The Relationship of Altered Water/Feed Intake Ratios on Growth and Abdominal Fat in Commercial Broilers

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(Received for publication July 6, 1982)

ABSTRACT Three trials were conducted to investigate the relationship of changing water/feed ratios on growth rate and abdominal fat levels of two genetic lines. Water/feed intake ratios were elevated by feed restriction programs (skip-a-day and 70% restriction) from 0 to 4 days of age. Following return to *ad libitum* feed, compensatory gains were observed in body weights, and the elevated water/feed ratios declined to levels similar to that of controls.

The addition of up to 2.4% dietary salt resulted in increased water/feed intake ratios without reductions in feed intake. Early body weights of birds receiving diets containing high levels of salt were larger than body weights of birds receiving the control diet. Peak differences in body weights occurred at 4 days and were larger in males than females. Feed efficiency from 0 to 4 days was higher for birds receiving high salt diets than for birds receiving the control diet. Decreasing the high salt levels resulted in reduced water/feed ratios to levels comparable to controls.

Small differences were observed in abdominal fat between the two genetic lines. Abdominal fat weights were significantly ($P \leqslant .05$) reduced (17 to 28%) in both lines when birds were fed a 2.4% salt diet. Although abdominal fat weights were similar between sexes, differences in body weights resulted in significant ($P \leqslant .05$) differences between males and females in percent abdominal fat. Data indicated that high water/feed intake ratios may be associated with reduced abdominal fat.

(Key words: feed restriction, body weights, diet, salt)

1983 Poultry Science 62:263–272

INTRODUCTION

Broilers under conditions of severe feed restriction tend to maintain normal water intake levels, which result in elevated water/feed ratios (Marks, 1980). In addition, the total lipid content of carcasses of feed restricted birds is lower than that of full-fed birds (Proudman *et al.*, 1970; Marks, 1980). These observations suggest a relationship between water intake level and carcass lipid content. Because reduction of lipid content in feed restricted birds could be related to the smaller body size in such birds, a causal relationship between high water/feed ratios and subsequent changes in body composition has not been established. However, the known inverse relationship between carcass moisture and carcass lipid (Donaldson *et al.*, 1956; Twining *et al.*, 1978) and the importance of minimizing carcass fat of commercially grown broilers justify a more detailed examination of the relationship of water/feed ratios to carcass lipid levels.

Early growth curves in Japanese quail and broilers have been shown to be altered by selection for high body weight (Marks, 1978, 1979). The purpose of this study was to investigate the influence of altering water/feed intake ratios on the early growth curves and the body composition in two commercial broiler lines.

MATERIALS AND METHODS

Three trials were conducted utilizing chicks from two commercial broiler lines that in previous experiments differed in amount of carcass fat. The control diet for all trials was the UGA Broiler Starter diet, which contains 23% protein with 3120 kcal/kg metabolizable energy and .4% added salt.

Trial 1. Trial 1 was designed to evaluate the influence of two early feed restriction programs from 0 to 4 days of age on water/feed intake ratios. It was of particular interest to determine if the altered water/feed ratios would continue following the return of birds to *ad libitum* feed. Day-old males were randomly assigned to three treatment groups and received the control diet:

1) feed provided *ad libitum;* 2) feed withheld on Days 1 and 3, followed by *ad libitum* feeding; and 3) feed restricted to approximately 70% of normal levels for Days 0 to 4 followed by *ad libitum* feeding. Hereafter, these three treatments will be referred to as control, skip, and 70%, respectively. Individual body weights were obtained at 0, 4, 8, 12, 16, and 28 days of age. Daily feed and water intake data were obtained through 16 days of age. Feed and water intake data were also measured from days 18 to 21 and from days 25 to 28 to estimate intake for Weeks 3 and 4, respectively. Water intake was measured by use of Mason jars with regular chick water founts attached to the outside of battery pens, allowing birds exposure to approximately one-third of the water fount lip area. For estimations of evaporative water losses, two waterers were placed in locations inaccessible to the birds. Each line-treatment subclass was replicated 4 times with 6 birds per subclass.

Trial 2. Trial 2 investigated the influence of high water/feed ratios established by increased water intake rather than by decreased feed intake. Feed grade salt (NaCl) was used as a stimulus to increase water consumption. Day-old males were randomly assigned to three dietary treatment groups; 1) control (.4% salt), 2) moderate salt (.8% salt), and 3) high salt (1.6% salt). Birds were fed these diets from 0 to 49 days of age. Feed and water intake data were obtained daily from 0 to 16 days of age. Individual body weights were obtained at 4-day intervals through 16 days and at 21, 26, 33, 36, 39, 42, and 49 days of age. In this trial each line-treatment subclass was replicated four times with 6 birds per subclass. At 28 days, all birds were moved from an electrically heated starter battery to rearing batteries. At 49 days of age, birds were slaughtered and abdominal fat removed and weighed as described by Washburn *et al.* (1983).

Trial 3. Trial 3 involved two objectives: first, to determine if removal of the stimulus causing increased water/feed ratios would result in a continued modification of ratios, and, second, to determine if increased water/feed ratios would reduce abdominal fat levels. In this trial, both males and females were used with birds reared in floor pens instead of batteries. Day-old chicks were randomly assigned to four dietary treatment groups: 1) control diet with .4% salt, 2) control diet with 1.6% salt, 3) control diet with varying levels of salt, 4) control diet with 2.4% salt. Birds in Treatment 3 received 1.6% salt from hatching through 21 days, .8% salt from 21 to 28 days, and .4% salt (control diet) from 28 to 49 days of age. At 21 days of age the 23% protein starter diet containing 3120 kcal/kg metabolizable energy was changed to a 21% protein finisher diet containing 3256 kcal/kg metabolizable energy. Individual body weights were obtained at 0, 4, 7, 11, 14, 21, 28, 35, 42, and 49 days of age. Feed and water intake were measured daily from 0 to 7 days. From 7 to 49 days, water intake was measured for a 3-day period each week, whereas feed intake was measured for the entire period. Water/feed ratios were calculated for 3-day periods each week (Barbato *et al.*, 1980). At 54 days of age, 15 birds from each diet/line/sex subclass were slaughtered and abdominal fat removed and weighed. Total carcass lipid was obtained for Line 2 males receiving the control treatment (.4% salt), the varying salt treatment (1.6 to .4%), and the high salt treatment (2.4%) by a modification of the Folch methanol extraction method described by Washburn *et al.* (1983).

Data in all trials were analyzed by the General Linear Model (GLM) procedure (Barr *et al.*, 1979) in which the principle of least squares is used to fit a fixed effects linear model.

RESULTS AND DISCUSSION

Trial 1. Both feed restriction treatments resulted in a 20 to 23% reduction in 4-day body weights (Table 1). Although, after Day 8, body weights of Line 2 birds were significantly ($P \leq .01$) larger than those of Line 1, nonsignificant line × treatment interactions were observed. Therefore, body weights of Lines 1 and 2 were combined in Table 1. At 28 days, body weights of birds previously exposed to feed restriction from 0 to 4 days were only 4 to 8% smaller than body weights of birds fed *ad libitum* (Table 1). Although body weight reductions of birds in the skip and 70% treatment groups were similar at 4 days, birds receiving the skip treatment did not exhibit as rapid growth recovery as did birds on the 70% restriction treatment (Table 1). The obvious role of feed intake in explaining these growth responses is shown in Figure 1. Feed intake of birds on the skip treatment was approximately 55% of the intake of controls for Days 0 to 4. Feed intake of birds on the 70% treatment was below the projected level for Days 0 to 2;

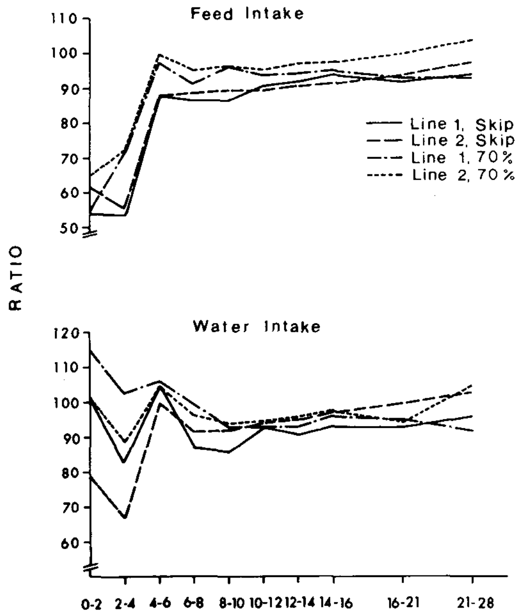

FIG. 1. Feed and water intake by age expressed as ratio of restricted feed treatments/control treatment X 100 (Trial 1).

however, the desired feed restriction level was obtained for Days 2 to 4 (Fig. 1). Following removal of birds from feed restriction at 4 days and placement on *ad libitum* feed, feed intake increased to approximately 90 to 95% of the control. Water intake patterns were very different from feed intake patterns during the period of restriction. Water intake of both lines on the 70% treatment and Line 1 of the skip treatment were equal to or higher than the water intake of control birds, whereas birds in Line 2 receiving the skip treatment consumed only 80% as much water as the control treatment during days 0 to 2 (Fig. 1). Water intake of both skip and 70% birds decreased during Days 2 to 4, but on a relative percentage basis, they remained above the levels of feed intake (Fig. 1). Dissimilar water intake patterns compared to feed intake patterns in feed restricted treatments during Days 0 to 4 are in agreement with previous observations regarding the failure of water intake to follow feed intake patterns during periods of feed restriction (Marks, 1980). Water intake of restricted birds tended to correspond to feed intake levels at approximately 95% of the control level following return to *ad libitum* feeding.

The near normal water intake of birds during feed restriction resulted in high water/feed ratios for Days 0 to 4. Following removal of the feed restriction programs, the water/feed intake ratios returned to that of the control treatment group (Fig. 2). Although the overall water/feed ratios of the two lines were slightly different (Line 1, approximately .20 higher

TABLE 1. *Mean body weights and feed efficiencies (lines combined) by treatment and age (Trial 1)*

Day	*Ad libitum* control	Restricted Skip	Restricted 70%	Ratio (restricted treatments/control X 100) Line 1 Skip	Line 1 70%	Line 2 Skip	Line 2 70%
Body weights (g):							
0	42[a]	42[a]	42[a]	100	99	102	100
4	93[a]	73[b]	72[b]	77	77	80	78
8	164[a]	136[c]	144[b]	81	86	84	89
12	269[a]	232[b]	242[b]	86	89	87	91
16	402[a]	358[b]	372[b]	88	92	89	93
28	901[a]	821[b]	854[b]	92	94	94	96
Feed efficiency (gain/feed):							
0-4	.98[b]	1.05[a]	.87[c]				
4-8	.70[b]	.70[b]	.74[a]				
8-12	.69[ab]	.72[a]	.68[b]				
12-16	.67[a]	.68[a]	.68[a]				
16-21	.58[a]	.60[a]	.58[a]				
21-28	.56[a]	.58[a]	.59[a]				

[a,b,c]Means within a row with different superscripts are significantly different ($P \leq .05$).

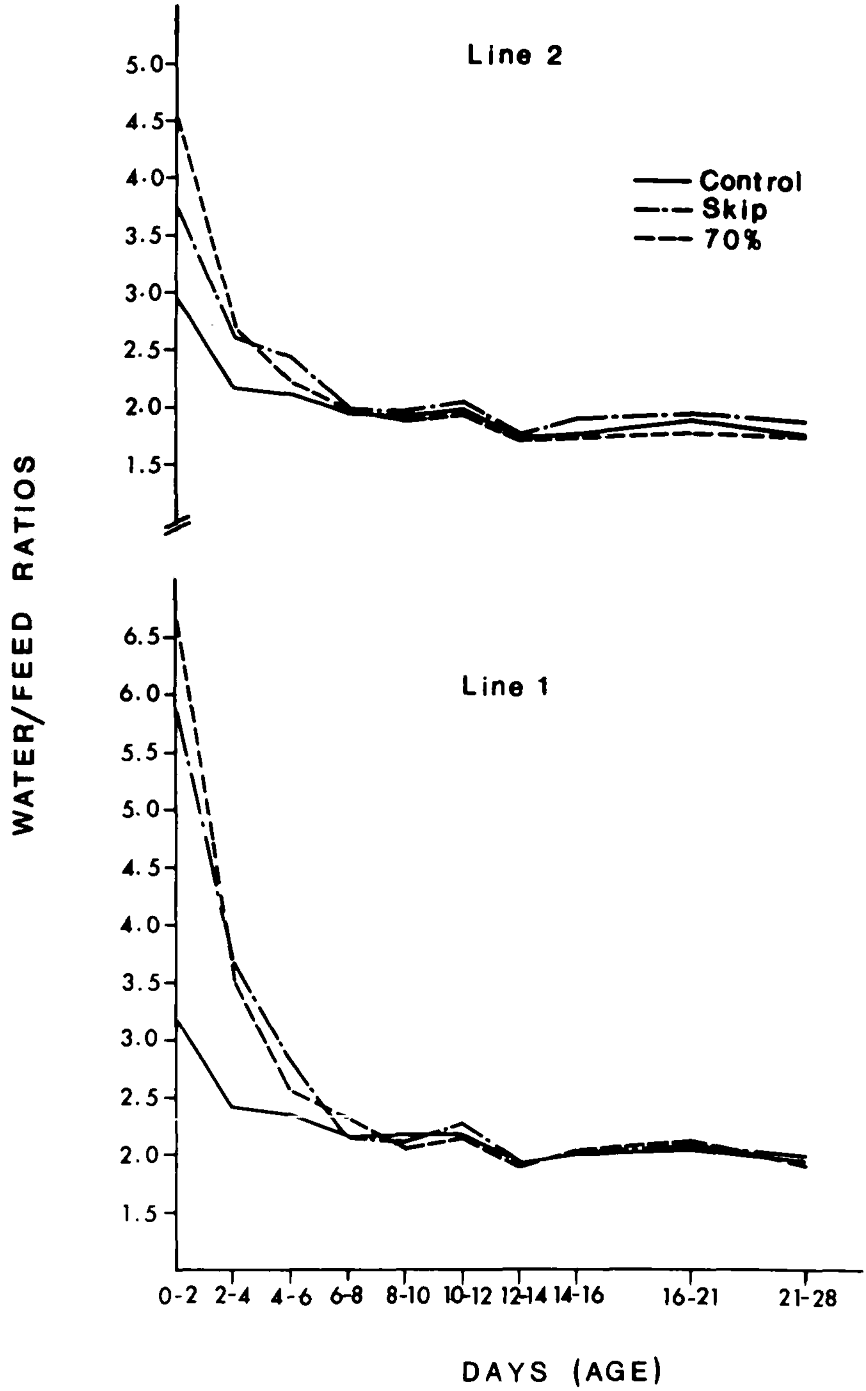

FIG. 2. Water/feed ratios by treatment, line, and age (Trial 1).

than Line 2), the water/feed ratios of feed restricted birds following removal from the feed restriction programs were very similar (within line) to ratios of *ad libitum* fed birds. This suggests that the two lines may have different inherent water/feed ratios.

Normal water intake accompanied by reduced feed intake of birds on the skip feed restricted treatment resulted in superior feed efficiency from 0 to 4 days (Table 1). McDaniel *et al.* (1975) and McCartney and Brown (1977) reported no adverse effect on body weight and improved feed conversion by limiting the feeding time of broilers. Data from this trial suggest that one possible explanation for improved feed conversions under feed restriction regimens may be related to higher water/feed ratios.

Trial 2. The addition of two and four times the control level of salt (.8 and 1.6% treatments, respectively) had no adverse effect on feed intake from 0 to 16 days of age (Table 2). Feed intake of birds receiving the .4% salt diet was significantly less than feed intake of birds receiving the .8 and 1.6% salt diets from 8 to 12 days of age. Water intake of birds on the .8 and 1.6% salt diets was significantly ($P\leqslant.05$) greater than for birds on the .4% diet for all observations through 16 days (Table 2). After Day 2, water intake of birds receiving the 1.6% salt diet was also significantly ($P\leqslant.05$) higher than the water intake of birds receiving the .8% salt diet. Water/feed ratios were significantly ($P\leqslant.05$) higher for birds receiving the .8 and 1.6% salt diets than for birds receiving the .4% diet. It is important to point out that the desired higher water/feed ratios were accomplished without a reduction in feed intake (Table 2). Birds of Line 1 tended to have overall higher water/feed ratios than birds of Line 2 (Table 2), which is in agreement with Trial 1 observations (Fig. 1).

Early body weights of birds receiving the .8 and 1.6% salt diets were heavier than body weights of birds receiving the .4% salt diet (Fig. 3). The peak difference in body weights occurred at Day 4 and the magnitude varied from 4 to 8%. These higher body weights of birds on the .8 and 1.6% salt diets tended to exist for relatively short periods and essentially disappeared by 21 days, although there appeared to be differences between lines with regard to the duration of the body weight advantages. Similar feed intake across treatment groups (Table 2) suggests that increases in body weight were due to increased water intake.

Feed efficiency from 0 to 4 days of birds receiving the high (1.6%) salt diet was significantly ($P\leqslant.05$) superior to the feed efficiency of birds receiving the .4 and .8% salt diets (Table 3). Feed efficiencies across treatments were similar during other observation periods through 16 days of age.

TABLE 2. *Mean feed and water intake and water/feed ratios from 0 to 16 days of age by dietary treatment (Trial 2)*

		Feed intake			Water intake			Water/feed ratio		
Line	Days	.4% NaCl	.8% NaCl	1.6% NaCl	.4% NaCl	.8% NaCl	1.6% NaCl	.4% NaCl	.8% NaCl	1.6% NaCl
		(g/bird/day)								
1	0-2	9.9^{a} ± .3	10.0^{a} ± .3	9.7^{a} ± .1	26.5^{b} ± 1.6	30.1^{a} ± 1.8	31.4^{a} ± 1.1	2.69^{b} ± .14	3.02^{a} ± .20	3.24^{a} ± .16
	2-4	16.0^{a} ± .2	16.7^{a} ± .5	16.1^{a} ± .3	38.9^{c} ± 1.5	42.5^{b} ± 1.2	48.4^{a} ± 1.3	2.43^{b} ± .08	2.55^{b} ± .09	3.01^{a} ± .11
	4-8	24.9^{a} ± .5	25.9^{a} ± .2	26.1^{a} ± .7	54.0^{c} ± 2.7	61.3^{b} ± 2.6	74.8^{a} ± 1.2	2.16^{c} ± .07	2.37^{b} ± .09	2.87^{a} ± .05
	8-12	35.0^{b} ± 1.1	37.6^{a} ± 1.4	37.7^{a} ± .5	73.3^{c} ± 3.4	84.7^{b} ± 1.9	107.5^{a} ± 1.5	2.09^{c} ± .06	2.26^{b} ± .07	2.85^{a} ± .04
	12-16	48.3^{a} ± .7	49.4^{a} ± .7	50.8^{a} ± .8	100.8^{c} ± 6.2	110.5^{b} ± 3.6	144.0^{a} ± 2.9	2.09^{c} ± .12	2.24^{b} ± .08	2.83^{a} ± .05
2	0-2	8.1^{a} ± .3	9.0^{a} ± .2	8.1^{a} ± .4	17.6^{b} ± 1.3	22.1^{a} ± 1.0	21.2^{a} ± 1.1	2.17^{b} ± .18	2.46^{a} ± .09	2.63^{a} ± .14
	2-4	14.2^{a} ± .5	15.1^{a} ± .2	14.3^{a} ± .7	30.7^{c} ± 3.0	36.8^{b} ± 1.8	40.3^{a} ± 1.4	2.15^{b} ± .14	2.44^{b} ± .12	2.83^{a} ± .06
	4-8	24.9^{a} ± .3	25.3^{a} ± .5	24.2^{a} ± .5	48.9^{c} ± 1.9	57.6^{b} ± .6	69.1^{a} ± 1.9	1.96^{c} ± .06	2.28^{b} ± .04	2.85^{a} ± .03
	8-12	36.0^{a} ± .3	36.7^{a} ± .2	36.8^{a} ± .5	68.3^{c} ± 2.2	78.4^{b} ± .6	103.0^{a} ± 1.4	1.89^{c} ± .05	2.14^{b} ± .03	2.80^{a} ± .03
	12-16	49.7^{a} ± 1.0	50.8^{a} ± .4	49.8^{a} ± .6	94.6^{c} ± 2.8	110.4^{b} ± 2.0	137.9^{a} ± 2.5	1.90^{c} ± .02	2.17^{b} ± .04	2.77^{a} ± .05

a,b,c Means within a row with different superscripts are significantly different ($P\leqslant.05$).

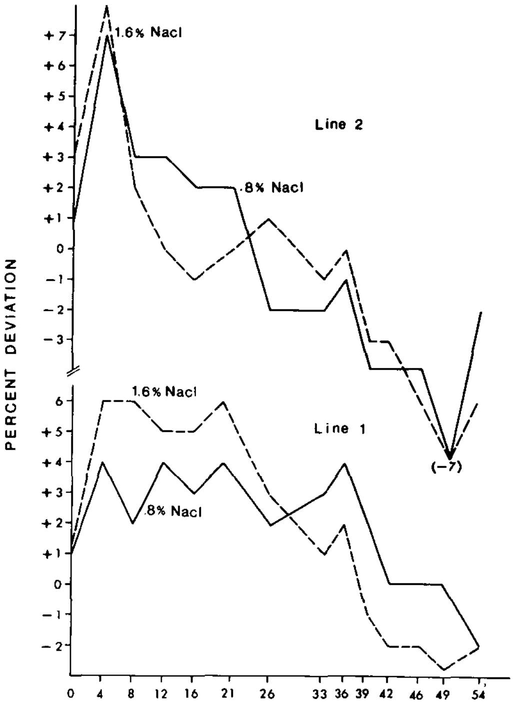

FIG. 3. Body weights of .8 and 1.6% dietary salt treatments as a percent deviation from control diet (.4% salt) by line and age (Trial 2).

TABLE 3. *Feed efficiencies (gain/feed) lines combined by dietary treatment and age (Trial 2)*

	Salt		
Days	.4%	.8%	1.6%
0-4	$.96^{b} \pm .02$	$.99^{b} \pm .02$	$1.07^{a} \pm .03$
4-8	$.74^{a} \pm .01$	$.72^{a} \pm .01$	$.74^{a} \pm .01$
8-12	$.71^{a} \pm .01$	$.71^{a} \pm .01$	$.68^{a} \pm .01$
12-16	$.69^{a} \pm .01$	$.68^{a} \pm .01$	$.68^{a} \pm .01$

[a,b]Means within a row with different superscripts are significantly different (P⩽.05).

Carcasses of Line 2 birds receiving the control diet had significantly (P⩽.05) more abdominal fat than carcasses of Line 1 birds receiving the control diet (Table 4). However, Line 2 birds receiving the .8% and 1.6% salt diets had significantly (P⩽.05) less abdominal fat than line 2 birds receiving the control diet (Table 4).

Trial 3. Dietary treatment effects for feed intake were nonsignificant in both males and females indicating that birds tolerated the high levels of salt without reductions in feed intake. Data are not presented because they were in general agreement with observations in Trial 2 (Table 2).

Water intake was significantly (P⩽.05) different between treatments for all observation periods (Fig. 4). Males consumed significantly (P⩽.05) more water than females. Treatment by sex interactions were significant in only two of eight analyses. Birds receiving the 1.6 and 2.4% salt diets consumed more water than birds receiving the .4% salt (control) diet. Water intake patterns were essentially the same in both sexes (Fig. 4). Changing the salt from 1.6 to .4% (hereafter, referred to as the 1.6 to .4% diet) resulted in the water intake returning to the same approximate level as that of birds receiving the .4% diet and declining to slightly

TABLE 4. *Mean body weight and abdominal fat weight by line and dietary treatment (Trial 2)*

	Salt		
Trait	.4%	.8%	1.6%
Line 1			
Body weight (g)	2053^{a}	2011^{a}	2014^{a}
Fat weight (g)	23.5^{a}	24.8^{a}	22.0^{a}
% Fat[1]	1.12^{a}	1.23^{a}	1.09^{a}
Line 2			
Body weight (g)	2151^{a}	2104^{a}	2046^{a}
Fat weight (g)	33.4^{a}	27.4^{b}	23.5^{b}
% Fat[1]	1.55^{a}	1.30^{ab}	1.13^{b}

[a,b,c]Means within a row with different superscripts are significantly different (P⩽.05).

[1]Fat weight/body weight × 100.

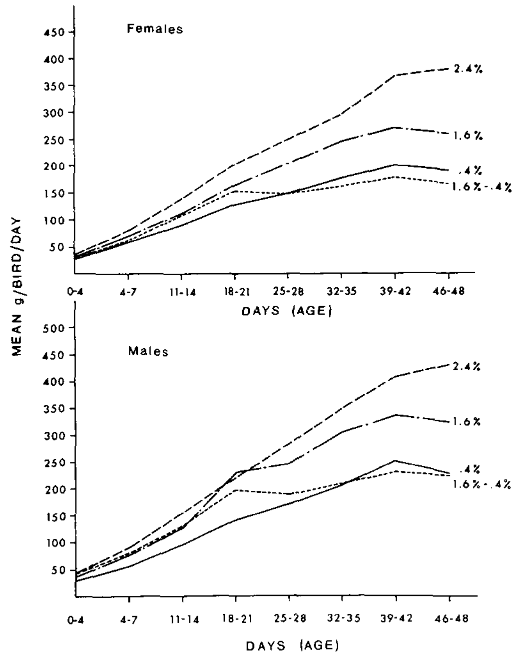

FIG. 4. Water intake (g/bird/day) by treatment, sex and age (Trial 3).

lower levels during the last two observation periods in both sexes (Fig. 4). Therefore, the salt stimulus was effective only during the stimulation period without evidence of a carryover effect in higher water/feed ratios following the removal of the stimulus. This supports the hypothesis of an inherent pattern of water intake as opposed to establishment of water/feed intake patterns as a conditioned effect.

Body weights at 4 days of age of both males and females receiving diets containing the elevated salt levels (1.6%, 1.6% to .4%, 2.4%) were higher than body weights of birds receiving the .4% salt diet. The peak body weight increases occurred at Day 4, with males tending to have higher peaks than females (Figs. 5 and 6). There was also evidence that the body weight advantage of birds receiving the high salt diets continued for longer periods in males than females. Body weight responses appeared to be dose related in males, with birds receiving the highest salt level (2.4%) having the greatest increase in body weight (Fig. 5). However, this pattern was not consistent in females (Fig. 6). Body weights of Line 1 males receiving the high

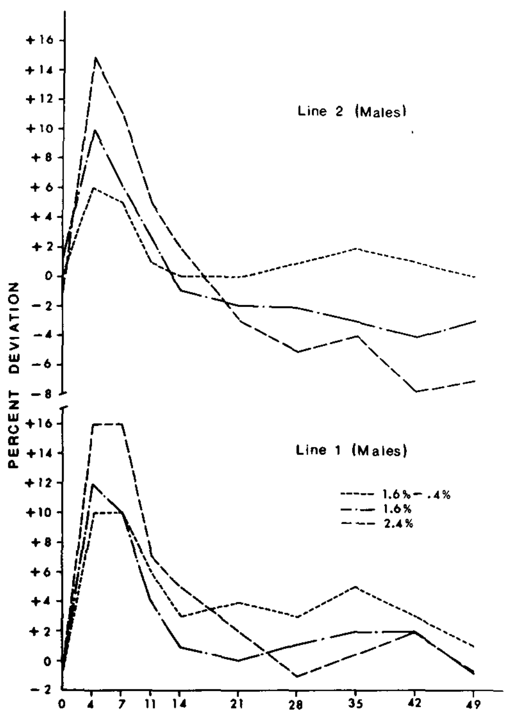

FIG. 5. Male body weights of high dietary salt treatments as a percent deviation from control diet body weights by line and age (Trial 3).

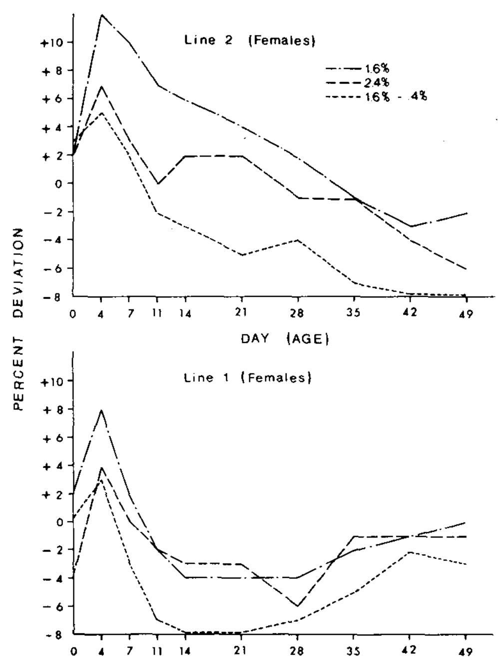

FIG. 6. Female body weights of high dietary salt treatments as a percent deviation from body weights of control treatment by line and treatment (Trial 3).

salt diets at 49 days were similar to body weights of males receiving the .4% salt diet (Fig. 5). However, Line 2 males receiving high salt diets (1.6 and 2.4%) had lower 49-day body weights than did birds receiving the .4% diet (Fig. 5). These body weight responses are in general agreement with observations in Trial 2 in which there was also evidence that high salt diets had a smaller adverse effect at later ages on Line 1 males than on Line 2 males. The smaller initial increase in body weight of females receiving the salt treatment indicates a possible sex difference in response to elevated dietary salt (Fig. 6). The body weights of 1.6 to .4% salt treatment males were heavier and females were lighter than the body weights of other treatments at 49 days of age (Figs. 5 and 6).

Water/feed ratios were significantly ($P \leq .05$) higher for birds receiving the 1.6 and 2.4% salt diets than for birds receiving the .4% salt diet from 0 to 49 days. Ratios of 1.6 to .4% treatment birds were also elevated until they were placed on the .4% diet at 28 days (Fig. 7). Although water/feed ratios of males were consistently higher than those of females (6 of 8 observations), the differences were significant for only two observation periods. The higher water/feed ratios of birds receiving the high salt diets were due to increased water intake since feed intake was not influenced by salt level. The water/feed ratios of the 1.6 to .4% treatment birds following placement on the .4% diet were actually lower than corresponding ratios of birds on the .4% diet (Fig. 7) due to reduced water intake (Fig. 4).

Feed efficiencies of birds receiving high salt

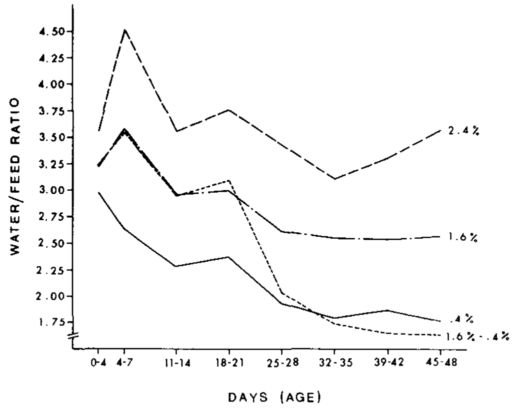

FIG. 7. Water/feed ratios by treatment and age (Trial 3).

were significantly ($P \leq .05$) superior to those of birds receiving the .4% salt treatment from 0 to 4 days. Thereafter, differences between treatments were similar except the 2.4% treatment birds had significantly ($P \leq .05$) lower feed efficiencies during Weeks 3 and 6 (Table 5). Males had significantly ($P \leq .05$) higher feed efficiency ratios than females for Weeks 1, 4, and 5 and numerically superior efficiencies for the remaining periods.

Abdominal fat weights across treatments were also higher in Line 2 than in Line 1 birds; however, this difference was not significant. A treatment by line interaction was evident from the decrease in abdominal fat of 1.6% treatment birds (Line 1) and the small increase in Line 2 birds. Abdominal fat weights were significantly ($P \leq .05$) reduced (17 to 28%) in

TABLE 5. *Mean feed efficiency (gain/feed), lines combined, by treatment and age (Trial 3)*

Age (days)	Salt			
	.4%	1.6%	1.6%[1]	2.4%
0-4	$.90^b \pm .03$	$1.05^a \pm .04$	$1.00^a \pm .04$	$1.13^a \pm .06$
4-7	$.70^a \pm .02$	$.72^a \pm .05$	$.75^a \pm .03$	$.81^a \pm .03$
7-11	$.75^a \pm .01$	$.69^a \pm .05$	$.71^a \pm .01$	$.72^a \pm .01$
11-14	$.71^a \pm .02$	$.73^a \pm .05$	$.70^a \pm .02$	$.70^a \pm .01$
14-21	$.65^a \pm .01$	$.63^a \pm .01$	$.64^a \pm .01$	$.65^a \pm .01$
21-28	$.58^a \pm .01$	$.58^a \pm .01$	$.58^a \pm .01$	$.54^b \pm .01$
28-35	$.50^a \pm .02$	$.51^a \pm .01$	$.51^a \pm .02$	$.56^a \pm .02$
35-42	$.42^a \pm .01$	$.41^a \pm .01$	$.41^a \pm .01$	$.38^b \pm .01$

[a,b]Means within a row with different superscripts are significantly different ($P \leq .05$).

[1] 1.6% from 0 to 21 days; .8% from 21 to 28 days, and .4% from 28 to 48 days (1.6 to .4%).

TABLE 6. *Abdominal fat weight and percent fat by treatment, sex, and line (Trial 3)*

		Salt					% Deviation from control		
Line	Sex	.4%	1.6%	1.6%[1]	2.4%	X̄	1.6%	1.6 −.4%	2.4%
				Fat weights					
1	Combined	35.3[a]	28.9[b]	36.5[a]	29.3[b]	32.5	−18	+ 3	−17
2	Combined	36.6[a]	38.5[a]	40.9[a]	26.5[b]	35.6	+ 5	+12	−28
				Percent abdominal fat					
Combined	Male	1.60[b]	1.53[b]	1.90[a]	1.26[c]	1.57	− 4	+19	−21
Combined	Female	2.03[a]	1.90[a]	2.05[a]	1.65[b]	1.91	− 6	+ 1	−19
				Percent carcass lipid					
2	Male	11.1[ab]	...	11.9[a]	10.4[b]				

[a,b,c]Means within a row with different superscripts are significantly different ($P \leq .05$).

[1] 1.6% from 0 to 21 days; .8% from 21 to 28 days, and .4% from 28 to 48 days (1.6 - .4%).

both lines receiving the 2.4% treatment (Table 6). Although abdominal fat on an absolute weight basis was similar for males and females, difference in body weight between sexes resulted in significant sex difference in percent abdominal fat. Treatment 1.6 to .4% birds, which initially received a high salt diet and subsequently the normal diet at 28 days, had a higher percent abdominal fat than other treatment groups (Table 6), which may have been related to the low water/feed ratios of these birds from 35 to 49 days of age (Fig. 7). There was evidence of a slight reduction in percent abdominal fat (4 to 6%) for birds receiving the 1.6% salt diet treatment and a larger reduction (19 to 21%) for birds receiving the 2.4% salt diet. Total carcass lipid of Line 2 males followed the same pattern as abdominal fat (Table 6). Birds receiving the 2.4% salt diet had significantly ($P \leq .05$) less carcass lipid than did birds receiving the .4% salt control diet. These differences in abdominal and carcass fat may be related to differences in the water/feed ratios (Fig. 7), low water/feed ratio being associated with increased abdominal fat.

The results of this study indicate that water/feed intake ratios can be increased by either feed restriction or by adding high levels of salt to the diet. The addition of salt offers the advantage of high water/feed ratios without a reduction in feed intake. Water/feed intake ratios returned to control levels following removal from feed restriction programs and removal of the salt stimulus, suggesting an inability to behaviorally modify these ratios. Diets high in salt resulted in increased early body weights and lower abdominal fat at market weights. Additional resrarch is warranted to investigate other methods of increasing water intake that might lead to higher retention levels.

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