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Effect of Daily Restriction and Age at Initiation of a Skip-A-Day Program for Young Broiler Breeders[1]

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ABSTRACT Two experiments were conducted with Cobb feather sex broiler breeders comparing skip-a-day (SAD) feeding programs which began at either 2, 4, 6, or 8 wk of age. A fifth program, daily restriction started at 2 wk of age, was also compared. Chicks hatched in December and July, respectively, in Experiments 1 and 2 were exposed to natural daylight until 20 wk of age. All birds were fed *ad libitum* until the respective restriction programs began. All grower programs terminated at 20 wk of age. A breeder diet was given daily after 20 wk. Males and females were grown together.

Sexual maturity was reached earlier in the 2-wk restriction groups (2-wk SAD in Experiment 1 and the 2-wk daily restriction in both experiments) than in the 8-wk SAD group. Egg production in Experiment 1 was also improved by the early restriction. Fertility and hatchability were not significantly affected by treatment. Based on the results of these experiments a SAD program beginning at 2 wk of age was as good as or better than one initiated at later ages. The 2-wk daily restriction program was equivalent to the 2-wk SAD program. (*Key words*: skip-a-day, feed restriction, sexual maturity, egg production, broiler breeders)

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INTRODUCTION

Young broiler breeders are normally grown on restricted diets to prevent obesity and excess body weight. A commonly used method of restriction in the United States is the "skip-a-day" (SAD) program. This program uses alternate day feeding of approximately 1.5 times the estimated daily *ad libitum* intake.

Luckham *et al.* (1963) compared the SAD method with other systems for growing replacement egg-type pullets and found that subsequent performance results were comparable. Voitle *et al.* (1974) reported that the SAD program was superior to low protein and low lysine diets during the growing period for broiler breeders. They hypothesized, however, that all of the programs would have been equally effective if modified to produce similar body weights at sexual maturity. The SAD program gave better results than low protein or *ad libitum* programs in a comparison by Wilson *et al.* (1983).

The commercial industry has recommended restriction at progressively earlier ages in recent years. Cobb, Inc. (1985) recommended initiation of daily feed restriction at 3 wk of age and the SAD restriction program at 4 wk of age. A more recent recommendation (Cobb, Inc., 1987) suggests initiation of daily feed restriction of females at 2 wk of age and SAD at 4 wk of age, with the males grown separately. Similar recommendations were given by other breeders (Hubbard, 1980; Arbor Acres, 1982), whereas others recommend daily restricted feeding beginning at about 1 wk of age (Ross, 1985). Essentially no data have been reported comparing ages at which feed restriction is initiated. However, nutritional restriction by the use of low quality feed at an early age has been reported to be detrimental. Starting broiler breeder males on low protein diets at 4 wk of age resulted in reduced fertility and hatchability (Wilson *et al.*, 1972). Lilburn (1984) reported lower egg production when breeders were fed a moderately low (13.5%) protein diet from 0 to 21 wk than when fed a higher protein (15.5%) diet.

In his review of broiler breeder feeding programs, Costa (1981) suggested that feed restriction should be started by 3 wk of age and the SAD program initiated at 5 wk of age.

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TABLE 1. *Composition of starter and grower diets and age of birds fed the diets*

Ingredient	Starter		Grower			
	1 day to 6 wk	6 to 8 wk	8 to 10 wk	10 to 12 wk	12 to 14 wk	14 to 20 wk
	(%)					
Crude protein level	21	19	17	16	15	14
Yellow corn	72.24	75.67	82.18	83.74	84.12	85.62
SBOM (48.5%)[1]	24.30	21.10	14.80	13.20	13.15	11.60
Dicalcium phosphate (22% Ca, 18.5% P)	1.60	1.40	1.25	1.30	1.00	1.05
Limestone	1.05	1.05	1.05	1.05	1.05	1.05
Salt	0.45	0.45	0.40	0.40	0.40	0.40
Micro premix[2]	0.25	0.25	0.25	0.25	0.25	0.25
DL-methionine	0.11	0.08	0.07	0.06	0.03	0.03

[1]Soybean oil meal.

[2]Supplied the following activities per kilogram of diet: vitamin A, 6,600 IU; vitamin D_3, 2,200 ICU; menadione dimethylpyrimidinol bisulfite, 2.2 mg; riboflavin, 4.4 mg; pantothenic acid, 13.2 mg; niacin, 39.6 mg; choline chloride, 499.4 mg; vitamin B_{12}, 22 μg; ethoxyquin, .0125%; manganese, 60 mg; iron, 50 mg; copper, 6 mg; cobalt, .198 mg; iodine, 1.1 mg; and zinc, 35 mg.

Starting restriction at an early age has the proposed advantage of greater flexibility in deciding when weight gain increments should be changed. He also hypothesized that daily feeding, as compared to SAD feeding, might be more feed efficient due to direct use of dietary carbohydrates as the energy source rather than body fat synthesis and subsequent oxidation on the skip day. Leeson and Summers (1985) have subsequently reported that dwarf broiler breeders were more efficient when fed on the daily restriction system than when fed on the SAD program. The objectives of the present studies were 1) to determine the effect of age at the start of the SAD program on subsequent performance and 2) to compare daily restriction with the SAD programs.

MATERIALS AND METHODS

Experiment 1. One-day-old (December hatch) broiler breeder chicks (Cobb feather sex) were randomized into 20 litter-floor pens with 45 females and 17 males per pen. Five growing treatments were tested with four replicate pens per treatment. The SAD treatments were given from 2 to 20 wk, 4 to 20 wk, 6 to 20 wk, and 8 to 20 wk of age. The fifth treatment began daily feed restriction at 2 wk and continued through 20 wk of age. Chicks were fed *ad libitum* until placed on their respective restriction programs. The starter diet contained 21% CP followed by decreases at 6, 8, 10, 12, and 14 wk of age (Table 1).

Feed was allotted to birds on all treatments in an amount necessary to obtain the breeder's recommendation for 20-wk body weight. Body weight was determined weekly throughout the experiment. Breeder diets were given at 20 wk of age, fed daily, and furnished the daily nutrient intake (Table 2) suggested by Wilson and Harms (1984). Amounts of feed given and diet formulations were changed according to energy needs to maintain desired body weight

TABLE 2. *Nutrient intake of broiler breeders after 20 weeks of age*

Nutrient	Daily intake
Protein, g	20.6
Sulfur amino acids, mg	754
Methionine, mg	400
Lysine, mg	938
Arginine, mg	1,379
Tryptophan, mg	256
Calcium, g	4.07
Phosphorus, mg[1]	683
Sodium, mg	170
Vitamins[2]	
Energy[3]	

[1]Expressed as total phosphorus.

[2]Levels of vitamins and trace minerals in finished feed met minimum daily intake suggested by National Research Council (1984).

[3]Diets were formulated for feed intake of 109 to 204 g/bird per day. Examples of energy intake are 301, 398, 495, and 636 kcal ME/bird per day for diets formulated for 109, 137, 164, and 204 g/bird per day feed consumption.

TABLE 3. *Body weights at various ages of broiler breeder females started on skip-a-day at ages from 8 to 60 weeks of age*

Treatment[1]	8	20	24	32	48	60
	(g)					
Experiment 1						
2	814[d]	1,956[c]	2,419[a]	3,263[a]	3,481[a]	3,534[a]
4	878[c]	1,952[c]	2,475[a]	3,239[a]	3,422[a]	3,519[a]
6	1,111[b]	2,032[b]	2,488[a]	3,302[a]	3,412[a]	3,544[a]
8	1,572[a]	2,128[a]	2,506[a]	3,266[a]	3,336[a]	3,575[a]
2D	808[d]	2,081[ab]	2,516[a]	3,209[a]	3,473[a]	3,558[a]
Experiment 2						
2	813[c]	1,846[c]	2,612[a]	3,196[a]	3,441[a]	3,377[a]
4	880[c]	1,889[bc]	2,723[a]	3,153[a]	3,448[a]	3,551[a]
6	1,052[b]	1,884[bc]	2,618[a]	3,218[a]	3,473[a]	3,539[a]
8	1,593[a]	1,936[b]	2,729[a]	3,202[a]	3,498[a]	3,593[a]
2D	996[b]	2,034[a]	2,736[a]	3,171[a]	3,487[a]	3,555[a]

[a–d]Means within a column and experiment with no common superscript are significantly different ($P<.05$).

[1]Treatments 2, 4, 6, and 8 indicate age in weeks at which skip-a-day feed restriction began. Treatment 2D began daily feed restriction at 2 wk.

gain and nutrient intake. At 24 wk of age bird numbers in each pen were reduced to 33 females and 3 males. Dead males were replaced by extra males kept on the same treatments.

Birds in all treatments were exposed to natural daylight until 20 wk of age (April 25). Thereafter, natural daylight was supplemented with artificial light to furnish a 17-h day (0430 to 1930 h). Egg production and mortality were recorded daily. Egg weight and specific gravity were measured at 4-wk intervals on 1 day's production. Fertility and hatchability were determined on 5 consecutive day's production at 4-wk intervals.

Experiment 2. The materials and methods were the same as in Experiment 1, with the following exceptions. One-day-old (July hatched) chicks were randomly distributed into 20 pens with 120 birds (approximately 90 females and 30 males) per pen. Birds were moved at 20 wk of age to 25 litter floor pens containing 40 females and 4 males each.

Experiment 1 was conducted at the University of Florida and Experiment 2 at Louisiana State University. Data from both experiments

TABLE 4. *Comparisons of feed consumption and feed conversion of broiler breeders started on skip-a-day at various ages*

	Consumption			Conversion		
Treatment[1]	2–24 wk	8–24 wk	24–64 wk	2–24 wk	8–24 wk	24–64 wk
	(g/bird)			(g feed/g gain)		(g feed/chick)
Experiment 1						
2	10,396	9,634	42,933	4.71	6.00	332
4		9,657	43,129		6.05	345
6		9,572	42,936		6.95	342
8		9,143	43,120		10.05	371
2D	11,186	10,298	43,820	4.86	6.03	328
Experiment 2						
2	11,851	11,000	44,255	4.97	6.16	334
4		10,820	45,019		5.94	339
6		10,610	44,721		6.85	331
8		10,110	45,007		9.13	345
2D	11,989	10,480	45,932	4.80	6.15	346

[1]Treatments 2, 4, 6, and 8 indicate age in weeks at which skip-a-day feed restriction began. Treatment 2D was daily restriction starting at 2 weeks.

TABLE 5. *Age at 50% egg production (sexual maturity), average egg production, fertility, hatchability of fertile eggs, and chicks per hen of broiler breeders started on skip-a-day at various ages*

Treatment[1]	Sexual maturity		Egg production		Fertility		Hatchability		Chicks/hen	
	Experiment 1	Experiment 2	Experiment 1	Experiment 2	Experiment 1	Experiment 2	Experiment 1	Experiment 2	Experiment 1	Experiment 2
	(days)		(% hen-day)		(%)				(n)	
2	204[b]	218[ab]	57.3[a]	57.1[a]	88.5[a]	92.7[a]	90.7[a]	90.3[a]	129.3[a]	132.6[a]
4	204[b]	218[ab]	52.5[bc]	55.8[a]	92.8[a]	90.3[a]	91.5[a]	91.8[a]	127.8[a]	132.9[a]
6	211[ab]	218[ab]	52.7[bc]	56.9[a]	93.5[a]	92.7[a]	90.9[a]	92.0[a]	125.3[a]	135.1[a]
8	215[a]	225[a]	50.3[c]	55.6[a]	92.1[a]	92.3[a]	89.2[a]	90.7[a]	116.2[a]	130.3[a]
2D	205[b]	212[b]	56.5[ab]	56.6[a]	92.5[a]	92.1[a]	91.0[a]	91.6[a]	133.8[a]	132.7[a]

[a-c]Means within a column with no common superscript are significantly different (P≤.05).

[1]Treatments 2, 4, 6, and 8 indicate age in weeks at which skip-a-day feed restriction began. Treatment 2D began daily feed restriction at 2 wk.

were subjected to one-way analysis of variance procedures using the Statistical Analysis System (Barr *et al.*, 1976) with significant differences between means determined by Duncan's multiple range test.

RESULTS AND DISCUSSION

The body weight goal (breeder guide standard) was 2,490 g at 24 wk of age. Body weights among treatments ranged from 2,419 to 2,516 g in Experiment 1 and 2,612 to 2,736 g in Experiment 2 (Table 3). There was considerable variation in body weights from week to week. This was most apparent in the first 3 wk following initiation of the SAD program for each group. Body weights differed significantly among treatments during the growing period and smaller, but still significant, differences were present at 20 wk of age in both experiments. No significant differences in body weight were present at 24 wk of age or thereafter.

Feed allowances given from 8 to 24 weeks were lower for the groups placed on SAD at later ages (Table 4). Consequently the feed/gain values were increased due to the small gains allowed in these groups. Feed consumed on a per chick hatched basis was lower for the daily restricted and 2-week SAD groups in Experiment 1, but daily restricted was highest in Experiment 2. In the comparison of the 2-week SAD to the 2-week daily restriction, feed conversion (feed/gain) for the period 8 to 24 weeks of age was almost identical for the two groups in both experiments. When the whole period, 2 to 24 weeks, was considered the SAD group had slightly better conversion.

Age at sexual maturity (50% production) was significantly (P<.05) delayed in the 8-wk SAD group as compared to the daily restricted group in both experiments, as well as the 2-wk and 4-wk SAD treatments in Experiment 1 (Table 5). Egg production in Experiment 1 was significantly higher (P<.05) in the 2-wk SAD and daily restricted groups than in the 8-wk SAD group. In Experiment 2 the differences in egg production among treatments were not significant. A portion of the differences in egg production can be attributed to the differences in age at sexual maturity.

Fertility and hatchability of fertile eggs were not significantly affected by treatment (Table 5). The number of chicks hatched per hen did not differ significantly among treatments.

TABLE 6. *Weight and specific gravity of eggs from broiler breeders started on skip-a-day at various ages*

Treatment[1]	Egg weight		Specific gravity	
	Experiment 1	Experiment 2	Experiment 1	Experiment 2
	(g)			
2	65.0[b]	64.3[a]	1.0796[a]	1.0833[a]
4	65.3[b]	65.7[a]	1.0799[a]	1.0839[a]
6	66.4[ab]	65.5[a]	1.0808[a]	1.0839[a]
8	67.8[a]	65.0[a]	1.0810[a]	1.0849[a]
2D	64.7[b]	65.0[a]	1.0787[a]	1.0840[a]

[a,b]Means within a column with no common superscript are significantly different (P<.05).

[1]Treatments 2, 4, 6, and 8 indicate age in weeks at which skip-a-day feed restriction began. Treatment 2D began daily feed restriction at 2 wk.

Egg weight was significantly (P<.05) heavier from birds placed on SAD at 8 wk (Table 6) in Experiment 1, but differences in egg weight in Experiment 2 were not significant. Egg specific gravity was not significantly affected by grower treatment in either experiment. No major differences in egg weight or specific gravity would be expected because breeder body weights and dietary nutrient intakes were similar during the laying period.

Mortality was not significantly affected during either the growing period or laying period. Although mortality during the growing period was considered somewhat high (11%) in Experiment 2, there were no detectable treatment effects. There was no apparent abnormal incidence of cannibalism or uterine prolapse in any of the treatments in either experiment.

Based on the results of these experiments it was concluded that beginning a SAD program for broiler breeders as early as 2 wk of age was equivalent to or better than programs initiated at 4 wk of age or later. The only disadvantage observed for the 2-wk initiation of SAD was a slightly reduced egg size in one experiment. However, in some flocks or strains a slight reduction in egg size might not be a disadvantage. The daily restriction program that began at 2 wk of age proved to give results equivalent to the 2-wk SAD program. Therefore, this program would appear to be a satisfactory alternative to the SAD system.

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