Effect of a Short-Term Feed Outage on Broiler Performance, Live Shrink, and Processing Yields

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ABSTRACT This study was conducted to investigate the effect of a 12-h feed outage at various times prior to slaughter on subsequent broiler performance, live shrink, and processing yields. Broilers were full-fed or subjected to a 12-h feed outage followed by a refeeding period of 12, 24, or 48 h. Bird live weights or feed consumption was monitored during the outage and recovery periods. Birds were subjected to a 10-h feed withdrawal period and were slaughtered using simulated commercial conditions. Carcass weights were recorded through processing for yield determinations. The 12-h feed outage affected female broilers more than male broilers. Although all birds lost weight during their respective feed outage periods, birds were able to consume enough feed upon refeeding such that no significant differences in final live weight were detected at the initiation of feed withdrawal. Female broilers processed after a 12-h refeeding period had significantly larger gall bladders (by weight) as compared to the gall bladders of birds in the other treatments. Other processing parameters were not significantly affected by treatment. A 12-h feed outage and feed replacement prior to normal preslaughter feed withdrawal does not significantly affect processing yields, provided sufficient feed is replaced for at least 12 h prior to feed withdrawal. Because total feed consumption did not change following feed outage replacement, feed must be sufficient to compensate for that not consumed during the outage.

(*Key words*: broiler quality, feed outage, feed withdrawal, live shrink, yield)

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INTRODUCTION

Implementation of the USDA Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems; Final Ruling; (or "Mega Reg"), and the "zero tolerance" requirement for visible fecal contamination has resulted in renewed interest in broiler feed withdrawal programs (USDA, 1996). Preslaughter feed withdrawal is a long-standing management technique used to minimize fecal contamination (Wabeck, 1972; Bilgili, 1988; May and Deaton, 1989; Rasmussen and Mast, 1989; Northcutt et al., 1997). The feed withdrawal period must be long enough to allow intestinal evacuation but short enough to prevent excessive live shrink (Wabeck, 1972; Veerkamp, 1986). Research has shown that withdrawal periods of 8 to 12 h result in an acceptable balance to maximize eviscerated yields and minimize fecal contamination (Smidt et al., 1964; Wabeck, 1972; Murphy and Goodwin, 1978; Benoff, 1982; Veerkamp, 1986).

During commercial production, broiler flocks may run out of feed prior to the scheduled feed withdrawal and processing date. This shortage could be due to a number of factors such as over placement of birds in the house, unexpected temperature changes, or simple miscalculation of the predicted feed consumption. May and Lott (1992a) reported that feed consumption increased during periods of cold temperature and decreased during hot weather. Unexpected temperature changes could, therefore, lead to increased consumption, which could result in broilers consuming the allotted feed before the scheduled processing date.

Poultry industry personnel indicate that these unintentional feed outage periods typically occur for 12 h but rarely exceeded this period (personal communication). Feed outage is of concern for broiler performance as well as for minimizing the effects of gorging prior to intentional feed withdrawal.

To date, no information is available concerning the effects of short-term feed outages and refeeding on subsequent bird performance, live shrink, or broiler carcasses yields. This project was conducted to determine the effects of a 12-h feed outage at various times prior to processing on broiler feed withdrawal, live shrink, and processing yields.

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Abbreviation Key: Trt = treatment; Mon = Monday; Tue = Tuesday; Wed = Wednesday.

MATERIALS AND METHODS

In each of two independent experiments, approximately 440 straight-run broilers were obtained at 28 d of age from a commercial broiler farm and were transported to the University of Georgia Poultry Research Center. Ten males and 10 females were randomly placed in 20 litter-floored pens supplied with feed and water ad libitum. Sex was determined on the 28-d-old birds by visual examination of secondary sex characteristics by an experienced poultry husbandry expert. The extra birds were held in a separate pen. Birds were grown to 42 d of age using standard production practices. An extra feeder was placed in each pen to ensure that all birds had unrestricted access to feed (especially during the subsequent outage and refeeding periods). In each of the subsequent experiments, on the day of treatment initiation, the birds were visually examined for physical condition and verified for sex by observation, and any missing birds, due to mortality, damaged or unhealthy birds, or mis-sexed birds were replaced by one of the separately held extra birds. Thus at the initiation of each of the experiments, there was a total of 400 birds.

Experiment 1

In the first experiment, five pens were randomly assigned to one of four treatment groups based on how long prior to slaughter the birds were subjected to a 12-h feed outage: control birds (Trt0)—no feed outage, feed outage 48 h prior to feed withdrawal (Trt48), feed outage 24 h prior to feed withdrawal (Trt24), and feed outage 12 h prior to feed withdrawal (Trt12). After the 12-h feed outage period, birds were immediately given free access to feed up to the scheduled preslaughter feed withdrawal.

Starting at 39 d of age, the control birds were individually weighed at 12-h increments (1100 and 2300 h), and the test birds were weighed only at the initiation and conclusion of the feed outage period and again at 2300 h the night prior to processing.

After the 2300 h weighing the night prior to processing, feeders were removed from all pens (initiation of the 10-h preslaughter feed withdrawal period), and the birds were allowed to remain in the litter-floored pens with free access to water for an additional 4 h, at which time the birds were caught, cooped, held for 6 h, and transported (approximately 0.4 km) to the pilot processing facility for immediate slaughter.

Experiment 2

The second experiment was conducted in a similar manner to the first experiment with the following exceptions. All of the birds, regardless of treatment, were individually weighed at 36 d of age and were not weighed again until the initiation of feed withdrawal at 2300 h the night before slaughter. Instead, beginning at 36 d of age, the feed was weighed and feed consumption monitored every 12 h (1100 and 2300 h) to minimize handling of birds.

Thus, the first experiment focused on the effect of feed outages on individual and pen bird weights, and the second experiment focused on the effect of feed outages on pen feed consumption patterns. All other parameters from the initiation of feed withdrawal through processing were the same.

Processing

In both experiments, following a 10-h feed withdrawal, birds were processed using simulated commercial conditions. Birds were removed from coops, individually weighed (dock weight), hung on shackles, stunned (two-stage electrical stunner,[2] 14 V, pulsed direct current at approximately 500 Hz for 18 s, followed by 14 V, 60 Hz for 9 s), killed by hand using a conventional unilateral neck cut to sever the carotid artery and jugular vein, bled for 140 s, scalded at 55 C for 110 s in an air-agitated commercial scalder,[3] and picked for 36 s in a commercial in-line picker.[4] Upon exiting the picker, the head and feet were removed, and carcasses were weighed (New York dressed weight) and rehung on an evisceration line. The abdominal cavity was opened manually, and carcasses were eviscerated with an in-line automatic eviscerator.[5] The gall bladder was removed and placed in preweighed individual containers for later analysis. Eviscerated carcasses were reweighed (shell weight) and chilled in a static ice and water mixture for 24 h. The individual processing weights and associated yield calculations are described in Table 1.

The individual bird gall bladders were weighed, macerated, and reweighed. The gall bladder and gall contents (bile) were dried for 48 h at 98 C in a drying oven to determine moisture content.

Statistical Analyses

Data within each experiment were analyzed using the ANOVA option of the general linear model (GLM) procedure of SAS software (SAS Institute, 1988). The model tested the main effects of gender, treatment (feed outage time), and replication (pen) as well as the interaction terms using residual error. Based on significant gender by treatment and gender by replication interactions, the data were analyzed and reported by gender. Because there were no significant treatment by replication interactions, the data are presented by treatment. Means were separated using Duncan's multiple-range test option of the general linear model procedure (SAS Institute, 1988). The total number of birds in each experiment was 400, 200 males and 200 females, 50 birds per sex and treatment, or 10 birds per pen, sex, and treatment.

[2]Simmons model SF-7001, Simmons Engineering Co., Dallas, GA.
[3]Cantrell Model SS300CF, Cantrell Machine Co., Inc., Gainesville, GA.
[4]Cantrell Model CPF-60, Cantrell Machine Co., Inc., Gainesville, GA.
[5]Cantrell Model Mark 4, Cantrell Machine Co., Inc., Gainesville, GA.

TABLE 1. Variables and descriptions for weights and yield calculations

Variable[1]	Description
Catch weight (g) (Wednesday p.m.)	Individual bird weight at catch (before feed withdrawal)
Dock weight (g)	Individual bird weight immediately prior to slaughter
NY dressed weight (g)	NY dressed weight (bled, picked, head and feet off)
Shell weight (g)	Prechill eviscerated carcass weight without giblets or neck
RTC weight (g)	RTC, chilled carcass weight
Viscera weight (g)	NY dressed weight – shell weight
Viscera (%)	(Viscera weight / dock weight) × 100
Gall weight (g)	Gall bladder weight
Live shrink weight (g)	Catch weight – dock weight
Live shrink (%)	(Live shrink weight / catch weight) × 100
NY dressed yield (%)	(NY dressed weight / dock weight) × 100
Shell yield (%)	(Shell weight / dock weight) × 100
RTC yield (%)	(RTC weight / dock weight) × 100
Chill water uptake (g)	RTC weight–Shell weight
Chill water uptake (%)	(Chill water uptake (g) / shell weight) × 100
Gall (%)	(Gall bladder weight / dock weight) × 100
Bile H_2O	Gall bladder and bile percentage moisture

[1]NY = New York; RTC = ready-to-cook.

RESULTS AND DISCUSSION

From the initiation of each experiment, there was no mortality, thus all 400 birds were processed and used for individual data collection. The results for the 12-h feed outages at 0, 12, 24, and 48 h prior to processing on female carcass weights in Experiment 1 are presented in Table 2. The table shows the weights of the treatment groups before and after the 12-h feed outage (designated as Δ) along with the weight of the control birds recorded every 12 h. There were no significant differences between the control bird weights and the weights of the treatment birds at initiation of outage period [e.g., Monday (Mon) a.m. for Trt48, Tuesday (Tue) a.m. for Trt24, or Tue p.m. for Trt 12]. However, feed period resulted in a significant reduction in bird weights by the end of the 12-h outage [Mon p.m. for Trt48, Tue p.m. for Trt24, and Wednesday (Wed) a.m. for Trt12]. After the recovery time, there were no significant differences in carcass weights among the treatments (Wed p.m.).

Live bird weight losses are also expressed as a difference (Δ) in grams and percentage in the lower half of Table 2. Feed outage resulted in the loss of approximately 3% of the BW, whereas the controls gained approximately 1% per incremental 12-h period (feed consumed plus growth). Birds compensated for this weight loss once the feeders were replaced and feed was readily available to the birds. The control birds were weighed every 12 h, whereas the feed outage treatments were only weighed before and after outage and at Wed p.m. Therefore, the stresses of extra handling may have affected feed consumption patterns and suppressed weight gain in the control birds.

The results for the male birds in Experiment 1 are presented in Table 3. Although the basic trends for the males are similar to those observed for the females, the males

TABLE 2. Female BW (mean and standard errors for the mean, g) and probabilities from birds subjected to a 12-h feed outage and feed replacement for 0 (control), 12, 24, or 48 h prior to preslaughter feed withdrawal in Experiment 1

		Treatment (h)				
Weight[1]	Δ[2]	0	12	24	48	P
Mon a.m.		1,917 ± 22	–	–	1,895 ± 23	0.4954
Mon p.m.	Δ A	1,942^a ± 21	–	–	1,831^b ± 22	0.0004
Tue a.m.		1,967 ± 21	–	1,931 ± 28	–	0.3062
Tue p.m.	Δ B	1,983^a ± 22	1,986^a ± 25	1,873^b ± 27	–	0.0015
Wed a.m.	Δ C	2,010^a ± 23	1,930^b ± 24	–	–	0.0188
Wed p.m.	Δ D	2,032 ± 24	2,018 ± 26	2,013 ± 29	2,044 ± 23	0.8314
	Δ A	26.0^a ± 3.4	–	–	–63.5^b ± 3.4	0.0001
	Δ A%	1.4^a ± 0.2	–	–	–3.3^b ± 0.2	0.0001
	Δ B	16.0^a ± 3.9	–	–57.6^b ± 2.5	–	0.0001
	Δ B%	0.8^a ± 0.2	–	–3.0^b ± 0.1	–	0.0001
	Δ C	27.1^a ± 4.0	–55.9^b ± 3.5	–	–	0.0001
	Δ C%	1.3^a ± 0.2	–2.8^b ± 0.2	–	–	0.0001
	Δ D	22.6^b ± 4.9	88.1^a ± 6.8	–	–	0.0001

[1]Mon = Monday; Tue = Tuesday; Wed = Wednesday.

[2]Δ = weight difference during the 12-h increment (for example, ΔA = Mon p.m. – Mon a.m.).

[a,b]Means within a row followed by different superscript letters differ significantly ($P < 0.05$).

n = 50 birds per treatment mean.

TABLE 3. Male BW (mean and standard errors for the mean, g) and probabilities of birds subjected to a 12-h feed outage and feed replacement for 0 (control), 12, 24, or 48 h prior to preslaughter feed withdrawal in Experiment 1

Weight[1]	Δ[2]	Treatment (h) 0	12	24	48	P
Mon a.m.		2,223 ± 33	–	–	2,273 ± 29	0.2527
Mon p.m.	Δ A	2,265 ± 32	–	–	2,193 ± 28	0.0877
Tue a.m.		2,300 ± 31	–	2,330 ± 32	–	0.4955
Tue p.m.	Δ B	2,331[ab] ± 31	2,382[a] ± 30	2,252[b] ± 30	–	0.0106
Wed a.m.	Δ C	2,373 ± 31	2,312 ± 29	–	–	0.1512
Wed p.m.	Δ D	2,409 ± 31	2,423 ± 28	2,433 ± 33	2,445 ± 28	0.8452
	Δ A	42.1[a] ± 4.6	–	–	–78.2[b] ± 3.3	0.0001
	Δ A%	2.0[a] ± 0.2	–	–	–3.4[b] ± 0.1	0.0001
	Δ B	30.5[a] ± 3.4	–	–78.9[b] ± 5.1	–	0.0001
	Δ B%	1.3[a] ± 0.1	–	–3.4[b] ± 0.2	–	0.0001
	Δ C	42.3[a] ± 4.1	–70.5[b] ± 3.5	–	–	0.0001
	Δ C%	1.8[a] ± 0.2	–2.9[b] ± 0.1	–	–	0.0001
	Δ D	35.9[b] ± 5.3	111.1[a] ± 7.1	–	–	0.0001

[1]Mon = Monday; Tue = Tuesday; Wed = Wednesday.

[2]Δ = weight difference during the 12-h increment (for example, ΔA = Mon p.m. – Mon a.m.).

[a,b]Means within a row followed by different superscript letters differ significantly ($P < 0.05$).

n = 50 birds per treatment mean.

appeared to be less sensitive to the feed outages. This finding is noted by the lack of differences between the Trt48 birds and Trt12 birds when compared to the control birds following feed outage. However, as with the females, there were no differences in BW among the treatments at the Wed p.m. weighing, again suggesting a compensatory weight gain following weight loss due to the feed outage. The differences (Δ) in grams and by percentage in the bottom half of Table 3, all followed the same patterns observed for females (Table 2). The differences in actual weight loss and the apparent difference in sensitivity to feed outage between the sexes was most likely due to the greater BW of the males (Mon a.m. weight = 2,223 g) being less sensitive to feed outages on an absolute basis than that of females (Mon a.m. weight = 1,917 g).

The processing weights and yields in Experiment 1 for the females are presented in Table 4 and for the males in Table 5. For the females, there were significant treatment effects on gall bladder weight, gall bladder percentage of carcass, water uptake (g and %), and shell yield. Gall bladders, by weight and percentage, were significantly greater in Trt12 compared to Trt0 (control), neither of which was different from the Trt24 or Trt48 birds. Although gall bladder weight differences existed among the treatments, no significant differences were observed in the percentage moisture of the bile. Gall bladder weights and moisture content were measured, as it has been observed that long feed withdrawal periods are associated with enlarged gall bladders, which are more prone to breakage and spillage during evisceration. These results indicate that feed outage affected gall bladder enlargement and moisture content. Eviscerated yield (shell %) was significantly lower for Trt12 than for the Trt24 or Trt48 birds, but none of the treatments was significantly different from the control (Trt0). There were no significant treatment effects for the males (Table 5).

These results indicate that birds initially react to a 12-h feed outage with an actual weight loss. Northcutt and Buhr (1997) reported that broiler growth was 0.1 kg/d, or 4 g/ h on feed from 45 to 47 d of age. However, birds rapidly regained weight such that a minimum of a 12-h recovery period (for the Trt12 group) will result in similar BW. There were two issues of concern regarding experimental design. First, the control birds were handled more than the feed outage birds, and second, no feed weights were recorded. The extra handling of the control birds might have suppressed the normal growth by disrupting eating patterns and reducing the actual _ between the control birds and the latter two treatment groups. Therefore, it was decided to focus the second experiment on feed consumption patterns instead of bird weights to reduce excessive disruption of eating patterns by handling the birds and to determine if feed consumption patterns would support the live bird data.

The results for feed consumption in Experiment 2, reported as incremental feed consumption every 12 h by treatment, are presented in Table 6. During the first six increments prior to the first feed outage treatment, there were no differences in feed consumption between the treatment groups. Increment 2 was an exception, in which Trt24 treatment was significantly lower than the other three treatments, which were not different from each other.

The first feed outage was for Trt48 during Increment 7. There was a significant difference between Trt48 and the other three treatments, which were not different from each other. This is expected as feed consumption for the Trt48 pens during Increment 7 was zero. However, the feed consumption during Increment 8 was significantly greater for the Trt48 pens (2,441 g) compared to the other treatment groups, which were not different from each other. Also, during increments 9, 10, and 11, the Trt48 group pens consumed 1,694, 1,971, and 1,871 g, respectively, each of which was significantly greater than the feed consumed in the control pens of 1,555, 1,588, and 1,558 g, during the same increments, respectively. These

TABLE 4. Effect of a 12-h feed outage and feed replacement for 0 (control), 12, 24, and 48 h prior to preslaughter feed withdrawal on female processing weights and yields (means ± standard error) and probability (P) in Experiment 1

Processing parameter[1]	Treatment (h) 0	12	24	48	P
Dock wt (g)	1,954 ± 24	1,951 ± 25	1,933 ± 28	1,959 ± 24	0.8934
NYD wt (g)	1,672 ± 20	1,669 ± 23	1,657 ± 25	1,676 ± 19	0.9420
Shell wt (g)	1,317 ± 22	1,278 ± 25	1,312 ± 22	1,354 ± 18	0.1183
Chill wt (g)	1,439 ± 18	1,423 ± 21	1,409 ± 22	1,435 ± 18	0.7131
Viscera wt (g)	362.1 ± 16.4	393.1 ± 20.2	345.2 ± 12.1	322.1 ± 7.0	0.3309
Viscera (%)	18.5 ± 0.8	20.2 ± 1.0	17.8 ± 0.5	16.5 ± 0.4	0.2326
Gall wt (g)	2.3^{b} ± 0.1	2.7^{a} ± 0.2	2.4^{ab} ± 0.1	2.5^{ab} ± 0.1	0.0434
Gall (%)	0.12^{b} ± 0.01	0.14^{a} ± 0.01	0.13^{ab} ± 0.01	0.13^{ab} ± 0.01	0.0071
Bile H_2O (%)	68.5 ± 0.6	70.2 ± 0.7	68.5 ± 1.0	70.1 ± 0.6	0.1441
Chill H_2O (g)	121^{ab} ± 17	143^{a} ± 19	97^{b} ± 11	81.6^{b} ± 6.2	0.0110
Chill H_2O (%)	10.2^{ab} ± 1.7	12.2^{a} ± 1.9	7.7^{bc} ± 1.0	6.1^{c} ± 0.5	0.0102
Chill yield (%)	73.3 ± 0.2	73.1 ± 0.3	72.8 ± 0.3	73.2 ± 0.2	0.5404
Shell (%)	67.1^{ab} ± 0.8	65.7^{b} ± 1.0	67.9^{a} ± 0.6	69.0^{a} ± 0.3	0.0100
NYD (%)	85.6 ± 0.1	58.9 ± 0.2	85.7 ± 0.1	85.6 ± 0.2	0.5959
Shrink (%)	4.0 ± 0.2	3.7 ± 0.3	4.0 ± 0.1	4.2 ± 0.2	0.3666

[1]NYD = New York dressed.

a-cMeans within a row followed by different superscript letters differ significantly ($P < 0.05$).

n = 50 birds per treatment mean.

results agree with the findings of May and Lott (1992b) who reported that feeding activity increased once feed was returned to broilers who had previously been without feed. Similar results were obtained for Trt24 and Trt12 when comparing feed outage consumptions (0 g) and the recovery feed consumption compared to the control pens. In each case, the feed consumption during the recovery period was significantly greater than the control pens.

When comparing total feed consumption during Increments 7 through 11, there was no difference between the Trt48 group and the control group. The Trt24 and Trt12 groups consumed significantly less total feed, 7,059 and 7,155 g, respectively, than the controls and Trt48, 7,705 and 7,977 g, respectively, but were not different from each other. There were no significant differences in the final total bird pen weights (Wed p.m.), efficiency of feed conversion (feed conversion ratio, or FCR, determined as the ratio of the weight of feed consumed divided by the broiler weight gain during the test period), or weight gains (from Day 36 to the final bird weights at Wed p.m.) among the treatment groups.

The results show that following a 12-h feed outage, broilers will immediately consume more feed when feed is replaced, for at least the next several days (e.g., Trt48). Based on the Trt48 results as well as the cumulative results for all treatments, it appears that this compensatory consumption will result in no difference in the final feed consumption or weight gains if broilers are allowed sufficient recovery time.

The results for the processing weights and yields from Experiment 2 for females and males are presented in Tables 7 and 8, respectively. For female broilers, there

TABLE 5. Effect of a 12-h feed outage and feed replacement for 0 (control), 12, 24, and 48 h prior to preslaughter feed withdrawal on male processing weights and yields (means ± standard error) and probability in Experiment 1[1]

Processing parameter[2]	Treatment (h) 0	12	24	48	P
Dock wt (g)	2,319 ± 30	2,330 ± 29	2,338 ± 31	2,351 ± 28	0.8917
NYD wt (g)	1,973 ± 26	1,989 ± 26	1,996 ± 27	2,004 ± 24	0.8535
Shell wt (g)	1,605 ± 24	1,610 ± 22	1,583 ± 28	1,620 ± 23	0.7527
Chill wt (g)	1,705 ± 24	1,703 ± 23	1,706 ± 25	1,726 ± 22	0.8816
Viscera wt (g)	377.3 ± 10.7	373.2 ± 6.8	412.8 ± 21.6	387.3 ± 13.2	0.1946
Viscera (%)	16.2 ± 0.4	16.1 ± 0.2	17.6 ± 0.8	16.5 ± 0.5	0.1936
Gall wt (g)	2.8 ± 0.1	3.0 ± 0.1	2.9 ± 0.1	2.7 ± 0.1	0.3309
Gall (%)	0.12 ± 0.01	0.13 ± 0.01	0.12 ± 0.01	0.11 ± 0.01	0.2960
Bile H_2O %	70.5 ± 0.6	71.7 ± 0.7	70.9 ± 0.6	71.3 ± 0.4	0.4927
Chill H_2O (g)	99.7 ± 9.7	88.3 ± 5.5	116.8 ± 19.4	106.7 ± 12.6	0.4535
Chill H_2O (%)	6.4 ± 0.8	5.5 ± 0.3	8.0 ± 1.6	7.0 ± 1.1	0.3906
Chill yield (%)	73.4 ± 0.3	73.1 ± 0.2	72.7 ± 0.2	73.4 ± 0.3	0.2347
Shell (%)	69.1 ± 0.5	69.3 ± 0.3	67.8 ± 0.8	68.8 ± 0.6	0.2398
NYD (%)	85.4 ± 0.1	85.4 ± 0.1	85.4 ± 0.2	85.3 ± 0.2	0.9760
Shrink (%)	4.1 ± 0.2	3.8 ± 0.2	3.9 ± 0.2	3.8 ± 0.2	0.7910

[1]n = 50 birds per treatment mean.

[2]NYD = New York dressed.

TABLE 6. Incremental feed consumption (g), cumulative feed consumed, BW, and feed conversion (FC) ratio (mean and standard error of the means) and probability for broilers subjected to feed outage and refeeding for 0 (control), 12, 24, or 48 h in Experiment 2

	Treatment (h)				
Increment	0	12	24	48	*P*
1	1,273 ± 58	1,331 ± 19	1,321 ± 18	1,320 ± 71	0.7685
2	1,359[a] ± 44	1,371[a] ± 26	1,281[b] ± 16	1,387[a] ± 56	0.0475
3	1,369 ± 30	1,443 ± 21	1,402 ± 21	1,422 ± 39	0.3087
4	1,464 ± 38	1,528 ± 27	1,431 ± 16	1,511 ± 58	0.1471
5	1,482 ± 46	1,508 ± 27	1,443 ± 35	1,480 ± 35	0.6262
6	1,520 ± 33	1,553 ± 27	1,470 ± 19	1,581 ± 47	0.1209
7	1,446[a] ± 34	1,514[a] ± 43	1,438[a] ± 40	0[b]	0.0001
8	1,558[b] ± 28	1,626[b] ± 31	1,528[b] ± 32	2,441[a] ± 67	0.0001
9	1,555[b] ± 45	1,522[b] ± 23	0[c]	1,694[a] ± 51	0.0001
10	1,588[c] ± 38	0[d]	2,380[a] ± 24	1,971[b] ± 46	0.0001
11	1,558[d] ± 44	2,493[a] ± 38	1,712[c] ± 51	1,871[b] ± 62	0.0001
Total 7 – 11	7,705[a] ± 161	7,155[b] ± 95	7,059[b] ± 108	7,977[a] ± 212	0.0148
Total 1 – 11	16,172[ab] ± 380	15,889[ab] ± 164	15,407[b] ± 157	16,679[a] ± 493	0.0248
Bird Wt. 36 d	23,834 ± 550	24,469 ± 232	23,400 ± 374	24,210 ± 227	0.2732
Bird Wt 41 d	32,887 ± 632	33,238 ± 384	32,273 ± 337	33,323 ± 403	0.1352
Gain 36-41 d, g	9,054 ± 126	8,769 ± 279	8,873 ± 392	9,112 ± 203	0.5129
FC Ratio	1.79 ± 0.03	1.82 ± 0.05	1.75 ± 0.07	1.83 ± 0.02	0.6358

[a-d]Means within a row followed by different superscript letters differ significantly ($P < 0.05$).

[1]Increments began for 36-d-old broilers at 1100 h and proceeded every 12 h until initiation of preslaughter feed withdrawal at 41 d of age at 2300 h.

n = 50 birds per treatment mean.

were significant treatment effects for the New York dressed carcass weights, gall bladder weights, and gall bladder percentages of carcass weights. For male broilers, as in Experiment 1, there were no significant processing effects (Table 8). The authors offer no explanation for the difference in New York dressed carcass weights, as the catch weights, dock weights, and the New York dressed percentages were not different.

The significant differences for the gall bladders from the female birds were consistent with the results from Experiment 1. In both experiments, the gall bladders were significantly larger from the Trt12 group, and in Experiment 2, all of the feed outage treatments had significantly larger gall bladders. This result would indicate that the feed outage affected the digestive system of the birds related to bile production and storage patterns. The authors offer no explanation for this effect being significant only in the female birds.

The results from these experiments indicate that a short-term feed outage (12-h duration) followed by feed replacement for 12, 24, or 48 h prior to preslaughter feed withdrawal has little effect on final birds weights, total feed consumption, or processing weights or yields. Feed outages appear to affect female birds more than males. Based on compensatory feed consumption patterns (Experiment 2), producers should be aware that replacement feed amounts should be sufficient to take into account the increased feed consumption following the outage. In

TABLE 7. Effect of a 12-h feed outage and feed replacement for 0 (control), 12, 24, and 48 h prior to preslaughter feed withdrawal on female processing weights and yields (means ± standard error) and probability (*P*) in Experiment 2

	Treatment (h)				
Processing parameter[1]	0	12	24	48	*P*
Dock wt (g)	1,445 ± 33	1,461 ± 26	1,450 ± 24	1,526 ± 28	0.1334
NYD wt (g)	1,230[b] ± 27	1,245[ab] ± 22	1,225[b] ± 21	1,307[a] ± 22	0.0485
Shell wt (g)	970 ± 22	974 ± 19	960 ± 17	1,021 ± 19	0.1276
Chill wt (g)	1,031 ± 23	1,036 ± 19	1,021 ± 19	1,088 ± 20	0.0982
Viscera wt (g)	263.5 ± 6.0	270.9 ± 5.2	265.2 ± 4.8	281.5 ± 5.3	0.0808
Viscera (%)	18.3 ± 0.2	18.5 ± 0.2	18.4 ± 0.2	18.5 ± 0.3	0.8737
Gall wt (g)	1.6[b] ± 0.1	1.9[a] ± 0.1	1.8[ab] ± 0.1	1.9[a] ± 0.1	0.0195
Gall (%)	0.11[b] ± 0.01	0.13[a] ± 0.01	0.12[a] ± 0.01	0.12[a] ± 0.01	0.0438
Chill H_2O (g)	6.4 ± 0.2	6.4 ± 0.2	6.6 ± 0.2	6.6 ± 0.2	0.5618
Chill H_2O (%)	71.2 ± 0.3	70.8 ± 0.3	70.4 ± 0.3	70.9 ± 0.3	0.3003
Shell (%)	66.9 ± 0.2	66.5 ± 0.3	66.1 ± 0.2	66.6 ± 0.3	0.2196
NYD (%)	85.0 ± .02	85.0 ± 0.2	84.4 ± 0.3	85.0 ± 0.3	0.2199
Shrink (%)	4.9 ± 0.3	5.0 ± 0.2	4.6 ± 0.2	5.3 ± 0.3	0.1987

[a,b]Means within a row followed by different superscript letters differ significantly ($P < 0.05$).

n = 50 birds per treatment mean.

[1]NYD = New York dressed.

TABLE 8. Effect of a 12-h feed outage and feed replacement for 0 (control), 12, 24, and 48 h prior to preslaughter feed withdrawal on male processing weights and yields (means ± standard error) and probability in Experiment 2[1]

Processing parameter[2]	Treatment (h) 0	12	24	48	*P*
Dock wt (g)	1,677 ± 34	1,695 ± 25	1,632 ± 36	1,635 ± 32	0.4010
NYD wt (g)	1,418 ± 29	1,440 ± 22	1,375 ± 29	1,381 ± 25	0.2502
Shell wt (g)	1,118 ± 24	1,135 ± 18	1,078 ± 24	1,082 ± 20	0.1848
Chill wt (g)	1,183 ± 25	1,198 ± 19	1,139 ± 25	1,144 ± 21	0.1765
Viscera wt (g)	299.6 ± 5.3	304.7 ± 4.4	297.1 ± 6.1	298.8 ± 5.0	0.7600
Viscera %	18.0 ± 0.2	18.0 ± 0.2	18.2 ± 0.2	18.4 ± 0.2	0.3373
Gall wt (g)	1.8 ± 0.1	2.1 ± 0.1	1.8 ± 0.1	1.8 ± 0.1	0.0539
Gall %	0.11 ± 0.01	0.12 ± 0.01	0.11 ± 0.01	0.11 ± 0.01	0.1738
Chill H2O (g)	5.8 ± 0.1	5.6 ± 0.2	5.7 ± 0.1	5.7 ± 0.2	0.8299
Chill H2O %	70.5 ± 0.2	70.7 ± 0.2	70.0 ± 0.2	70.1 ± 0.3	0.1459
Shell %	66.6 ± 0.2	66.9 ± 0.2	66.2 ± 0.2	66.2 ± 0.3	0.1075
NYD %	84.5 ± 0.1	84.9 ± 0.1	84.5 ± 0.2	84.6 ± 0.2	0.2039
Shrink %	5.1 ± 0.1	4.9 ± 0.2	4.7 ± 0.2	5.0 ± 0.2	0.5414

[1]n = 50 birds per treatment mean.

[2]NYD = New York dressed.

other words, the amount of feed not consumed during the outage period needs to be included in the replacement feed. Otherwise, the compensatory increased consumption could create a second outage prior to the scheduled preslaughter feed withdrawal.

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REFERENCES

Bilgili, S. F. 1988. Research note: Effect of feed and water withdrawal on shear strength of broiler gastrointestinal tract. Poult. Sci. 67:845–847.

Benoff, F. H. 1982. The "live-shrink" trap: Catch weights a must. Broiler Ind. 41:56, 60.

May, J. D., and J. W. Deaton. 1989. Digestive tract clearance of broilers cooped or deprived of water. Poult. Sci. 68:627–630.

May, J. D., and B. D. Lott. 1992a. Feed and water consumption patterns of broilers at high environmental temperatures. Poult. Sci. 71:331–336.

May, J. D., and B. D. Lott. 1992b. Effect of periodic feeding and photoperiod on anticipation of feed withdrawal. Poult. Sci. 71:951–958.

Murphy, B. D., and T. L. Goodwin. 1978. Effect of food and water withdrawal from broilers on weight loss and carcass yields. Arkansas Farm Res. 27(5):9.

Northcutt, J. K., and R. J. Buhr. 1997. Longer feed withdrawal can be costly. Broiler Ind. 60:28–34.

Northcutt, J. K., S. I. Savage, and L. R. Vest. 1997. Relationship between feed withdrawal and viscera conditions of broilers. Poult. Sci. 76:410–414.

Rasmussen, A. L., and M. G. Mast. 1989. Effect of feed withdrawal on composition and quality of broiler meat. Poult. Sci. 68:1109–1113.

SAS Institute. 1988. SAS/STAT Guide for Personal Computers. Version 6.03 ed. SAS Institute Inc., Cary, NC.

Smidt, M. J., S. D. Formica, and J. C. Fritz. 1964. Effect of fasting prior to slaughter on yield of broilers. Poult. Sci. 43:931–934.

USDA Food Safety and Inspection Service. 1996. Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems; Final Rule. Fed. Reg. 61:38806–38989.

Veerkamp, C. H. 1986. Fasting and yield of broilers. Poult. Sci. 65:1299–1304.

Wabeck, C. J. 1972. Feed and water withdrawal time relationship to processing yield and potential fecal contamination of broilers. Poult. Sci. 51:1119–1121.