Use of Simple Feeding Programs for Broilers

D.O. Skinner-Noble, J.G. Berry, and R.G. Teeter

Story in Brief

An experiment was conducted to study the effects of feeding the grower diet throughout, the starter diet throughout, or a classical three-diet (Starter, Grower, and Finisher) feeding program on body weight (BW), performance, feed conversion ratio (FCR), carcass characteristics, and economic response of male and female broilers. Feed intake, body weight, weight gain and feed conversion were recorded weekly by pen. Individual body weights were also recorded at 21 and 42 d of age. Feeding the grower diet throughout reduced body weights of birds by 7 d of age, with reductions in body weight still evident at 42 d of age. Reductions in feed intake lagged behind and paralleled differences in body weight. Overall FCR was poorest in birds fed the grower-only program, best in birds fed the starter-only program, with the classical feeding program intermediate. Composition of carcasses were not different among diet programs past 21 d, though changes in carcass weight were evident. Changes in final body weight were offset by changes in feed cost, resulting in similar income less feed costs regardless of dietary treatment.

Key Words: Broilers, Feeding Program, Growth, Feed Conversion, Carcass Traits, Feed Costs

Introduction

Traditional dogma in the feeding of meat-type poultry holds that birds should be fed diets with decreasing protein and increasing energy as they approach market age and/or weight. Broilers are commonly fed three diets with increasing energy and decreasing protein content. Similarly, turkeys are also fed diets with increasing energy and decreasing protein that are changed approximately every 3 to 4 wk. If meat-type poultry are fed a single diet of ‘average’ composition relative to the multiple diet feeding program, then theoretically the protein level of the single diet would be lower than recommended as the birds are young, and higher than recommended levels as the bird gets older. Similarly, energy levels would be higher than recommended as the birds are young and lower than recommended as the birds get older. The effect of protein under-nutrition followed by protein over-nutrition, however, is generally lacking.

Ideally, growth restriction could be accomplished by use of fewer diets to reduce early growth and thus metabolic disorders. Feeding fewer diets would reduce the complications of changing from diet to diet and from one feed form to another (mash to crumbles to pellets). Previous studies in this laboratory (Skinner-Noble et al., 2000) have indicated that a single diet may prove useful in broiler feeding. Though the diet in the aforementioned report was a proprietary formula, it was generally intermediate to starter and grower diet in contents of most nutrients. With that in mind, an experiment was designed to use two single diet feeding programs, compared to the classical ‘Starter, Grower, Finisher’ feeding program on performance, carcass traits, and economic traits of broilers.

Materials and Methods

Diet composition and nutrient specifications are presented in Table 1 and are based on diets used in the broiler industry. Feeds were mixed at the OSU Feed Mill in a manner that assured that diets differed only in the specified ingredients and nutrients.

Table 1. Composition of diets (as fed basis)

	Diet (days fed)		
Ingredient (%)	Starter (0-21)	Grower (21-35)	Finisher (35-42)
Corn	58.00	62.99	70.11
Soybean meal (48% Protein)	33.92	29.66	22.26
Menhaden fish meal	1.41	--	--
Fat	3.09	3.69	3.84
Ground limestone	1.58	1.85	1.80
Dicalcium phosphate	1.20	1.08	1.24
Salt	.38	.30	.23
DL-Methionine	.19	.19	.20
L-Lysine	--	.02	.09
Vitamin premix	.05	.05	.05
Mineral premix	.05	.05	.05
Choline chloride	.05	.04	.04
Avatek (Lasalocid)	.05	.05	.05
Copper sulfate	.03	.03	.03
Selenium premix	.01	.0015	.0015
Calculated analysis			
Crude protein (%)	22.67	20.20	17.33
Metabolizable energy (kcal/kg)	3077	3154	3229
Crude fat	5.59	6.17	6.49
Methionine	.57	.52	.49
Total sulfur amino acids	.90	.82	.75
Lysine	1.28	1.11	.96

Birds were obtained from a commercial hatchery following routine vaccinations and sexing. Upon arrival at Oklahoma State University's Poultry Research Center, the birds (600 commercial broiler females and 600 commercial broiler males) were wingbanded and assigned into 30 pens. Birds and feed were weighed on a pen basis weekly, with birds individually weighed at 21 and 42 d of age. Each time the birds receiving the three-diet feeding program were switched from one diet to the next, feeders were emptied completely in all pens, regardless of diet treatment. This was done to reduce behavioral effects of presenting a novel feed. Water was provided by nipple drinkers and feed was in mash form from hatching to 21 d, and in pellet form thereafter.

At 21, 35, and 42 d of age, one bird per pen was chosen to be slaughtered for carcass evaluation. Birds were fasted overnight, then electrically stunned and slaughtered by exanguination. Once birds were slaughtered and evicerated, hot carcass weights were recorded. Carcasses were then chilled in ice water for 2 hr, at which time chilled carcass weights were recorded. Birds were weighed in water to determine specific gravity, and the abdominal fat pad was removed and weighed. Estimates of carcass protein and energy were made based on the equations of Wiernusz et al. (1999).

Feed costs were provided by the OSU Feed Mill and market prices of slaughtered chickens were obtained from a commonly accepted source (Urner Barry, 2001). Estimates of feed cost, return from slaughtered birds, and income over feed costs were calculated. All traits were analyzed within age or period measured by analysis of variance with feeding program (diet) as the source of variation.

Results and Discussion

Body Weight. Feeding the grower diet throughout reduced body weight as early as 7 d post hatching, and continued throughout the experiment (Table 2). This reduction, however, became less severe as birds approached market age. Previous reports with broilers used periods of growth restriction lasting less than 2 wk and starting at greater than five d of age (Plavnik and Hurwitz, 1985; Cartwright et al., 1986; Shlosberg et al., 1991). The length and severity of growth restriction in the present study was longer and more severe than in previous reports.

Skinner-Noble et al. (2000) reported that body weight of females fed a single diet was higher at 42 d than birds fed a three-diet feeding program. Differences at 42 d were caused by a reduction in body weight in birds fed the finisher diet. In the current study, it appears that a similar reduction in growth due to feeding the finisher diet was also occurring. Even so, at least an additional 4 wk of feeding at current differences in growth rate would be required to permit birds fed the grower diet to ‘catch up’ with those fed the classical feeding program.

Table 2. Body weights (g) by age, sex, and dietary treatment

	Age (d)					
Dietary Program	7	14	21	28	35	42
Starter Only	116.83a	307.03a	647.05a	1172.74a	1705.33a	2313.38a
Starter, Grower, Finisher	118.95a	312.65a	633.80a	1151.59a	1703.41a	2245.99b
Grower Only	103.91b	262.24b	534.19b	977.89b	1487.25b	2064.15c
Sex						
Male	114.36	297.81	617.98	1126.08	1689.50	2287.58
Female	112.68	292.13	597.97	1082.36	1580.73	2137.92
ANOVA Source						
Diet	*	**	*	**	**	*
Sex	ns	ns	*	**	**	*
S x D	ns	ns	ns	ns	ns	ns

a,b= adjacent means in a column with no common letter differ ($P \leq .05$)

**= $P \leq .01$

* = $P \leq .05$

ns= Not Significant

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Feed Intake. Differences in feed intake between the grower-only treatment lagged behind treatment differences in body weight (Table 3). This may not be surprising, given the reductions in body weight. Reductions in body weight would lead to reduced maintenance requirements. Skinner-Noble et al. (2000) reported that feed intakes were similar between single-diet and three-diet feeding programs. In the aforementioned report, birds had similar body weights, regardless of dietary treatment.

Table 3. Feed Intake (g per bird) by period, sex, and dietary treatment							
	Period (d of age)						
Dietary Program	0-7	7-14	14-21	21-28	28-35	35-42	0-42
Starter Only	194.18	435.24a	740.01a	785.43	987.54a	1382.63	4525.04a
Starter, Grower, Finisher	205.55	463.89a	679.47ab	823.91	978.04a	1366.93	4517.80a
Grower Only	198.71	369.45b	643.01b	781.42	890.38b	1418.36	4301.33b
Sex							
Male	218.79	439.17	733.46	838.55	1000.10	1433.57	4663.64
Female	178.85	409.19	641.42	753.42	904.84	1339.82	4227.55
ANOVA Source							
Diet	ns	**	*	ns	**	ns	**
Sex	**	ns	**	**	**	*	**
S x D	ns	ns	ns	ns	ns	ns	ns
a,b= adjacent means in a column with no common letter differ (P≤.05) ** = P≤ .01 *= P≤ .05 ns= Not Significant							

Feed Conversion. Differences among treatments in feed conversion ratio (FCR) were most striking both early in the experiment (Table 4; 0 to 7 d) and when diets were switched in the classical feeding program. Birds fed the grower-only diet had higher (poorer) FCR from 0 to 7 d, and lower (better) FCR from 35 to 42 d. Regardless of improvements in FCR from 35-42 d, birds from the grower-only diet still had poorer FCR overall. Previously, Skinner-Noble et al. (2000) reported that feed conversion was reduced when birds were switched to the finisher diet in a three-diet feeding program. Feed conversion prior to 21 d of age was poorer than expected, and this can be attributed to feed wastage caused by the feeding system.

Table 4. Feed conversion (feed:gain) by period, sex, and dietary treatment							
	Period (d of age)						
Dietary Program	0-7	7-14	14-21	21-28	28-35	35-42	0-42
Starter Only	2.64b	2.29	2.27	1.46b	1.86	2.26b	1.99b
Starter, Grower, Finisher	2.71b	2.40	2.03	1.64a	1.78	2.52a	2.05ab
Grower Only	3.26a	2.34	2.36	1.76a	1.75	2.47ab	2.13a
Sex							
Male	3.08	2.39	2.30	1.67	1.78	2.41	2.08
Female	2.62	2.29	2.11	1.56	1.82	2.42	2.02
ANOVA Source							

Diet	*	ns	ns	**	ns	*	*
Sex	*	ns	ns	ns	ns	ns	ns
S x D	ns	ns	ns	ns	ns	ns	ns
a,b= adjacent means in a column with no common letter differ (P≤.05) ** = P≤.01 * = P≤.05 ns= Not Significant							

Carcass Traits. Means of carcass traits are shown in Table 5. Differences among treatments in percent carcass protein, fat, and energy were evident only at 21 d of age. Differences among dietary treatments past 21 d were strictly in hot and chilled carcass weights. It appears that feeding the grower-only diet reduced carcass protein content and increased carcass fat to 21 d, but that differences become less pronounced with approach to market age.

Table 5. Carcass traits by age, dietary treatment, and sex

		Dietary Treatment			Sex		ANOVA Source		
Age	Trait	Starter	SGF	Grower	Male	Female	Sex	Diet	S x D
21	Chilled Carcass Wt (g)	426.7a	463.8a	368.2b	448.7	390.4	**	**	ns
	Specific Gravity	1.053a	1.053a	1.048b	1.051	1.051	ns	**	ns
	Carcass Protein (%)	18.83a	18.82a	18.35b	18.64	18.69	ns	**	ns
	Carcass Fat (%)	9.60b	9.66b	11.75a	10.45	10.22	ns	**	ns
	Carcass Energy (cal/g)	5.964b	5.968b	6.088a	6.014	6.000	ns	**	ns
35	Chilled Carcass Wt (g)	1223.2a	1184.9a	1034.4b	1253.7	1041.4	**	**	ns
	Abdominal Fat (g)	24.16	28.37	24.21	27.24	23.91	ns	ns	ns
	Abdominal Fat (%)	1.97	2.39	2.26	2.17	2.25	ns	ns	ns
	Specific Gravity	1.053	1.052	1.052	1.052	1.052	ns	ns	ns
	Carcass Protein (%)	18.87	18.75	18.72	18.78	18.77	ns	ns	ns
	Carcass Fat (%)	9.47	9.98	10.11	9.84	9.86	ns	ns	ns
	Carcass Energy (cal/g)	5.957	5.987	5.994	5.98	5.98	ns	ns	ns
42	Chilled Carcass Wt (g)	1642.7	1703.4	1574.6	1786.5	1494.0	**	ns	ns
	Abdominal Fat (g)	28.79	34.37	33.49	33.86	30.57	ns	ns	*
	Abdominal Fat (%)	1.77	1.98	2.13	1.87	2.05	ns	ns	ns
	Specific Gravity	1.054	1.051	1.053	1.054	1.052	ns	ns	ns
	Carcass Protein (%)	18.95	18.66	18.86	18.90	18.75	ns	ns	ns
	Carcass Fat (%)	9.08	10.35	9.51	9.32	9.97	ns	ns	ns
	Carcass Energy (cal/g)	5.934	6.008	5.959	5.948	5.986	ns	ns	ns
a,b= adjacent means in a row with no common letter differ (P≤.05)									

** = P≤ .01 * = P≤ .05 ns= Not Significant					

Economic Analysis. Given the slaughter weight of the birds in this study, returns would be $0.49/lb (Urner Barry, 2001). Feed costs for Starter, Grower, and Finisher diets were $154.56, $146.26, and $140.80/ton, respectively. Given these values, substantial savings in feed costs can be realized by feeding the grower-only program (Table 6). The starter-only feeding program similarly increased total feed costs. Changes in ending BW, however, offset differences in feed costs, resulting in no differences among dietary treatments in income less feed costs.

Table 6. Economic analysis of income from birds, feed costs, and income over feed costs by sex and diet

		Trait	
Dietary Program	Income ($US)	Feed Costs ($US)	Income over feed costs ($US)
Starter Throughout	1.926a	.769a	1.157
Starter, Grower, Finisher	1.872ab	.731b	1.142
Grower Throughout	1.735b	.692c	1.044
Sex			
Male	1.910	.766	1.144
Female	1.782	.695	1.087
ANOVA Source			
Diet	*	**	ns
Sex	*	**	ns
D x S	ns	ns	ns
a,b= adjacent means in a column with no common letter differ (P≤.05) ** = P≤ .01 * = P≤ .05 ns= Not Significant			

Implications

The results of this study indicate that different single-diet feeding programs for broilers may have merit. The simplicity of feeding a single diet may appeal to producers lacking a sophisticated feed milling operation or adequate equipment to maintain multiple diets. Potential differences in final BW and/or days to similar weight must be taken into consideration when choosing this production scheme.

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