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The Effects of Feed Removal During the Day on Some Production Traits and Blood Parameters of Broilers

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Abstract : This experiment was conducted to investigate the effects of feed removal during the day on broiler performance and some blood parameters. Live material of the experiment consisted of 600 mixed sex day-old commercial (Avian Farm) broiler chicks. The experiment was held in six rooms with a randomly allocated control group and two treatment groups and their replicates. The birds were full fed ad libitum in the control group while the feeders were removed for three and six hours per day for the treatment I and treatment II groups respectively between the 5th and 37th days.

Average live weights of the control, treatment I and treatment II groups at 40 days of age were 1992.5, 1918.0 and 1940.0 g, respectively. The differences between the control group and the two others were statistically significant ($P < 0.05$). Feed conversion ratios were 2.03, 2.08 and 2.00 for the groups, respectively. For the same groups, the average figures for the carcass weight as a percentage of live weight were calculated to be 68.68, 67.88 and 69.15%, respectively. For the groups haematocrit values (%) were 28.57, 29.14 and 30.50, haemoglobin values (g/100 ml) were 5.58, 5.88 and 6.78, and red blood cell numbers (cell/mm³) were 2.27×10^6 , 2.49×10^6 and 2.35×10^6 , respectively.

Key Words: Broiler, performance, feed removal, blood parameters

Gün Esnasında Yemsiz Bırakmanın Broilerlerin Bazı Verim Özellikleri ve Kan Parametreleri Üzerine Etkileri

Özet : Bu çalışma gün esnasında yemsiz bırakmanın broilerlerin bazı verim özellikleri ve kan parametreleri üzerine olan etkilerini araştırmak amacı ile yapılmıştır. Araştırmanın canlı materyali karışık cinsiyette 600 adet ticari broiler civcivden (Avian Farm) oluşmuştur. Araştırma, kontrol ve iki deneme grubunun iki tekrarlı olarak altı odada rastgele yerleştirilmesi şeklinde düzenlenmiştir. Kontrol grubunda yer alan hayvanlar devamlı ad libitum olarak yemlenirken, birinci ve ikinci deneme gruplarında yer alan hayvanların yemlikleri 5 ve 37. günler arası günde sırası ile 3 ve 6 saat süre ile kaldırılarak yem verilmemiştir.

Kesim öncesi ortalama canlı ağırlıklar (40. gün) kontrol, birinci ve ikinci deneme grupları için sırasıyla; 1992.5, 1918.0 ve 1940.0 g olarak tespit edilmiştir. Bu özellik için kontrol ve diğerleri arasında belirlenen farklılıklar istatistiki olarak önemli bulunmuştur. ($P < 0.05$). Gruplarda yemden yararlanma oranları sırasıyla; 2.03, 2.08 ve 2.00 olarak tespit edilmiş, canlı ağırlığın yüzdesi olarak karkas ağırlığı değerleri sırasıyla; % 68.68, 67.88 ve 69.15 hesaplanmıştır. Gruplarda hematokrit değerleri sırası ile % 28.57, 29.14 ve 30.50, hemoglobin değerleri sırasıyla; 5.58, 5.88 ve 6.78 g/100 ml, eritrosit değerleri sırasıyla; 2.27×10^6 , 2.49×10^6 ve 2.35×10^6 olarak bulunmuştur.

Anahtar Sözcükler: Broiler, verim, yemsiz bırakma, kan parametreleri

Introduction

Broilers are generally full-fed from start to market and are encouraged to eat as much as possible, since more feed consumption means faster growth and better feed conversion. For rapid growth and high feed conversion scientists have performed countless studies to develop new management practices that would produce rapid and economical gains. However, superior management

practices are an important trigger of some metabolic disorders. Fast-growing birds were found to be more susceptible to the metabolic disorder ascites than slower growing birds and there is evidence that the leg abnormalities are more prevalent in high performance flocks (1-3). At the same time red blood cell counts, haematocrit and haemoglobin concentrations are also known to increase in ascites prevailing flocks (1,4). Several management practices are developed to reduce losses from

skeletal and circulatory problems without any reduction in broiler performance. One of these practices is to reduce the early growth rate of broilers to minimise susceptibility to certain metabolic and skeletal disorders. Early feed restriction or feed removal with compensatory growth is frequently used to decrease the incidence of leg problems and ascites (5,6). Earlier studies (7-9) have shown that broiler chickens subjected to early feed restriction utilised their feed more efficiently and accumulated less abdominal fat compared to broilers fed *ad libitum*. A number of variations on this theme have been evaluated, ranging from the removal of feed for up to 8 hours a day, allowing birds to feed only once/hour and feeding once every other day (10-12).

McGovern et al. (13) found that 40-day body weight was significantly greater in the *ad libitum* birds than in the feed-restriction birds. Saleh et al. (14) reported that final body weight did not differ among those restricted to 20 or 40% and those fully fed, and the abdominal fat percentage decreased with increasing feed restriction. Zhong et al. (15) reported that no differences in mean body weights were observed between the full feed and restricted males and combined-sex broilers and the feed conversion and abdominal fat levels of female and combined-sex were lower for the restricted than the full-fed broilers. In another study, it has been demonstrated that the incidence of ascites can be significantly reduced through feed restriction and that the restriction programs practised also have a detrimental effect on growth characteristics (16). Vo et al. (17) reported that feed restriction to 70% of the full-fed control for 2 weeks significantly reduced weight gain. Zubair and Leeson (18) reported that the feed-restricted broilers apparently require a more prolonged growth period. Palo et al. (19) showed that feed-restricted broilers were lighter in body weight at 48 days of age and the effects of no treatment were abdominal fat pads.

Researchers from the Adas Research Unit in the UK found that the best feed conversion was achieved when eight-hour feed removal per day between day 5 and day 37 was used (12). Payawal (20) reported that feed removal improved feed conversion efficiency and had no effect on carcass composition. Summers et al. (11) could not show an advantage in terms of abdominal fat for broilers with restricted feeding from 7 to 14 days of age when compared with broilers that ate *ad libitum*. Additional work by Plavnik et al. (8) noted that feed restric-

tion from 1 week of age for male broilers would produce essentially the same amount of meat at market age and significantly less abdominal fat. Khontabrab et al. (21) reported that feed withdrawal markedly inhibited deposition of abdominal fat. Fontana et al. (22) found that no significant differences were observed for abdominal fat pad, gizzard weights and liver between early restricted birds and *ad libitum* controls at 49 days of age. Balog et al. (23) found that haematocrit values and the typical haematological indicators of the ascites were decreased with feed restriction programs.

This experiment was designed to determine the effects of feed removal during the day on some production traits of broilers. At the same time this study was planned to investigate to susceptibility of broilers to metabolic disorders by examining some blood parameters.

Materials and Methods

This research was conducted at the Research and Experimental Farm of the Faculty of Veterinary Medicine, in Bursa. Six hundred mixed-sex day-old chicks of Avian Farm genotype were used. The experiment consisted of a control group and 2 treatment groups with two replicate pens of 100 broilers per pen. The groups were as follows: (1) Full-feed controls which were fed *ad libitum* throughout the experiments, (2) Removal of feed for 3 hours (between 9.00AM and 12.00PM) from days 5 to 37, (3) Removal of feed for 6 hours (between 9.00AM and 3.00PM) from days 5 to 37. Broilers in experiment groups 2 and 3 ate full feed from day 1 to day 5 and from day 37 to day 40.

The chicks were randomly assigned to the groups with two replicates and were placed in floor pens, which were covered 7 cm deep with clean wood shavings. A gasbrooder was used as a heat source in each pen throughout the experimental period. All chicks were brooded and reared at 28°C for the 1st week, 27°C for the 2nd week, 24°C for the 3rd week, and 21°C from the 4th week until the end of the experiment. Feed and water were provided in each pen with a hanging waterer and feeder. Broilers were fed with a commercial compound diet from one-day-old until the end of the treatments. The chicks were vaccinated for infectious bronchitis, Newcastle disease and infectious bursal disease on days 4, 7 and 19, respectively. The broilers were weighed week-

ly, and deaths and feed consumption were recorded. Blood samples were collected from the vein of the wing of 5 birds in each pen individually in a heparinized tube at the end of the treatment. Total haemoglobin and haematocrit values were determined by the sahli and microhaematocrit method. Red blood cell count was made in Hayem solution on the Thoma slide (24). At the end of the treatment 5 male and 5 female broilers from each replicate pen were weighed individually and then sacrificed by severing the jugular vein. The weights of the carcass, liver, gizzard, heart and abdominal fat were determined individually. The percentages of carcass, abdominal fat, liver, gizzard and heart for individual broilers were calculated by dividing the weight of carcass, abdominal fat, liver, gizzard and heart by the individual body weight. The observed differences in the groups were statistically evaluated by ANOVA and the Tukey methods (25).

Results

Results about the average body weight of broilers for the three feeding regimes are presented in Table 1. The

full-feed group had significantly heavier average body weights throughout the experiment, and the final body weights of the full-feed control, 3-hour feed removal and 6-hour feed removal groups were found to be 1992.5, 1918.0 and 1940 g, respectively. The differences between the control group and the two others were statistically significant ($P < 0.05$).

The effect of feeding regimes on feed conversion ratio are presented in Table 2. The feed conversion ratios of the groups in the 40 days of age were found to be 2.03, 2.08 and 2.00, respectively.

Means of edible components and carcass weights, expressed as raw weight and percentage of live body weight of broilers in the groups at the end of the experiment are shown in Table 3. Feed removal had no significant effect on percentage of live body weight of carcass, liver, gizzard weight and abdominal fat. The observed differences for percentage of heart in the groups were found to be significant ($P < 0.05$).

Effects of feed removal on some blood parameters are presented in Table 4.

Table 1. Effect of feeding regime on average body weight of broilers (g).

Age (Week)	Feeding Regime		
	Full feed control $\bar{x} \pm S \bar{x}$	3 h feed removal/day $\bar{x} \pm S \bar{x}$	6 h feed removal/day $\bar{x} \pm S \bar{x}$
0-1	119.91 \pm 1.03 ^a	115.77 \pm 1.05 ^b	118.44 \pm 1.17 ^{ab}
0-2	311.98 \pm 2.53 ^a	274.54 \pm 2.82 ^b	248.41 \pm 2.63 ^c
0-3	632.14 \pm 5.18 ^a	579.89 \pm 5.89 ^b	543.44 \pm 4.85 ^c
0-4	1143.0 \pm 8.85 ^a	971.50 \pm 9.90 ^b	906.0 \pm 8.87 ^c
0-5	1738.1 \pm 15.5 ^a	1608.4 \pm 18.0 ^b	1608.0 \pm 14.8 ^b
40 days	1992.5 \pm 16.6 ^a	1918.0 \pm 20.4 ^b	1940.0 \pm 18.4 ^b

* Differences for means with a different figure in the same row were significant ($P < 0.05$).

Table 2. Feed conversion ratios of broilers in the groups throughout the experiment (kg).

Age (Week)	Feeding Regime		
	Full feed control	3 h feed removal/day	6 h feed removal/day
0-1	1.18	1.18	1.14
0-2	1.40	1.47	1.49
0-3	1.63	1.67	1.66
0-4	1.64	1.78	1.74
0-5	1.77	1.89	1.84
0-40 days	2.03	2.08	2.00

Table 3. Effect of feed removal on relative organ weights (g).

Organs	Feeding Regime					
	Full feed control		3 h feed removal/day		6 h feed removal/day	
	$\bar{x} \pm Sx$	%	$\bar{x} \pm Sx$	%	$\bar{x} \pm Sx$	%
Carcass	1368.44±37.1	68.68	1301.93±68.85	67.88	1341.51±67.9	69.15
Liver	50.41±2.96	2.53	51.59±2.63	2.69	52.38±2.51	2.70
Heart	11.15±0.62 ^a	0.56	9.39±0.47 ^b	0.49	11.83±0.52 ^a	0.61
Gizzard	21.71±1.14	1.09	21.09±1.16	1.10	23.66±1.05	1.22
Abdominal Fat	49.20±1.88	2.46	46.79±2.04	2.44	46.36±2.84	2.39

* Differences for means with a different figure in the same row were significant (P<0.05).

Table 4. Some blood parameters in the experimental groups.

Factors	Feeding Regime		
	Full feed control	3 h feed removal/day	6 h feed removal/day
	$\bar{x} \pm Sx$	$\bar{x} \pm Sx$	$\bar{x} \pm Sx$
Haematocrit (%)	28.57±0.81	29.14±1.01	30.50±0.65
Haemoglobin(g/100ml)	5.58±0.17 ^b	5.88±0.18 ^b	6.78±0.22 ^a
Red Blood Cell /mm ³	2.27x10 ⁶ ±0.149	2.49x10 ⁶ ±0.141	2.35x10 ⁶ ±0.176

*Differences for means with a different figure in the same row were significant (P<0.05).

No treatment differences were observed for haematocrit and the number of red blood cells at the end of the treatment. The haemoglobin figures of the groups were significant (P<0.05).

Discussion

In this study, feeding regimes had a significant effect on average body weight of broilers. It was expected, based on previously reported studies (Cooper et al.(16), Vo et al.(17), Zubair and Leeson (18), Palo et al.(19) and McGovern et al.(13)), that the feeding regime would result in a decrease in body weight because of the feed removal. Decreasing the meal length in feed removal groups resulted in poorer body weight. This data was not concurrent with the work of Plavnik et al. (7). Saleh et al. (14) also reported that there were no effects of feed restriction or feed removal on body weight.

The feed removal treatments reduced the feed conversion of the birds compared with the full feed control treatment, but by 40 days the feed removal birds

achieved a better feed conversion efficiency when a six-hour withdrawal was used. The effect of feed removal increasing feed conversion seems to be in agreement with the work of Rosenbrough et al.(6), Plavnik et al.(7), Plavnik et al.(8) and Payawal (20), that showed that restricted feeding or feed removal increased feed conversion. A similar effect was shown by the Adas research unit, Gleastharge (12). Compensatory feed efficiency was observed in feed restricted groups after returning to the full-fed feeding. This data was not concurrent with the work of Zhong et al.(15). The chicks in the treatment group of 6-hour feed removal had better feed conversion rates than the other groups at the end of the experiment.

As was found by Payawal (20) and Saleh et al.(14), it was found that the feed removal during the day had no effect on dressing percentage and the dressing percentage of the most severe removal group was higher than controls. The broilers in the 6 h feed removal group had greater percentages of carcass, liver, heart and gizzard weights than the other groups. The observed differences for the heart were the same as in the findings of McGov-

erns (13) and the lack of differences for the gizzard and liver was consistent with the findings of Fontana et al. (22). As expected, results from this experiment for abdominal fat were higher in full-fed control group than the feed removal groups. These findings are the same as previous studies' findings (7-9,21). No significant differences for abdominal fat were found and these findings were concurrent with the work of Summers et al. (11), Palo et al. (19) and Fontana et al. (22). The full-fed control group had a greater percentage of abdominal fat due to having a greater body weight than the restricted groups.

The haematocrit, haemoglobin and red blood cell levels were lower in the full-fed control group than the 3 h feed removal and 6 h feed removal/day groups. Although differences in haematocrit and red blood cell levels were not significant, there was a trend towards higher concentrations in chicks in the feed removal groups. Findings in this experiment about blood parameters do not support

the previous findings (1,4,23). The reason for this effect is unclear. It is probable that optimal environmental conditions obtained during the experiment may have prevented metabolic disorders. Hence, blood parameters related to ascites were not determined.

Based on this result, using the feed removal resulted in significantly decreased body weight, but the results of feed conversion in the present study were better in the 6 h removal feed group. Although removal of feed in broilers did not enhance broiler performance, this treatment may be a feasible method for broilers under heat stress during the hot hours of the day in the summer without a very significant reduction in performance (26). Regarding ascites and to minimise susceptibility to some metabolic and skeletal disorders, a qualitative feed restriction may be more effective than a quantitative one. Further studies are required to determine the effects of feed removal and other management factors on broiler performance and metabolic disorders.

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