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## The Importance of Endogenous Nutrition of Chicks from Divergent Strains for Growing Tested by Deutectomy

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Body weight, chick, deutectomy, strain, yolk sac.

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### ABSTRACT

Effects of yolk sac removal (deutectomy) upon performance of chicks from three divergent strains were tested to evaluate the importance of endogenous nutrition on the post-hatch phase. Chicks from three different strains (Hy-Line W98, Cobb 500, and JA57) were submitted to a surgery procedure after hatching. Half of them had the residual yolk removed, and the other constituted a sham-deutectomized group. After operation, chicks were designated to a 3 x 2 factorial design (3 strains x 2 presence/absence of yolk sac), in a total of six experimental groups and ten replications of two to four birds. During 14 experimental days all birds were fed *ad libitum* a 21% CP and 3050 kcal/kg EM mash diet. Data were analyzed by ANOVA, and Tukey's test ( $p < 0.05$ ). Relative yolk sac weights were similar among chicks from different breeders, averaging 11.7% to 13.5%. Comparing to sham-operated, deutectomized chicks had lower weight gain at 7 and 14d, indicating that endogenous nutrition, via yolk sac, is very important to galliform birds whatever their strain. Hy-line deutectomized chicks gained 40% less body weight at the 7<sup>th</sup> day as compared to their sham counterparts. Analysis of the same criterion to Cobb and JA57 groups revealed a decrease of 16.1% and 10.8%, respectively, on weight gain efficiency. At the 14th rearing day, Hy-Line chicks had the lowest weight gain, followed by JA57s' and Cobbs'. The results suggested that chicks selected for fast growth are less dependent on endogenous nutrition, responding better when exogenous nutrition is associated to yolk assimilation.

### INTRODUCTION

Some authors support the theory that growth of neonatal birds is highly dependent on endogenous nutrition through residual egg yolk. However, delayed early feeding of newly hatched chicks depresses performance of 42-d-old broilers (Gonzales *et al.*, 2000, 2003). This fact indicates that the supplementation of nutrients via residual yolk seems not sufficient to support the extremely high growth rate of broiler chicks in their initial post-hatch period.

According to Nitsan *et al.* (1991), the size of yolk sac from birds selected for high growth rate (broiler chick) is smaller than those having slow development, as White Leghorn birds. Thus, the use of residual yolk and the need of exogenous nutrition (feed) of neonatal chicks from divergent background for growing could be different and related to at least two factors, the genetic constitution of the bird, and the duration of feed deprivation immediately after hatching.

The effect of removing the yolk sac (deutectomy) upon the performance of chicks was tested in order to evaluate the importance of the endogenous (residual yolk) nutrition to chicks from breeders of divergent background for growing.



## MATERIAL AND METHODS

Chicks used in this trial were obtained from breeder eggs of three strains, one from a broiler line selected for high growth rate and excellent feed conversion (Cobb 500), the second also from a broiler strain, but not selected to fast growth (JA57 - naked neck), and the third from white egg-layer strain (Hy-Line W98). Eggs from breeders in the middle of their productive period were selected to represent the average weight 5% at a given stage of egg production. Breeder ages were 48, 43, and 50 weeks, and the mean egg weights were 62, 60.5, and 65 g for Hy-Line, Cobb and JA57 breeders, respectively.

The chicks were subjected to a surgical procedure immediately after hatching, defined as the time when birds completely left the shell. Half of them had the residual yolk removed. The other half constituted a sham deutectomized group for whom a simple incision of the skin was done.

The following surgical procedure was adopted according to modified method reported by Chambele *et al.* (1992): 1) Mark; 2) Weigh; 3) Removal of downs next to navel area; 4) Disinfection by swabbing the area with tincture of iodine; 5) Infusion of 0.3 mL of Pearson anesthetic; 6) Incision of the skin on the right side of the navel hole; 7) Opening of abdominal cavity and exposure of the yolk sac; 8) Cutting of the yolk sac stalk at the point of attachment to Meckel's diverticulum; 9) Excision of yolk sac (deutectomy), when appropriate; 10) Closing of surgical incision with catgut strap 3-0; 11) 0.5 mL IM injection of PentVet Plus; 12) Resting of the chicks for at least 2 hours in heated environment using a 60W lamp.

After operation, the chicks were designated to a 3 x 2 factorial design (3 strains x 2 presence/absence of yolk sac), in a total of 6 experimental groups and 10 replications of 2 to 4 birds each. The birds were distributed in three batteries, each with five floors divided in two boxes. Each floor of the batteries was considered one experimental block. When necessary, the thermoneutral conditions of chicks during the rearing period were achieved by the use of infrared lamps placed in front of the batteries. During 14 days of rearing, all birds were fed *ad libitum* a 21% CP and 3050 kcal/kg EM mash diet. Because spillage occurred, feed intake was not recorded.

Data were analyzed by ANOVA for a 3 x 2 factorial arrangement using the General Linear Model of SAEG (1999) software. Significant differences among means were separated by Tukey's test. ( $p < 0.05$ ).

## RESULTS AND DISCUSSION

Similar to what occurred in a previous experiment (Gonzales *et al.*, submitted), the relative weight of yolk sac from chicks of different genetic backgrounds were not different (Table 1). However, the values here obtained were lower, ranging from 11.7 to 13.5% of the live weight. The period between hatching and measurement of the yolk sac was long due to the deutectomy procedure, demanding a long time to collect the weight of the yolk sac. Thus, the possibility that some residual yolk was consumed during the waiting time exists as formerly observed by Noy and Sklan (2001). However, Chamblee *et al.* (1992) reported that during 12 h after hatching no significant use of residual yolk by broiler chicks was verified. So, origin and age differences of neonatal birds should be considered when analyzing yolk residue measurements.

The statistical evaluation of body weight and weight gain at 7th and 14th experimental days showed a significant effect ( $p < 0.05$ ) of strain and deutectomy (Table 2). However, no interaction ( $p > 0.05$ ) between the two factors was observed (Table 2). As compared to sham-operated chicks, deutectomized birds had significantly lower body weight and weight gain at 7 and 14 days of age, indicating that endogenous nutrition was very important for the birds whatever their strain origin. However, it is necessary to mention that the surgical procedure was in itself a stress factor that influenced feed and water consumption for at least 24 hours after the deutectomy procedure. Independently of surgical procedure Cobb chicks performed better than JA57 and Hy-Line, as expected.

The weight gain of Hy-Line deutectomized chicks was 40% lower than their sham-operated counterparts (sham-operated, non-deutectomized Hy-Line chicks). On the other hand, the analysis of the same criterion (deutectomized against sham-operated) in Cobb and JA57 groups revealed 16.1% and 10.8% lower weight gain, respectively (Table 3). At 14 days of rearing, Hy-Line deutectomized chicks presented -13.6% weight gain as compared to non-deutectomized counterparts. For JA57 and Cobb chicks, differences in weight gain between deutectomized and non-deutectomized were -12.1% and -9.7%, respectively.

Thaxton (1984) demonstrated that broiler chicks were able to compensate deutectomy four weeks later. However, Gonzales *et al.* (2000, 2003) observed growth depression in broiler chicks fasted for 24 h in neonatal period, similar to the effect of deutectomy.



The initial growth depression due to feed deprivation was not compensated 42 days later (Gonzales *et al.*, 2003), indicating that good initial nutrition, both endogenous (residual yolk) and exogenous (diet), is essential for the expression of the growth according to the genetic background of the bird.

**Table 1** - Body weight, and absolute (g) and relative (%) weights of yolk sac after hatching of chicks from different strains.

Strain	Yolk sac weight,		
	Body weight, g	g	% 1
Hy-Line W98	40.0c	4.67b	11.71
Cobb 500	46.6b	5.98a	12.75
JA57	49.2a	6.73a	13.53

a,b - Values sharing no common superscripts in the same column are statistically different (Tukey's test,  $p < 0.05$ ). 1 - Relative to body weight.

**Table 2** - Body weight and weight gain on 7th and 14th experimental days of chicks from different strains subjected or not to deutectomy.

Parameters	7 days		14 days	
	Body weight, g	Weight gain, g	Body weight, g	Weight gain, g
<b>Strains</b>				
Hy-Line W98	55.4c	19.3c	101.9c	65.8c
Cobb 500	125.9a	83.6a	309.0a	266.8a
JA57	94.8b	51.4b	207.0b	163.8b
<b>Deutectomy</b>				
Yes	83.9x	46.4x	193.4x	155.9x
No	100.0y	56.5y	218.6y	175.1y
<b>Effects</b>				
Strain (S)	*	*	*	*
Deutectomy (D)	*	*	*	*
S x D	NS	NS	NS	NS

\* - Significant ( $p < 0.05$ ). NS Not significant ( $p > 0.05$ ). a, b, c, - Values sharing no common superscript in the same column are statistically different by Tukey's test at  $p < 0.05$  (strain effect). x, y - Values sharing no common superscript in the same column are statistically difference by F's test at  $p < 0.05$  (deutectomy effect).

**Table 3** - Relative difference (Dif, %) on weight gain at 7th and 14th experimental days among deutectomized (D) and non-deutectomized (ND) chicks from different strains.

Strains	Weight gain, g					
	7 days			14 days		
	D	ND	Dif, %	D	ND	Dif, %
Hy-Line W98	14,4a	24,1b	-40.2 %	60,5a	70,5b	-13.6 %
Cobb 500	76,3a	90,9b	-16.1 %	253,1a	280,4b	-9.7 %
JA57	48,5a	54,4b	-10.8 %	154,0	175,2b	-12.1 %

a, b, c - Values sharing no common superscript in the same column are statistically different by Tukey's test at  $p < 0.05$ .

The mortality indexes were relatively low (only 2 to 3 birds per experimental units) and were not statistically different among treatment groups (Table 4). However, all deutectomized groups displayed some mortality, indicating that the method affected the birds, mainly the Hy-Line ones. Placing the feeder and the drinker inside the box as a management procedure to facilitate the access of the birds, encouraging feed and water

consumption, was very important to improve the liability and the performance depressed by surgical process.

**Table 4** - Mortality index at 7th and 14th experimental days of chicks from different strains subjected or not to deutectomy.

Strain	Deutectomy	7 days		14 days	
		N/total	%	N/total	%
Hy-Line W98	Yes	3/20	15.00	3/20	15.00
	No	2/20	10.00	3/20	15.00
Cobb 500	Yes	2/35	5.71	2/35	5.71
	No	0/30	0.00	0/30	0.00
JA57	Yes	3/35	8.57	3/35	8.57
	No	0/30	0.00	0/30	0.00

The results suggested that chicks selected for fast growth, such as Cobb, are less dependent on endogenous nutrition, responding better when yolk assimilation and exogenous nutrition via diet are associated. However, the yolk sac is essential for growth initiation of light-strain birds (Hy-Line).

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