Yield and quality of the *Pectoralis major* during recovery of broilers from early feed restriction

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Introduction

Early restriction in body weight gain using any number of different procedures generally provides relief from late mortality and an advantage in feed conversion, however, body weight and breast meat may not recover (Arce *et al*.,1992; Renden *et al*., 1993;'Acar *et al*., 1995; Saleh *et al.,* 2005). Present experimentation examined the effects of early feed restriction on fillet characteristics during recovery.

General procedures

Commercial source male chicks (Ross X Ross 708) received vaccinations for Marek's disease, New Castle disease, infectious bronchitis, and infectious bursal disease. Chicks were placed in 32 pens having fresh pine shaving litter of an open-sided house (40/13.7m^3). Corn-soybean meal feeds were provided 0-21, 21-42, and 42-56 days of age (Table 1). All feeds had been steam-pelleted and initially offered as a crumb followed by intact pellet. Lighting was continuous throughout experimentation with intensity varying from 0.2 lux from incandescent lighting at night to 35 lux with contribution of sunlight. Treatments involved feed being provided *ad libitum* in one half of the pens and access limited to 8 hours with the other half only from 7 to 21 days of age. From 0 to 7 and 21 to 56 days all feeds were ad libitum. Gross necropsy defined incidence of sudden-death syndrome and ascites apart from the total.

At 42 days of age, one half of the birds in each pen were removed on the basis of alternate wing band number, cooped and held 14 hours prior to slaughter and on-line processing. Carcasses were static slush-ice chilled 4 hours, then abdominal fat removed. Breast meats removed 20 hr later using experienced personnel following commercial procedure. The entire *Pectoralis major* corresponding each carcass left side was trimmed then measured for length, width and depth. Light reflectance (CIE) focused at the muscle center on the skin-side. Each muscle was subsequently wrapped in absorbent paper, and refrigerated in a vapor proof bag at 4C for 48 hours. Weight, dimensions and light reflectance conducted in the same manner as when fresh. Birds remaining at 56 days of age and resulting fillets were handled in the same manner as 42 days. Data were statistically evaluated as an analysis of variance in a randomized complete block design. Percentages associated with mortality were transformed to the arcsine of their square root for statistical analyses, and valid standard errors of the mean are not available. All computations employed SAS general linear model procedures.

Results and Discussion

Feeds were formulated (Table 1) to support optimal live performance and environmental conditions were favorable to support potential. Feed when restricted during the day was accessible from 8am until 5pm when llght intensity was maximal and inaccessible when least intense. Restriction substantially reduced live performance during this period (Table 2). Although a significant improvement in feed conversion was subsequently apparent until 42 days, only body weight gain equivalent to controls occurred. Advantage in both feed conversion and body weight gain were obtained from 42 to 56 days. By completion of experimentation, restriction led to a significantly better feed conversion in total while relieving the incidence of lSDS-ascites; however, body weight remainded marginally less than control.

Restriction also led to reduced amounts of carcass and breast meats that were more extensive at 42 than 56 days while the converse was apparent for abdominal fat (Table 3).

Reductions in the amount of fillet were exhibited as decreases in width, depth and length at 42 days but only width and depth decreases continued by 56 days (Table 4). Restriction led to additional refrigeration loss at 42 days with the converse apparent at 56 days. A greater loss occurred during refrigerated holding at 42 days when broiler had been restricted, whereas the converse occurred at 56 days. Decreased length, width and depth all reflected loss in fillet weight at 42 days from restriction, whereas only decreased width and depth were apparent at 56 days. Dimension responses to restriction were similar before and after refrigerated loss. Differences in light reflectance attributable to feed restriction were variable and only detected with fillets from 42 day-old broilers when weight differences were extensive. Feed restriction to relieve late mortality not only impairs fillet yield but adversely affects quality until recovery would be complete.

TABLE 1. Composition of feeds and days fed, % "as is"

Ingredient	0-21 Days	21-42 Days	42-56 Days
Corn	53.80	61.80	65.65
Soybean Meal	36.50	29.85	26.30
Poultry Fat	5.00	4.00	4.00
Dicalcium Phosphate	1.90	1.75	1.65
Limestone	1.35	1.15	1.11
DL-Methionine	0.35	0.35	0.25
L-Lysine HCl	0.10	0.10	0.05
L-Threonine	---	---	0.05
Salinomycin, 0.05; Vitamin Mix ,0.25; Mineral Mixes, 0.25; salt,0.45% to 100%			
Calculated Analyses			
% CP	22.7	19.1	17.7
kcal ME/g	3.16	3.18	3.22
Total Calcium	1.02	0.90	0.84
Avail. Phosphorus	0.48	0.45	0.42
Lysine	1.31	1.13	0.99
TSAA	1.02	0.95	0.85

TABLE 2. Live performance of male broilers subjected to feed restriction 7-21 days of age followed by common feeds to 58 days of age[1]

	g Body Weight		F/G		% Mortality		% SDS + Ascites	
Contrast	Final	Gain	Period	Accrued	Period	Accrued	Period	Accrued
				0-7 DAYS				
Total Av.	179	139	1.45	---	0.5	0	0	0
SEM	1.1	1.1	0.020	---	---	---	---	---
				7-21 DAYS				
7-21 Days	***	***	NS	NS	NS	NS	NS	NS
Ad libitum	791	611	1.44	1.44	1.5	2.1	1.3	1.3
8 Hr Access	587	407	1.41	1.43	1.3	1.8	0.8	0.8
SEM	4.0	3.6	0.026	0.019	---	---	---	
				21-42 DAYS				
7-21Days	***	NS	***	*	NS	NS	NS	NS
Ad libitum	2697	1905	1.75	1.66	1.6	3.4	0.9	2.2
8 Hr Access	2476	1890	1.69	1.63	2.2	4.3	1.3	2.1
SEM	10.4	9.3	0.019	0.010	---	---	---	---
				42-56 DAYS[2]				
7-21Days	*	*	*	*	**	NS	**	NS

Ad libitum	4060	1364	2.24	1.86	1.5	4.8	1.3	3.5
8 Hr Access	3954	1478	2.13	1.82	0.1	4.6	0.1	2.2
SEM	33.6	30.0	0.028	0.013	--	--		

[1]Values represent a total of 32 pens each having 40 chicks (41g at day of age).
[2]One half of the birds removed at 42 d; data at 56 d had 32 pens with *ca.*18 birds.

TABLE 3. Carcass and breast meat yield of broiler males at 42 and 56 days of age following feed restriction 7-21 days followed by common feeds through to completion[1]

	Abdominal Fat		Carcass w/o Fat		Fillets		Tenders	
Contrast	g Wt.	%Carc.	g Wt.	%Live	g Wt.	%Carc.	g Wt.	%Carc.
				42 DAYS OF AGE				
7-21 Days	NS	***	***	***	***	***	***	*
Ad libitum	40	2.17	1810	66.9	452	24.9	108	6.1
8 Hr Access	40	2.39	1619	65.2	387	23.9	89	5.5
SEM	0.6	0.032	10.4	0.11	3.5	0.12	2.7	0.16
				56 DAYS OF AGE				
7-21 Days	NS	**	***	**	***	***	***	NS
Ad libitum	71	2.45	2840	69.2	674	23.6	151	5.3
8 Hr Access	73	2.60	2712	68.5	618	22.8	142	5.2
SEM	1.1	0.035	14.5	0.14	4.9	0.11	1.3	0.04

[1]Values represent ca. 16 carcasses originating from a total of 32 pens.

TABLE 4. Fillet characteristics when fresh and after refrigeration with 42 and 56 day old broiler males that had restricted feed access 7-21 days followed by a common regimen throughout experimentation[1]

	Immediate to Carcass Removal								After Two Days Refrigeration @ 4C							
	One Fillet			mm Dimensions					Hold Loss		mm Dimensions					
Contrast	Light Reflectance		g Wt.	% Trim	Length	Width	Depth	L*	LightReflectance		g Wt.	%	Length	Width	Depth	L*
	a*	b*							a*	b*						
								42 DAYS OF AGE								
7-21 Days	***	**	**	***	***	NS	*	***	NS	***	***	***	***	***	NS	**
Ad libitum	229	8.5	177	100	25	61.8	6.4	14.0	5.7	2.8	176	95	24	59.5	7.6	17.0
8 Hr Access	195	9.0	173	95	21	61.1	6.2	13.1	5.7	3.6	172	90	22	58.5	7.5	16.4
SEM	2.0	0.25	0.6	0.5	0.2	0.29	0.07	0.11	0.15	0.08	0.6	0.4	0.2	0.17	0.07	0.11
								56 DAYS OF AGE								
7-21 Days	***	NS	NS	*	**	NS	NS	NS	**	*	NS	**	**	NS	NS	NS
Ad libitum	339	2.4	204	114	31	61.7	6.2	13.3	7.8	2.4	203	109	31	60.4	7.4	16.1
8 Hr Access	315	3.0	204	111	28	61.3	6.1	12.9	6.4	2.1	203	105	28	59.8	7.5	16.0
SEM	1.0	0.30	1.1	0.8	0.3	0.27	0.12	0.19	0.28	0.09	0.9	0.8	0.3	0.23	0.13	0.17

[1]Values represent the right fillet removed from ca. 8 carcasses originating from a total of 32 pens.

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