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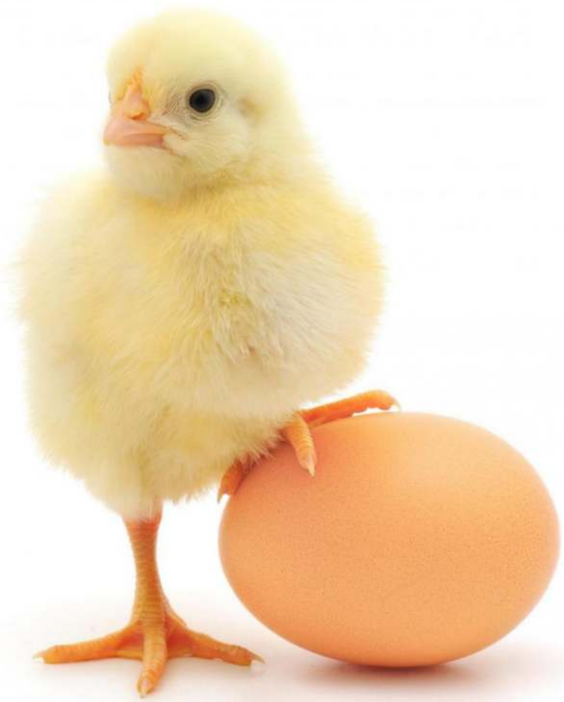

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Effects of Different Feed Withdrawals on Performance and Fecal Contamination of Carcass in Broiler Chickens

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Abstract: The objective of this study was to investigate the effects of different feed withdrawal durations on some performance parameters in broilers and fecal contamination of carcass. A total of 150 day-old broiler chicks were randomly allocated to five groups of 30 in each had been consisted of the material. It was determined that feed withdrawal had significant effects on body weight at the 37^{th} day ($P<0.01$). As a part of digestive system, gizzard weight (with ingesta) has exhibited a statistically significant decrease (4.5 %) from 0 to 14 hours following the feed withdrawal ($P<0.001$). It was observed that for zero and eight hours feed withdrawal, the mean numbers of coliform bacteria recovered from carcass were found as 5.28 $\log_{10}$ cfu/ml and 4.86 $\log_{10}$ cfu/ml, while 7.86 $\log_{10}$ cfu/ml and 7.35 $\log_{10}$ cfu/ml for caecum, respectively ($P<0.001$).

Key words: Broiler chicken, feed withdrawal, performance, fecal contamination

Introduction

Feed withdrawal which defines removal of feed and water from broilers before pre-slaughter procedures is a standard management practice that has been used by poultry enterprises for more than 50 years. It refers to the total length of time the broiler is without feed before processing. This includes the time the chickens are in the hen without feed, as well as the time the chickens are in transit and in the live hold area at the processing plant.

Improper feed withdrawal program prior to pre-slaughter period, resulting in feed residues in the digestive system at the time of processing is the greatest contributor of fecal contamination that is a leading cause of bacterial contamination at the processing plants (Bartov, 1998). Northcutt *et al.* (1997) reported that under normal rearing conditions and access to water 80 to 85 % of the ingesta within the broiler's digestive tract will be evacuated during the first six hours of feed withdrawal.

Ideal feed withdrawal program should be individually designed for each enterprise that produces a digestive system that has an empty crop, a small gizzard, flattened intestines which cause a concave body cavity so that it's easier to eviscerate. Because, numerous factors such as level of stress, time of feeding, quantity of feed consumed and lighting program have important effects on emptying the digestive tract of a chicken (Northcutt *et al.*, 1997). Northcutt *et al.* (1997) reported that lighting program, frequency of feeding, temperature (high temperature increases feed consumption during cooler times of day) and chicken intensity in the hen should be taken into account when determining an optimum feed withdrawal duration. It has been well known that feed movement through the digestive system slows down when the chickens are exposed to the stress. For that reason, optimum feed withdrawal duration should be determined for broilers before crating. Bartov (1998) reported that feed is usually take 2 to 3 hours to passage through the digestive system of a chicken. Feed clears the crop and proventriculus in about four to five hours following feed withdrawal, if water is available. If water is not available, it takes about two or three more hours. If feed is taken off than five hours and water is available, many chickens will begin to drink water and eat litter. After 8-10 hours from the feed withdrawal, digestive system becomes flattened and peristalsis stops. This alteration is generally affected by temperature (Benyi and Habi, 1998). Following 12 hours from the feed withdrawal, intestinal strength starts to decrease. In addition, processing at this stage results in heavy dehydration, enlarged gall bladder, shrunken livers, retain excess fluid from chilling and significant economical losses (Northcutt *et al.*, 1997).

Total coliform bacteria which is an indicator of fecal contamination of carcass that normally can be seen in intestinal flora of both human and animals. But in recent years this bacteria has been accepted as a main responsible for many endemic because of its pathogenic potential (Hartemink and Rombouts, 1999; Allen *et al.*, 2003).

The first objective of present study was to find out the effects of different feed withdrawal durations on slaughter weight, the yield of carcass (%), edible organ weights (hearth, liver and gizzard) and abdominal fat weights. The second was to investigate the effects of different feed withdrawal durations on total coliform bacteria counts and to determine the level of fecal contamination of carcasses.

Materials and Methods

A total of 150, day-old commercial broiler chicks (Ross 308) were obtained from a local hatchery. On day 1, the

Table 1: Some performance parameters by groups

Parameter		Group I Mean±SEM n= 29	Group II Mean±SEM n= 28	Group III Mean±SEM n= 30	Group IV Mean±SEM n= 29	Group V Mean±SEM n= 28	P
BW (g)	Day 1	41.2±1.0	40.8±0.9	41.5±0.9	40.2±0.7	41.0±1.1	-
	Day 37	$2156.8{\pm}85.5^a$	$2139.8{\pm}65.2^a$	$2020.1{\pm}95.4^b$	$1981.7{\pm}81.6^b$	$1872.4{\pm}69.3^c$	**
	Decrease[1] (%)	-	0.8	6.8	8.8	15.2	
Total FI (g) (1-37 days)		3593	3615	3389	3243	3052	
FCR		1.67	1.69	1.68	1.64	1.63	
Mortality (%)		3.3	6.7	0.0	3.3	6.7	-

-: non significant, **: P<0.01, abc: Within lines means with the same superscript are statistically significant.

[1]Defines the decrease in body weights in groups referring to Group I. BW : Body Weight. FI: Feed Intake. FCR: Feed Conversion Ratio

chicks were individually weighted; wing-tagged and housed in groups of 30 in 5 rooms with deep litter of wood shavings. Ambient temperature was maintained between 22 and 24°C and a constant photo-period of 24 h was provided. The feed supply was changed from starter (3060 kcal ME/kg; 23% crude protein) to finisher pellet (3200 kcal ME/kg; 22 % crude protein) at 14 days of age.

Before slaughter day different feed withdrawal durations were applied to animals. Feed withdrawal regimen applied as follows: Zero hours (Group I), 4 hours (Group II), 8 hours (Group III), 12 hours (Group IV) and 14 hours (Group V). All the chickens were individually weighted and slaughtered on day 37. Animals were tried to expose to the same conditions in both slaughter and the other processing stages. After the defeathering process all the carcasses were opened carefully and edible organs were taken to the plastic bags for weighing. Then, carcasses washed twice and left for dry. Following the 30 min drying period carcasses were weighted for the calculation of carcass yield. Abdominal fat pads were removed from carcasses that had been kept in 4°C for 24 hours with hands and weighted with a balance sensitive to 0.01 g. Total feed intake during trial was recorded and feed conversion ratio (FCR) was determined. Mortality was also recorded daily.

For microbiological analyses caecal ingesta that had been taken to the sterile tubes was diluted by 1000^{-1} with peptone water (PW) and then mixed by vortex to determine the number of coliform microorganisms. Serial dilutions were prepared from 10^{-1} to 10^{-6} (Bilgehan, 1995). The total viable bacterial count was determined on selective *E. coli* / Coliform Chromogenic Medium (Oxoid CM1046). The microorganisms were streaked by using a surface plating technique (Hartemink and Rombouts, 1999).

Carcasses were placed in a sterile stomacher bags to determine the level of fecal contamination. Then 225 ml PW was added to these stomacher bags and exposed to friction for 1-2 min (Rinse method). Following this process the carcasses were removed from the bags and serial dilutions were prepared from 10^{-1} to 10^{-3}.

The plates were incubated at 37°C under aerobic conditions for 24 hours. Following the incubation the microorganisms that had been grown were evaluated for morphological chacteristics (Pink colonies were defined as coliform microorganisms) (Anonymous, 2000). The numbers of microorganisms recovered were expressed as $\log_{10}$ colony forming unit (cfu) /ml.

The data for total coliform bacteria was normalized using logarithmic transformation prior to analyses. Data on mortality were analyzed by Chi-Square test. A one-way analysis of variance was used to test the effects of feed withdrawal durations and Duncan test for determine the differences between groups (Sümbüloglu and Sümbüloglu, 1993; Duncan, 1955).

Results

Effects of feed withdrawal durations on slaughter weight, total feed intake, feed conversion ratio and mortality are presented in Table 1.

Total feed intake during the study in groups were determined as 3593, 3615, 3389, 3243 and 3052 g while body weights at slaughter had been recorded as 2156.8, 2139.8, 2020.1, 1981.7 and 1872.4 g for group I, II, III, IV and V, respectively. Feed conversion ratios for group I, II, III, IV and V were found 1.67, 1.69, 1.68, 1.64 and 1.63, respectively. During the study, there is no death were recorded in the third group, while one (% 3.3), two (% 6.7), one (% 3.3) and two (% 6.7) deaths had been observed in group I, II, IV and V, respectively.

Edible organ weights, slaughter weights, abdominal fat weights and carcass yields in groups were given in Table 2.

There is a slight decrease in liver weight because of elapsed time from the feed withdrawal (0 to 14 hours) but it was determined that feed withdrawal duration had no significant effect on liver weight. Similarly, it was found that hearth weight has not been affected by feed withdrawal regimen. However, it was determined that gizzard weight as a part of digestive tract had decreased as parallel with feed withdrawal duration. Gizzard weight in group I (0 hours), group II (4 hours), group III (8 hours), group IV (12 hours) and group V (14 hours) were recorded as 48.7, 47.8, 46.1, 45.6 and 44.7 g, respectively. The difference in groups for gizzard weight was found statistically significant (P<0.001). On the other hand, it was determined that abdominal fat weight and the yield of carcass had not been affected from different feed withdrawal durations.

Table 2: Edible organ weights, abdominal fat weights and carcass yields by groups

Groups	Edible organ weights (g)			Abdominal fat weight (g)	Carcass yield (%)
	Liver Mean±SEM	Hearth Mean±SEM	Gizzard[1] Mean±SEM		
1 (n= 29)	40.7±0.7	11.0±0.2	48.7±1.2[a]	36.1±1.1	73.5±0.4
2 (n= 28)	40.2±0.6	10.6±0.3	47.8±0.8[ab]	35.6±2.0	74.6±1.2
3 (n= 30)	39.0±0.8	11.6±0.4	46.1±1.1[abc]	38.1±1.4	76.7±0.5
4 (n= 29)	39.1±1.2	11.1±0.3	45.6±0.5[bc]	32.6±1.6	76.0±0.4
5 (n= 28)	39.3±0.9	11.4±0.5	44.7±0.9[c]	33.7±1.9	77.0±0.4
General	39.9±0.5	11.2±0.1	46.6±0.4	35.2±1.0	76.3±0.3
P	-	-	***	-	-

[1]Gizzards were weighted without emptied. ***: P<0.001. abc: Within columns means with the same superscript are statistically significant.

Table 3: The mean numbers of coliform bacteria recovered from carcasses and caecum ingesta ($\log_{10}$ cfu/ml)

Groups	Carcass Mean±SEM	Caecum Mean±SEM
0 hour (n= 29)	5.28±0.04[a]	7.86±0.09[b]
4 hours (n= 28)	5.07±0.03[b]	7.56±0.15[c]
8 hours (n= 30)	4.86±0.04[c]	7.35±0.07[c]
12 hours (n= 29)	5.26±0.06[a]	8.08±0.04[b]
14 hours (n= 28)	5.37±0.08[a]	8.60±0.05[a]
General	5.21±0.03	7.89±0.07
P	***	***

***: P<0.001. abc: Within columns means with the same superscript are statistically significant.

The mean numbers of microorganisms recovered from carcass surface and caecum ingesta were shown in Table 3.

It can be seen from Table 3 that feed withdrawal duration had significant effects on total coliform bacteria recovered from both carcass and caecal ingesta (P<0.001). The mean numbers of coliform bacteria recovered from carcass surface was found as 5.28, 5.07, 4.86, 5.26 and 5.37 $\log_{10}$ cfu/ml for 0, 4, 8, 12 and 14 hours following the feed withdrawal, respectively. It was determined that coliform bacteria has a decreasing trend to 8 hours from the removing of the feed but started to increasing after 8 hours. Similarly, caecal coliform bacteria counts were found as follows; 7.86, 7.56, 7.35, 8.08 and 8.60 $\log_{10}$ cfu/ml for 0, 4, 8, 12 and 14 hours following the feed withdrawal, respectively. The lowest caecal coliform bacteria count was recorded in group III (8 hours).

Discussion

It was determined that feed withdrawal durations had significant effect on slaughter weight (37th days) of broilers (P<0.01). This study revealed that long feed withdrawal durations (14 hours) have lead 15.2 % decrease at body weight. Sarica *et al.* (1995) reported that feed withdrawal program had negative significant effect on body weight. Authors claimed that broilers that had been exposed to 12 hours feed withdrawal have shown 10.2 % less body weight than control (0 hour) group. Mielnik and Kolstad (1991) reported that broilers that had been subjected to 6 and 12 hours feed withdrawal have 3.2 % and 5.0 % less body weight than controls. Nortcutt *et al.* (1997) also reported that the reduction in carcase weight was consistently significant related to the feed withdrawal duration and optimal feed withdrawal duration for broilers was 8-12 hours.

Despite the significant reduction at body weights feed withdrawal regimen did not reduce carcass yield. The data of the present study demonstrated that feed withdrawal for 12 hours resulted in an slight increase (3.3 %) in the carcass yield of the bird in agreement with Sarica *et al.* (1995) (4.7 %) and Bartov (1998) (5.2 %). It was thought that feed withdrawal, which resulted in a decrease in the weight at slaughter (because of the emptying the digestive tract) consistently increased carcase yield. Results of this study were revealed that different feed withdrawal durations have no significant effect on mortality which was in agreement with the results of Demir *et al.* (2004).

The data of this study indicated that feed withdrawal duration has no significant effect on the various variables of carcass quality such as liver and heart weight. Sarica *et al.* (1995) reported that feed withdrawal has no significant effect on gizzard weight while has reduction in liver (23.97 %) and heart (16.93 %) weights between 0-12 hours after feed withdrawal (P<0.01). Petek (2000) reported that mean liver, hearth and gizzard weights for normal rearing conditions in broilers were 50.41, 11.15 and 21.71 g, respectively. It was determined that abdominal fat weight was varied between 32.6 and 38.1 g in feed withdrawal for 8 hours and 0 hours, respectively. Demir *et al.* (2004) reported that abdominal fat weights for 8 and 16 hours feed withdrawal were 25.7 and 25.1 g, respectively.

Total coliform bacteria load on carcasses was found as 5.21 $\log_{10}$ cfu/ml in the present study. Based on bacteria counts, feed withdrawal duration the lowest number of bacteria was isolated from 8 hours feed withdrawal duration. Windham *et al.* (2005) reported that coliform bacteria numbers rinsed from carcasses were 5.3 $\log_{10}$ cfu/ml for broilers. Authors also claimed that bacterial numbers on whole carcasses due to fecal contamination were not different. Therefore, the presence of visible ingesta on carcasses does not influence microbial counts. On the other hand, mean coliform load for caecal ingesta was found as 7.89 log_{10} cfu/ml in this study. As in the bacterial load of the carcasses, it was determined that caecal bacteria load was diminishing to 8 hours after the feed removal but started to increase from 12 hours. Wiliczhiewich (2006) reported that total coliform bacteria load in caecum was found as 6.36 log_{10} cfu/ml. It was thought that the difference between two studies could be originated from the feeding material and genotypes used for rearing.

It may be concluded from the results of this study that where feed withdrawal was exposed to the broiler chickens, feed withdrawal for 8 hours was preferable to 0, 4, 12 and 14 hours because feed withdrawal for 8 hours could be resulted in optimum body weight, carcass and edible organ yield with the lowest fecal contamination risk.

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