Growing

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ABSTRACT

The study was designed to evaluate the productive consequences of fasting neonatal chicks obtained from strains genetically divergent for growing. Four hundred eight chicks from three strains, 160 from breeders selected for high growth rate and excellent feed conversion ratio (Cobb 500), 160 from breeders not selected for fast growth (JA57), and 160 from a white egg layer strain (Hy-Line W98) were allotted in a 3 (strain) x 2 (fasting period - 8 and 36h after hatching) factorial arrangement with 5 replicates of 16 chicks each. Immediately after hatching, all chicks had similar ($P>0.05$) relative yolk sac weights (14.13%, 14.50%, and 15.49% for Hy-Line, Cobb, and JA57, respectively). The yolk sac retractions were proportionally higher for Cobb and JA57 chicks up to 144 h (6 days) after placement, but were not influenced by 36h of feed fasting. At 7 and 14 days of age only Cobb chicks had their body weight and weight gain significantly ($P<0.05$) depressed by 36h feed fasting after hatching. Results indicate that broiler chicks with intense initial growth rates (Cobb 500) need an outstanding nutritional supply, either from exogenous (feed) or endogenous (residual yolk) sources, to achieve a final weight compatible with their genetic constitution. For slow-growing chicks (Hy-Line), nutritional supplementation via yolk sac seems to be more important than exogenous supply (feed) of nutrients during the neonatal period.

INTRODUCTION

Factors that regulate growth rate of chicks after a period of feed restriction are partially related to the adaptation of the gastrointestinal tract, such as weight increase, increase in the activity of digestive enzymes, and decrease in the time of digesta retention (Nir *et al.*, 1993). More attention has been recently given to the time that the chicks remain without feed after hatching, which influences the performance of broilers at slaughter age (Gonzales *et al.*, 2000, 2003). Similar to the phenomenon of yearly feed restriction, feed fasting results in poor development of supply organs and tissues of the gastrointestinal tract (Uni *et al.*, 1998).

It is known that the growth of neonatal chicks before exogenous feeding (feed) depends on the nutritional elements absorbed from the residual yolk sac (Noy & Sklan, 1998). However, as previously mentioned, delays in placement and feeding of broiler chicks cause productive losses later on, at 42 days of age (Gonzales *et al.*, 2003). Early feeding after hatching, as compared to delayed feeding, appears to stimulate yolk utilization (Noy & Sklan, 1998; Speake *et al.*, 1998).

According to Nitsan *et al.* (1991), the size of yolk sac of birds selected for high growth rate (broiler chicks) is smaller than those birds that present slow development, such as White Leghorn birds. These facts indicate



that the supplementation of nutrients via residual yolk is not sufficient to support the extremely high growth rate of broiler chicks during the initial post-hatch phase. Thus, the use of residual yolk and the need of exogenous nutrition (ration) of neonatal chicks from divergent background for growing may be different and related to at least two factors - the genetic bird constitution and the feed fast time immediately after hatching.

This study was designed to evaluate the productive consequences of chickens obtained from strains genetically divergent in growth rate (Cobb-500, JA57, and Hy-Line W48) and subjected to a period of either 8 or 36h of feed fasting after hatching.

MATERIAL AND METHODS

Chicks were obtained from three breeder strains: Cobb 500, selected for high growth rate and excellent feed conversion ratio; JA57 (naked-neck broiler), not selected to grow very fast; and Hy-Line W98, light bird selected for egg production. Mean weights of the incubated eggs for chick production were 63.7g, 72.0g and 73.0g for Hy-Line, Cobb, and JA57 breeders, respectively.

Chicks were allotted eight hours after hatching to a randomized block experimental design with a 3 x 2 factorial arrangement (3 strains: Cobb 500, JA57, and Hy-Line; and 2 fasting periods after hatching - 8 and 36h), with 5 replicates of 16 chicks each, totaling 6 treatment groups, 30 experimental units, and 480 chicks, being 160 of each strain.

Birds were distributed in three batteries of five floors each divided in two boxes. When necessary, heat was provided during the post-hatch rearing period (1 to 14 days) using infrared lamps placed in front of the batteries.

Immediately after placement (8 hours after hatching), all birds had ad libitum access to water. At this moment, half of the birds of each strain were fed. The other half was fed only 28h after placement (36h after hatching).

Feed was supplied in mash form, and formulated to contain 3050 kcal/kg ME, 0.57% Met, 0.94% Met+Cys, 1.20% Ca, and 0.46% available P.

After hatching, ten birds of each strain were weighed, killed by cranial traumatism, and had their yolk sacs excised and weighed. The same sacrifice procedure and residual yolk sac evaluations of two experimental birds per replicate were carried out at 24, 48, 72, 96, 120 and 144h after placement. Body weight, weight gain, and mortality index of the

experimental groups were recorded on the 7th and the 14th experimental days.

Results were statistically processed using General Linear Model procedures of SAEG (1999) computational program. Data were submitted to analysis of variance (ANOVA) according to a block experimental design with a 3 x 2 factorial arrangement. When necessary, differences among means were separated by Tukey's test ($p < 0.05$).

RESULTS AND DISCUSSION

Chicks from the three strains had similar relative yolk sac weights immediately after hatching despite the differences in body weight (Table 1). Cobb neonatal chicks presented the highest body and yolk weights, which were different from those of Hy-Line and JA57 chicks. However, yolk sac percentage relative to chick body weight was similar among strains (14.50%, 15.49%, and 14.13% for Cobb, JA57, and Hy-Line, respectively), which is consistent with the results obtained by Chamblee *et al.* (1992).

Table 1 - Body weight (g) and absolute (g) and relative (%) yolk sac weights of chicks from different genetic constitutions obtained 30 min after hatching.

Strain	Yolk sac weight,		
	Body weight, g	g	% ¹
Cobb 500	47.4a	6.88	14.50
JA57	43.1b	6.70	15.49
Hy-Line W98	44.5b	6.30	14.13

1 - Relative to body weight. a, b - Values sharing no common superscripts are statistically different by Tukey's test ($P < 0.05$).

No statistical interaction ($P > 0.05$) between strain and feed fasting effects was observed for yolk sac retractions (Table 2) up to 144h (6 days) after placement. Independently of the fasting period, a normal standard curve of residual yolk sac reduction as a function of post-hatching time was observed. Only small amount of residual yolk was present up to 144h after placement in all chicks of the three evaluated strains. However, residual yolk utilization was proportionally higher in Cobb chicks as compared to Hy-Line birds. JA57 chicks presented intermediate yolk sac retraction. Holding the birds for 36h without feed did not influence the proportional use of the yolk sacs. However, other studies indicated that fasting depressed yolk utilization (Noy & Sklan, 1998; Gonzales *et al.*, 2003). This difference may be attributed to the high coefficient of variation observed, which is characteristic of this kind of measurement.



Table 2 - Change in absolute (g) and relative (%) yolk sac weights after hatching (h) of chicks of different strains.

Strain	24 h		48 h		72 h		96 h		120 h		144 h	
	g	%	g	%	g	%	g	%	g	%	g	%
Cobb 500	5.29a	11.49a	3.06	5.81	1.63	2.57b	0.98b	1.37c	0.87	1.04b	0.42	0.40b
JA57	3.76b	9.13b	2.76	6.10	1.73	3.36b	1.51a	2.54b	1.25	1.80a	0.33	0.43b
Hy-Line W98	5.03a	12.48a	3.00	7.37	2.35	5.29a	1.79a	3.79a	1.00	1.88a	0.49	0.84a
Fast period												
8 h	4.63	10.71	3.02	6.23	1.80	3.33	1.43	2.56	1.00	1.43	0.39	0.52
36 h	4.75	11.36	2.87	6.62	2.01	4.15	1.42	2.57	1.07	1.72	0.43	0.60
CV	20.68	17.80	21.52	22.41	38.39	36.97	32.30	30.58	47.54	50.56	56.38	64.81

a, b, c - Values sharing no common letters are statistically different by Tukey's test (P<0.05).

Significant interactions (P<0.05) between feed fasting period x chick strain were observed for body weight and weight gain (Table 3). As expected, consistent weight gain of the Cobb chicks at 7 and 14 days of rearing was registered (Table 3), and independently of fasting, they presented the highest body weight and weight gain, followed by JA57 and Hy-Line birds. However, only Cobb chicks had their body weight and weight gain depressed by 36h of feed fasting. Body weights and weight gains of Hy-Line and JA57 chicks were not affected by the long period of fasting. In fact, Hy-Line birds held without feed for 36h after hatching showed higher, despite not significant, weight gain than their 8h-fasted counterparts. Confirming other studies (Gonzales *et al.*, 2000, 2003), delaying access to feed for 36h after hatching impaired body weight and weight gain of broiler chicks selected for fast growth.

Observing the relative weight gain curve of the 8h-fasted chicks up to 6 days after placement, a clear difference in favor of Cobb chicks for growth was verified (Figure 1). This figure also shows that Hy-Line chicks had negative weight gain at 24 and 48h after hatching, and grew very slowly from the 3rd to the 6th day post-hatching, suggesting that these birds did not respond enough to the supply of feed.

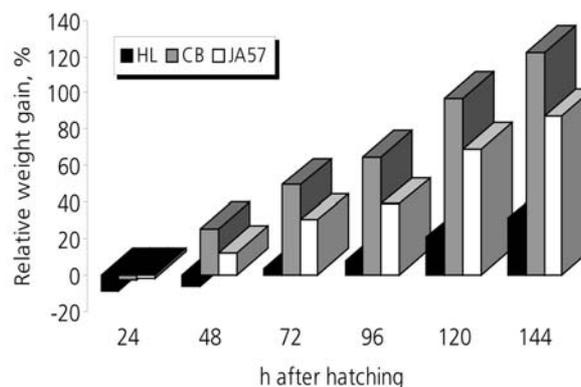


Figure 1 - Relative weight gain of chickens of different genetic constitutions for growth after hatching. HL = Hy-Line W98; CB = cobb 500; JA57 = Nacked neck JA57.

Mortality index was low, and did not differ among the treatment groups (Table 4).

Table 4 - Number of dead (N), Initial number (Total) and % of mortality of chicks from different strains subjected or not to fasting during the neonatal period.

Strains	N/Total	%
Strain		
Cobb 500	2/160	1.25
JA57	2/160	1.25
Hy-Line W98	1/160	0.63
Fasting¹		
8 h	2/240	0.83
36 h	3/240	1.25

Table 3 - Body weight and weight gain on days 7 and 14 of birds from different genetic constitutions subjected or not to feed fasting after hatching.

Fast period	Body weight, g			Weight gain, g		
	8 h	36 h	Mean	8 h	36 h	Mean
1 to 7 days						
Strain						
Cobb 500	139.8 A a	121.8 A b	130.8	91.7 A a	73.7 A b	82.7
JA57	96.7 B	90.1 B	93.4	53.6 B	47.0 B	50.3
Hy-Line W98	64.5 C	66.0 C	65.3	22.0 C	23.8 C	22.9
Mean	100.3	92.6		55.8	48.1	
1 to 14 days						
Strain						
Cobb 500	347.9 A a	267.5 A b	307.7	299.8 A a	219.4 A b	259.6
JA57	197.3 B	181.5 B	189.4	154.2 B	138.3 B	146.3
Hy-Line W98	111.2 C	115.2 C	113.2	68.7 C	73.0 C	70.8
Mean	218.8	188.1		174.2	143.6	

A, B, C - In a column, no common capital letters indicate significant strains effects (Tukey's test, P<0.05). a, b - In a row, no common letters indicate significant feed fast period effects (F test ,P<0.05).



The results of this experiment indicate that chicks with intense initial growth rates (Cobb 500) need an outstanding nutritional supply, either from exogenous (feed) or endogenous (residual yolk) sources, to achieve a final weight compatible with their genetic constitution. For slow-growing chicks (Hy-Line), the nutritional supplementation via yolk sac seems more important than the exogenous source (feed) during the neonatal period.

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