



## Curtain color and lighting program in broiler production: II. carcass and parts yield and abdominal fat deposition

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**ABSTRACT** - The objective of the present study was to evaluate carcass and parts' yield, abdominal fat deposition and breast and foot pad blisters of broilers reared under two lighting programs (nearly continuous or intermittent) in broilers houses with yellow and blue curtains. The experiment was conducted between June, 2004 and May, 2005. Six flocks were sequentially housed in four 12 × 10 m broiler houses divided into 4 pens with 200 birds each. The litter was reused six times or until flock 6. A completely randomized design in a 6 × 2 × 2 factorial arrangement (flocks, lighting programs, curtains) with four replicates per treatment was applied. A total of 288 birds were evaluated for carcass yield. Curtain color did not affect carcass or parts' yield. The effect of lighting program and curtain color on carcass yield may depend on other factors related to flock. Intermittent lighting program promoted the highest drumstick and thigh yields. Lighting programs and curtain colors did not affect abdominal fat deposition or the presence of breast and foot pad blisters.

Key Words: breast blister, breast yield, foot pad blister, intermittent, leg yield, nearly continuous

### Introduction

Understanding the influence of photoperiod on broiler production allows producers to select the best lighting program and make decisions to optimize the combination of production characteristics that bring higher profits. Long duration lighting programs (24 hours of light) may have beneficial effects on breast yield, but increase leg problems in broilers. Intermittent lighting programs (23 hours of light and 1 hour of darkness or 16 hours of light and 8 of darkness) are characterized by repeated light and dark periods within 24 hours. Broilers submitted to intermittent lighting program show higher productivity and fewer leg problems when compared to those reared under continuous lighting programs (Classen, 1996). According to Renden et al. (1991), despite the large number of studies on lighting programs, there is still little information on their effect on carcass yield or quality. Moraes (2006), when studying the effect of lighting programs on parts yields, did not find any influence on the carcass yield of broilers slaughtered at 45 days of age, but those submitted to 23 daily hours of light presented higher breast yield, as reported by Renden et al. (1992), Renden et al. (1993) and Renden et al. (1994), who also observed higher breast yield in 49-day-old broilers submitted to a program of 23 hours of light relative to a program of 16 hours of light. However, in other studies, Renden et al. (1991) and Renden et al. (1996) did not find any influence of lighting programs

on breast yield. It must be mentioned that carcass parts' yields and abdominal fat contents found by Renden et al. (1991), Renden et al. (1992), Renden et al. (1993), Renden et al. (1994), Renden et al. (1996) and Moraes (2006) are very different.

In addition to lighting programs, another issue that is much discussed in broiler production is the use of blue or yellow curtains in open-sided poultry houses. There is little scientific information on this subject, and recommendations are based on assumptions of the beneficial effects of the use of these materials.

Therefore, the objective of this study was to evaluate carcass and parts' yield, abdominal fat deposition, and the incidence of breast and foot pad blisters of broilers submitted to two different lighting programs (nearly continuous and intermittent) and reared in open-sided broiler houses with yellow or blue curtains.

### Material and Methods

This experiment was carried out at Embrapa Suínos e Aves, Brazil, between June 24, 2004 and May 12, 2005. Six consecutive broiler flocks were reared in four broiler houses measuring 12 m × 10 m, internally divided in four pens, each one housing 200 birds.

A total of 19,200 Ross males were distributed according to a completely randomized experimental design in a 6 × 2 × 2

factorial arrangement (flocks, lighting programs and curtains), with four replicates per treatment.

The first flock was housed on a new litter, which was reused by the subsequent flocks. Litter was replaced only in the brooding area. Light was provided by 60 W incandescent light bulbs.

The effects of color curtain (blue or yellow) and lighting program (nearly continuous: 23L:1D; intermittent: 16L:2D + 1L + 2D, where L=hours of light and D=hours of darkness) were evaluated as follows: house 1 = blue curtain and intermittent light; house 2 = yellow curtain and intermittent light; house 3 = yellow curtain and nearly continuous light; house 4 = blue curtain and nearly continuous light.

Carcass yield was evaluated by removing from each pen, three birds whose body weight was as close as possible to pen average, totaling 288 birds. Birds were duly identified and sacrificed, and slaughter weight, eviscerated carcass weight, cuts weights, and abdominal fat weight (bound to the abdominal wall) were determined. The incidence of breast and foot pad blisters was visually scored in 20% of the broilers (40 per pen) in the third week after housing and at slaughter using a 1-5 subjective scale (1 = absence of lesions and 5 = high incidence of lesions).

Data were submitted to analysis of variance using the GLM procedure of SAS statistical package (2003), considering the effects of flock, lighting program, curtain color, and their interactions.

## Results and Discussion

Flock significantly influenced ( $P < 0.0001$ ) carcass, wing, drumstick, thighs, breast, back, and abdominal fat yields. There was a significant effect ( $P < 0.05$ ) of flock  $\times$  lighting program  $\times$  curtain color interaction on carcass and back yields. Significant differences ( $P < 0.05$ ) between the applied lighting programs were observed only in drumstick and thighs' yields. The other parameters were not affected by lighting program. Also, there was no effect of curtain color ( $P > 0.05$ ) on none of the evaluated parameters (Table 1).

When the effect of the interaction flock  $\times$  lighting program  $\times$  curtain on carcass yield was evaluated (Table 2), significant effects of lighting program within curtain or of curtain color within lighting program were observed only in flocks 1 and 4. Flock 1's broilers reared in houses with blue curtain presented higher carcass yield when submitted to the intermittent lighting program. In flock 4, the lowest carcass yields were obtained with intermittent lighting program in houses with yellow curtain. These results indicated that the effect of lighting program and curtain color on carcass yield may depend on another factor related to flock, which was not evaluated in the present study.

Wing and breast yields were not influenced by lighting program or by curtain color. On the other hand, drumstick and thighs yields (Figure 1) were better when the intermittent lighting program was applied, regardless of curtain color, and were only influenced by that factor. These results are opposed to the findings of Moraes (2006), who obtained higher drumstick + thighs' yield with a program of 23 hours of light than the program of 16 hours of light and natural lighting. However, Renden et al. (1991), Renden et al. (1992), Renden et al. (1993) and Renden et al. (1994) did not observe any effect of the lighting program on drumstick yield, but in a subsequent study, Renden et al. (1996) concluded that broilers reared under a lighting program of 16 hours of light presented higher drumstick yield when compared to those reared under 23 hours of light, daily.

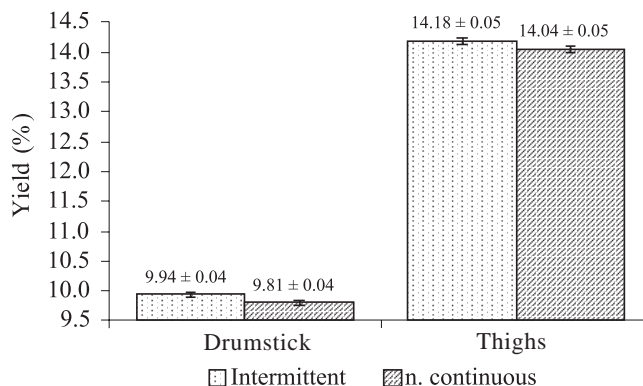


Figure 1 - Drumstick and thighs' yield.

Table 1 - Analysis of variance of carcass, parts and abdominal fat yields

Source	DF <sup>1</sup>	Carcass	Wing	Drumstick	Thighs	Breast	Back	Abdominal fat
Flock	5	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0757
Light	1	0.0864	0.2793	0.0255	0.0440	0.5836	0.2106	0.8449
Flock $\times$ light	5	0.4494	0.9227	0.9413	0.6604	0.2210	0.6716	0.9632
Curtain	1	0.1061	0.1720	0.8090	0.2199	0.2569	0.7247	0.2937
Flock $\times$ curtain	5	0.7648	0.4814	0.8900	0.8960	0.5777	0.4484	0.5202
Light $\times$ curtain	1	0.8523	0.4640	0.1875	0.6656	0.2110	0.6025	0.3761
Flock $\times$ light $\times$ curtain	5	0.0414	0.1157	0.0723	0.0567	0.1049	0.0190	0.6434

<sup>1</sup> Degrees of freedom.

Table 2 - Average yield (%) of carcass, parts and abdominal fat, as a function of flock, lighting program and curtain color

Part	Lighting program	Curtain color		Mean
		Yellow	Blue	
Period 1 (6/24 to 8/05/2004)				
Carcass	Intermittent	74.92aA	75.39aA	75.15
	Nearly continuous	74.42aA	73.97aB	74.20
	Mean	74.67	74.68	
Wing	Intermittent	7.62	7.70	7.66
	Nearly continuous	7.51	7.51	7.55
	Mean	7.56	7.60	
Drumstick	Intermittent	9.96	10.05	10.00A
	Nearly continuous	9.76	9.96	9.86B
	Mean	9.86	10.00	
Thighs	Intermittent	14.29A	13.89B	14.09
	Nearly continuous	14.03B	13.91A	13.97
	Mean	14.16	13.90	
Breast	Intermittent	23.79	24.58	24.18
	Nearly continuous	23.79	23.39	23.59
	Mean	23.79	23.98	
Back	Intermittent	17.54	17.81	17.68
	Nearly continuous	17.66bA	17.74aA	17.70
	Mean	17.60bA	17.77aA	
Abdominal fat	Intermittent	1.52	1.27	1.40
	Nearly continuous	1.51	1.41	1.46
	Mean	1.51	1.34	
Period 2 (8/19 to 9/30/2004)				
Carcass	Intermittent	75.16	74.00	74.58
	Nearly continuous	74.36	74.33	74.35
	Mean	74.76	74.16	
Wing	Intermittent	7.45	7.42	7.44
	Nearly continuous	7.36	7.48	7.42
	Mean	7.40	7.45	
Drumstick	Intermittent	9.67	9.58	9.63A
	Nearly continuous	9.54	9.52	9.53B
	Mean	9.60	9.55	
Thighs	Intermittent	14.21	14.08	14.15A
	Nearly continuous	13.98	13.94	13.96B
	Mean	14.09	14.01	
Breast	Intermittent	22.76	22.60	22.68
	Nearly continuous	22.43	22.52	22.48
	Mean	22.59	22.56	
Back	Intermittent	16.86	16.60	16.73
	Nearly continuous	16.79	16.59	16.69
	Mean	16.82	16.59	
Abdominal fat	Intermittent	1.67	1.58	1.63
	Nearly continuous	1.63	1.61	1.62
	Mean	1.65	1.59	
Period 3 (10/14 to 11/25/2004)				
Carcass	Intermittent	72.86	72.36	72.66
	Nearly continuous	71.95	72.16	72.05
	Mean	72.40	72.26	
Wing	Intermittent	7.20	7.35	7.28
	Nearly continuous	7.14	7.40	7.27
	Mean	7.17	7.37	
Drumstick	Intermittent	9.99	9.84	9.92A
	Nearly continuous	9.69	9.79	9.74B
	Mean	9.84	9.81	
Thighs	Intermittent	13.87	13.87	13.87A
	Nearly continuous	13.56	13.59	13.58B
	Mean	13.71	13.73	
Breast	Intermittent	22.24	22.20	22.22
	Nearly continuous	22.70	22.13	22.42
	Mean	22.47	22.16	

Continue

Cont. Table 2

Part	Lighting program	Curtain color		Mean
		Yellow	Blue	
Back	Intermittent	15.78	15.69	15.74
	Nearly continuous	15.50	15.81	15.66
	Mean	15.64	15.75	
Abdominal fat	Intermittent	1.61	1.39	1.50
	Nearly continuous	1.53	1.35	1.44
	Mean	1.57	1.37	
Period 4 (12/09/2004 to 01/20/2005)				
Carcass	Intermittent	74.85bB	76.26aA	75.56
	Nearly continuous	76.61aA	75.32aA	75.97
	Mean	75.73	75.79	
Wing	Intermittent	7.52	7.73	7.63
	Nearly continuous	7.67	7.58	7.63
	Mean	7.59	7.65	
Drumstick	Intermittent	9.83	9.98	9.91A
	Nearly continuous	9.91	9.72	9.82B
	Mean	9.87	9.85	
Thighs	Intermittent	14.61	14.83	14.72A
	Nearly continuous	14.86	14.47	14.67B
	Mean	14.73	14.65	
Breast	Intermittent	22.41	23.00	22.71
	Nearly continuous	23.27	22.89	23.08
	Mean	22.84	22.94	
Back	Intermittent	17.24bB	17.73aA	17.49
	Nearly continuous	17.51aA	17.37bB	17.44
	Mean	17.37	17.55	
Abdominal fat	Intermittent	1.35	1.35	1.35
	Nearly continuous	1.38	1.38	1.38
	Mean	1.36	1.36	
Period 5 (02/03 to 03/17/2005)				
Carcass	Intermittent	74.97	73.90	74.44
	Nearly continuous	73.70	73.74	73.72
	Mean	74.33	73.82	
Wing	Intermittent	7.73	7.53	7.63
	Nearly continuous	7.47	7.62	7.55
	Mean	7.60	7.57	
Drumstick	Intermittent	10.09	9.60	9.85A
	Nearly continuous	9.40	9.81	9.61B
	Mean	9.74	9.70	
Thighs	Intermittent	14.26	14.33	14.30A
	Nearly continuous	14.16	13.92	14.04B
	Mean	14.21	14.12	
Breast	Intermittent	21.75	21.88	21.82
	Nearly continuous	22.66	21.93	22.30
	Mean	22.20	21.90	
Back	Intermittent	17.85	17.15	17.50
	Nearly continuous	16.95	17.16	17.06
	Mean	17.40	17.15	
Abdominal fat	Intermittent	1.35	1.47	1.41
	Nearly continuous	1.42	1.38	1.40
	Mean	1.38	1.42	
Period 6 (03/31 to 05/12/2005)				
Carcass	Intermittent	73.73	72.32	73.03
	Nearly continuous	73.07	72.82	72.95
	Mean	73.40	72.57	
Wing	Intermittent	7.69	7.63	7.66
	Nearly continuous	7.59	7.68	7.64
	Mean	7.64	7.65	
Drumstick	Intermittent	10.36	10.31	10.34A
	Nearly continuous	10.34	10.22	10.28B
	Mean	10.35	10.26	
Thighs	Intermittent	14.19	13.75	13.97A
	Nearly continuous	13.83	14.25	14.04A
	Mean	14.01	14.00	

Continue

Cont. Table 2

Part	Lighting program	Curtain color		Mean
		Yellow	Blue	
Breast	Intermittent	23.05	21.84	22.45
	Nearly continuous	22.62	22.65	22.64
	Mean	22.83	22.24	
Back	Intermittent	17.16	17.53	17.35
	Nearly continuous	17.63	16.92	17.28
	Mean	17.39	17.22	
Abdominal fat	Intermittent	1.59	1.44	1.52
	Nearly continuous	1.29	1.58	1.44
	Mean	1.44	1.51	

Means followed by different small letters in the same row and different capital letters in the same column are different ( $P \leq 0.05$ ) by F test.

There were no significant differences in abdominal fat yield, which demonstrates that fat deposition was not affected by the lighting programs. Renden et al. (1996) applied four different photoperiods: 1) 23L:1D; 2) 16L:8D; 3) 16L:3D1L:4D; 4) 16L:2D:1L:2D:1L:2D, where L = hours of light; and D = hours of darkness and did not find any influence of photoperiod on abdominal fat, wings, or thighs yields. However, Buyse et al. (1996), when evaluating abdominal fat deposition in broilers submitted to intermittent (1L:3E) or nearly continuous (23L:1E) lighting programs found that the intermittent lighting program reduced broiler abdominal fat deposition at 28 and 41 days of age. These authors concluded that adipose tissue deposition was postponed due to a change in the slope of the growth curve imposed by intermittent lighting. On the other hand, Ohtani & Leeson (2000), when studying the effect of lighting program on abdominal fat, observed that abdominal fat accumulation was higher in broilers submitted to intermittent lighting program when compared to continuous lighting program.

In terms of carcass quality, in the six flocks, despite litter reuse, no breast or food pad blisters were observed, indicating that correct litter management is essential to prevent this type of lesion. These results are different from those obtained by Renden et al. (1992), who demonstrated that birds submitted to a program of 23 hours of light and 1 h of darkness presented fewer breast blisters, but more leg problems and broken collar bones. Breast blister are caused by the contact with the soil, which causes skin irritation. Those differences may be related to the fact that the broilers submitted to a lighting program of 16 hours of light and 8 of darkness spend longer periods in the dark, which allows resting. Renden et al. (1993) observed lower incidence of leg abnormalities in broilers reared under 14 hours of light and 10 hours of darkness if compared to those kept under 23 hours of light and 1 hour of darkness. Broilers submitted to

continuous lighting program presented higher breast development, whereas those reared under 14 hours of light had better developed legs.

It is assumed in commercial poultry production that blue curtains promote a calmer environment, which may interfere in bird activity, favoring resting, and therefore, the development of breast blisters. However, the results of the present experiment do not confirm this assumption. The observed absence of breast and foot pad blisters demonstrated that curtain color and lighting program had no influence on this problem. Adequate litter management, removing clods and rotating the litter, seemed to be sufficient to keep broiler breasts and foot pads healthy.

## Conclusions

Curtain color does not influence carcass or parts' yield, but intermittent lighting program results in higher drumstick and thighs' yield. Moreover, lighting program and curtain color do not affect abdominal fat deposition or the incidence of breast and foot pad blisters.

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