

## Effects of Delayed Placement and Dietary Lysine Levels on Performance and Diameter of the Skeletal Muscle Fibers of Broiler Chickens in the Starting Period

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### Abstract

The objective of this paper is studying the effects of delayed placement (DP) and dietary lysine levels on performance and diameters of muscle fibers (DMF). 1,760 male Cobb chicks distributed in a completely randomized design in a factorial arrangement of 4x2 (DP of 12, 24, 36 and 48h, and digestible lysine levels of 1.143 and 1.267%), totalizing eight treatments, four replicates, and 55 chicks per experimental unit. After the respective delayed placement, the chicks received water and the experimental diets until 21-d-old. The corn and soybean meal diets were based on ideal protein concept. Moreover there was no interaction ( $P>0.05$ ) between the DP and lysine levels. The birds fed with 1.143% of lysine level showed highest ( $P<0.05$ ) body weight and feed intake, but did not have difference on the other parameters. The DP affected of negative linear form ( $P<0.05$ ) the body weight, feed intake, and DMF. However, it not affect ( $P>0.05$ ) the feed conversion or abdominal fat. According to the results, the diet contend 1.143% of digestible lysine, based on the ideal protein concept, provides better performance of the chickens, independent of the DP.

### Introduction

Recently, search consumers' for products of easy preparation such as the processed products and boned cut of chicken meat, mainly the breast meat cut, has increased considerably. The increase of broiler's breast mass is dependent of muscle fibers diameter, especially of *Pectoralis major* fibers. However, in chickens, approximately 95% of the DNA of muscle fibers derived from satellite cells that proliferated, differentiated and fused with existing fibers. The fibers number is important. Instead, without the addition of the new nucleus by satellite cells, the muscular fibers do not increase in size and have little increase in the muscular mass and meat production (HALEVY *et al.*, 1998). The process of muscle fiber maturation after hatch is sufficiently fast and programmed in broiler chickens and any delay as the delayed placement could have an irreversible effect on this maturation (HALEVY *et al.*, 2000). After hatching the chicks remain in the hatchery until being sexed, vaccinated and carried until the destination places. This time for the placement has been a significant factor in the reduction of the chicken's growth, with effect the shorter and longer time (NOY and SKLAN, 1997). Beyond the delayed placement, an adequate nutrition has great effect on the muscle mass optimization of broilers, especially the dietary lysine levels. Therefore, this amino acid is one of the main constituent of the animal protein (ACAR *et al.*, 1991). The increase of the lysine levels above of the recommended for the excellent performance of the broiler, seems to be related with the carcass yield optimization, mainly the breast meat yield improvement feed conversion and fat reduction (NASCIMENTO, 2003). A way to obtain the better relation between amino acids of the diet is that each essential amino acid has been expressed in relation to one amino acid reference, being the lysine as reference to define the ideal protein pattern. Thus, the objective of this trial was to study the effects of delayed placement and dietary lysine levels in diets, based on ideal protein concept on performance and diameter of the skeletal muscle fibers, considering pectoral muscle of broilers in the starting period (1 to 21-d-old).

### Materials and Methods

1,760 male chicks obtained from a commercial hatchery were used in this experiment. The chicks were originated from the same flock of Cobb broiler breeders of 47 wk of age. After

they were removed from the hatchers, the birds were winged-sexed, vaccinated for Marek's disease and carried to experimental farm. The total time between the hatching of chicks (06:00 a.m) and the placement in the farm (06:00 p.m) was 12 hours. In the farm, the chicks were weighed and assigned to floor pens inside of cardboard boxes without access to water or experimental diets until the respectively time for placement have been evaluated. The design used was completely randomized with a factorial arrangement of 4 x 2 (delayed placement: 12, 24, 36 and 48 h; digestible lysine level: 1.143 and 1.267 %), totalizing eight treatments, with four replicates and 55 chicks per experimental unit. After the respective delayed placement, the chicks received water and the experimental diets until 21-d-old. The diets were based on corn and soybean meal and formulated according to the chemical composition of feedstuffs and nutritional requirements recommended by ROSTAGNO et al. (2000). All diets were supplemented with synthetic amino acids to obtain the pattern of ideal protein for digestible amino acids, considering the lysine is equals to 100%, methionine and cystine 71%, threonine 59% and tryptophan 16%. The diets were isoenergetic (3,000 kcal/kg ME), isoproteic (19%), isocalcium (0.960%), isophosphorus (0.450% Pd), isosodium (0.222%), and isochloride (0.311), varying the lysine levels evaluated and the other amino acids levels according of IP pattern. The abdominal fat was determinate to the 21-d-old using eight chickens per treatment (two birds per experimental unit). Implementing the evaluation of the muscle fibers diameters used collected one sample of the muscle tissue on the superficial region of right *Pectoralis major* muscle of three birds per treatment. The samples were maintained in ambient temperature during 15 minutes, after they were immerse in n-Hexane at -70°C with nitrogen liquid (two minutes). The samples of muscle were transferred to cryostat and he histological cuts had eight µm of thickness. These were submitted to Hematoxiline-Eosina method to study the fibers diameters and to evaluate the hypertrophy degree, using small diameter method according with DUBOWITZ (1985). The experiment obtained 15 images of muscle tissue from the birds evaluated. Each image measured 20 muscle fibers, totalizing 300 fibers per animal (900 fibers/treatment). General procedure of the SAEG software (SAEG, 1999) was used to performance one-way analyses of variance to determine the lysine and delayed placement effects on broiler's performance and diameter of muscle fibers. The degrees of freedom, referring to delayed placement had been unfolded in polynomials, using the regression analyses.

## Results and Discussion

In accordance with the results, there was no interaction ( $P>0.05$ ) between DP and the digestible lysine levels studied on the evaluated parameters (Table 1). The lysine levels affected ( $P<0.05$ ) the 21-d-old body weight and the feed intake. The birds fed with 1.143% of lysine showed the highest weight and feed intake, however there was no difference ( $P>0.05$ ) on feed conversion or abdominal fat. The strategy of increased the dietary lysine levels for broilers, balancing the essential amino acids based on IP concept could improve the feed conversion because there are an increase of muscular growth, body weight gain, and reduction the abdominal fat, without to modifies the feed intake (NASCIMENTO, 2003). However, the results showed in this work disagree with this author. These results can be related with protein level (19%), which was not sufficient to supply the necessary amount of nitrogen for endogenous protein synthesis, when the high amino acid level was used. Also the DP affected ( $P<0.05$ ) the 21-d-old body weight, feed intake and the DMF. With the increase of the DP and consequently of the fasting, there was a negative linear effect on body weight ( $Y = 767.42 - 1.63276X; r^2 = 0.36$ ), feed intake ( $Y = 1139.73 - 3.058X; r^2 = 0.50$ ) and DMF ( $Y = 34.9737 - 0.0853935X; r^2 = 0.18$ ). Moreover, the reduction of the DMF caused by DP can be related with the satellite cells proliferation immediately post-hatch. When comparing the number of satellite cells in proliferation during all the growth, HALEVY *et al.* (2000) verified that the

young chickens submitted to the post-hatch fasting period (48 h) presented a little index of proliferation to these cells. Probably, this factor would be the reason for the slower process of maturation in these muscle fibers. In accordance with the authors, the reduction of the hypertrophy and the muscular mass studied and the feed supply in enough amounts, immediately after hatch, can be critical in affecting the posterior development of the muscle. In this research, we concluded that the diet contend 1.143% of digestible lysine, based on the ideal protein concept, provides better performance of the chickens, independent of the DP. However, when the chicks and feed are placement earlier, there is much better performance and higher is the diameter of skeletal muscle fibers in their pectoral muscle at 21 days.

Table 1 – Effects of delayed placement and dietary lysine levels on body weight at 21d (BW), feed intake (FI), feed conversion (FC), abdominal fat (AF) and diameters of muscle fibers (DMF) of broilers chickens in the starting period (1-21d)

Delayed Placement (h)	Parameters					
	BW, 21d		FI	FC	AF	DMF
	g		g	g: g	%	µm
12	747.85 (100.0) <sup>1</sup>		1099.85	1.584	1.73	33.95
24	728.26 (97.38)		1064.48	1.534	1.61	32.92
36	708.66 (94.76)		1029.10	1.543	1.70	31.90
48	689.07 (92.14)		993.74	1.554	1.55	30.88
Digestible Lysine Levels (%)						
1.143	735.47		1076.91	1.547	1.66	32.47
1.267	698.19		1017.45	1.562	1.64	32.26
Mean	716.83		1047.18	1.555	1.65	32.37
CV (%)	2.86		2.70	2.81	11.8	7.69
Lysine levels	*		*	NS	NS	NS
Delayed Placement	Linear <sup>2</sup>		Linear <sup>3</sup>	NS	NS	Linear <sup>4</sup>
Interaction	NS		NS	NS	NS	NS
R <sup>2</sup>	0.36		0.50	-----	-----	0.18

\* Significant; (P<0.05); NS = Not significant (P>0.05);

<sup>1</sup>. The number in brackets is relative to 12 h of delayed placement (%);

<sup>2</sup>Y = 767.42 – 1.63276; <sup>3</sup>Y = 1139.73 – 3.058X; <sup>4</sup> Y = 34.9737 – 0.0853935X;

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