INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2006/08–4–546–549
http://www. fspublishers.org

Effect of Feeding Management on Energy, Protein Intake and Carcass Characteristics of Broilers During Summer

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ABSTRACT

Effect of feeding management (limiting the feed by mechanical removal of feed troughs) and nutritional manipulation (addition of fat in the ration) on energy, protein intake and carcass characteristics of broilers during hot and humid climatic conditions was studied. Three feeding methods i.e. continuous feeding (CF, 24 h feeding), intermittent feeding (IF, 1 h feed & 3 h off) and feed withdrawal (FW, no feed from 9:00 am. to 5:00 pm.) were used for the study. Under each feeding system birds were fed a ration either without supplemented fat or with 3% supplemented fat. The birds maintained on continuous feeding system showed the highest crude protein and metabolizable energy intake followed by those fed under feed withdrawal and intermittent feeding systems. Dressing percentage remained un-affected under different feeding methods. Supplementation of fat in the ration showed significant decrease of crude protein intake. However, no effect was observed on metabolizable energy intake. Intestine length and relative intestine weight of the birds was not affected due to the feeding methods used. Abdominal fat in the birds kept under feed withdrawal system was more than those of continuous fed birds. Whereas, relative weight of the organs studied did not show any difference due to the feeding systems or fat supplementation in the ration. Addition of fat in the ration significantly reduced the intestinal length of the experimental birds.

Key Words: Feeding management; Protein; Carcass characteristics of broiler

INTRODUCTION

Hot environmental conditions adversely affect performance of birds during summer. This may be caused by changed behavior of the birds for their energy, protein requirements. The change in energy, protein intake also affects various productive parameters of the birds. Metabolizable energy (ME) requirements decrease with increasing temperature above 21°C (Daghir, 1995) as a result of reduced requirements of maintenance, because energy requirements during summer are reduced up to 15% than winter. High environmental temperature also adversely affected the immune response and exposure of broilers to high temperature (exceeding 29°C) have shown to increase the abdominal fat (Temim *et al.,* 2000) also found that high ambient temperature increased the abdominal fat proportion in broilers. However, the contradictory effect have been reported by Plavnik and Yahav (1998) who observed that relative abdominal fat pad was significantly lower in chickens kept at 25- 35°C

Use of high energy ration for broilers has become quite common in warm regions. Fuller and Rendon (1977) found that broilers fed a diet in which 33% of the ME was supplied by fat, consumed 10% more both ME and protein contents and also gained more weight than chickens fed low fat ration. Addition of fat to the diet appears to increase the energy value of other feed constituents (Mateos & Sell, 1981). Fat has also been shown to decrease the rate of food passage in the gastrointestinal (GI) tract (Mateos *et al.,* 1982) and thus increase nutrient utilization. Dietary fat therefore, help counteracting the effect of high temperature by improving feed utilization.

Early growth restriction induced by feed restriction have been resulted into a significant decrease in relative heart, liver and breast meat weight at 8 weeks of age in birds (Plavnik and Yahav, 1998). Decrease in liver weight due to extended feed withdrawl periods from male broilers at 0, 6, 12, 18 or 24 h before processing has also been reported by Willis *et al,* (1996). Hence, it could be concluded that method of restriction and duration of restriction are the basic factors responsible for abdominal fat content of broilers.

This study was conducted to find out the effect of different methods of feed restriction and addition of fat on the birds performance during summer.

MATERIALS AND METHODS

Three feeding methods i.e. continuous feeding (CF, 24 h feeding), intermittent feeding (IF, 1 h feed & 3 h off feed) and feed withdrawal (FW, no feed from 9:00 am to 5:00 pm) were used for the study. Under each feeding system birds were fed a ration either without supplemented fat (0%) or the ration with three % supplemented fat (3%). Three replicate having ten birds each were allotted to each treatment. Each experimental unit was reared in a thoroughly cleaned and disinfected pen measuring 3′ × 4′.

The birds were kept under the same managemental conditions like floor space, light, temperature, ventilation and relative humidity. Fresh and clean water was provided *ad libitum* throughout the experimental period.

Weekly record of feed consumption was kept for each experimental unit during the experiment. Further energy and protein contents were determined by chemical analysis of feed samples and multiplying it's per kg factor with total intake. At the end of the experiment, two birds from each replicate were slaughtered randomly and excised for their abdominal fat, organ weights (liver, gizzard, heart, lungs, kidney, intestine) and intestinal length. The gizzard and intestine of the slaughtered birds were emptied, whereas the rest of the organs were defatted before weighing and the information recorded was used to calculate relative organ weight. The data thus collected were analyzed by analysis of variance technique using Completely Randomized Design with 3 × 2 factorial arrangement of treatments (Steel *et al.*, 1997). The differences in means of the treatments were compared by Duncan's Multiple Range test (Duncan, 1955).

RESULTS AND DISCUSSION

Temperature and relative humidity. Environmental temperature and relative humidity both remained high during the experimental period. Average temperature during the experimental period ranged between 28.8 to 34.99°C and the relative humidity ranged from 62.32 to 82.54%. High temperature (35°C) and cyclic temperature (25 - 35°C) has also been reported to have adverse effect on broiler performance (Acar *et al.,* 1995; Plavnik & Yahav, 1998). It can therefore, be envisaged that the temperature and relative humidity during the experimental period was high enough to alter the performance of the broilers.

Crude protein and metabolizable energy intake. Mean values of crude protein and metabolizable energy intake of the birds under various feeding management practices are shown in Table I. Statistical analysis of the data revealed a significant effect of ($P < 0.01$) feeding methods on crude protein and metablizable energy intake. The birds maintained under feed restriction systems (intermittent feeding & feed withdrawal) exhibited reduced intake of crude protein and metabolizable energy than those fed *ad libitum* probably due to reduced feed intake of the birds kept under these systems. Protein and energy intake of birds fed intermittently was lower than those kept under feed withdrawl system. Therefore, it may be concluded that system of feed restriction may alter the intake of crude protein and metabolizable energy depending upon duration of feed restriction.

Supplementation of fat in the ration showed significant decrease of crude protein intake, but the results in case of metabolizable energy intake remained un-affected, indicating that protein intake was dependent upon energy contents of the diet (Daghir, 1995). Fat supplementation also reduced the protein percentage in the ration to some extent and on the other hand the birds mostly ate for their energy requirements. Therefore, when energy contents of diet were increased due to addition of fat, it limited the protein intake (McNaughton & Reece, 1984). This indicated that, while using different feeding practices espically addition of fat in the ration or feed restriction, both methods lead towards reduced protein intake and if a reduced growth rate is required both methods may be used.

Carcass characteristics. Feeding management methods did not exhibit any effect on dressing percentage of birds (Table I). The results of the present study are compatible with those reported by Mizubuti *et al.* (2000), who observed non-significant effect of feed restriction on the carcass characteristics of broilers. Intestine length and relative intestine weight of the birds were not affected due

Table I. Crude protein (g/bird), metabolizable energy (Kcal/bird) intake and dressing percentage of broilers kept under different feeding management practices

Feeding Method	Crude Protein Intake	Metabolizable Energy Intake	Dressing %age
CF	609.91 ± 15.50 ^{A}	8614.3 ± 99.95 ^{A}	67.75±0.36
IF	545.77 ± 17.55 ^{C}	7701.6 ± 99.64 ^{C}	67.11±0.15
FW	577.41 ± 11.88 ^{B}	8158.8 ± 75.28 ^{B}	67.75±0.79
Fat Supplement			
0%	1.18±0.064	3.00 ± 0.120	67.86 ± 0.44
3%	1.32±0.086	3.29 ± 0.149	67.21 ± 0.35
Interaction			
CF x 0%	641.20 ± 9.58	8549.3 ± 127.8	68.33 ± 0.28
CF x 3%	578.62 ± 11.43	8679.3 ± 171.46	67.17 ± 0.47
IF x 0%	581.92 ± 11.27	7758.9 ± 150.20	67.16 ± 0.31
IF x 3%	509.62 ± 10.29	7644.3 ± 154.28	67.06 ± 0.07
FW x 0%	602.81 ± 1.78	8037.4 ± 23.75	68.11 ± 1.33
FW x 3%	552.01 ± 7.61	8280.2 ± 114.23	67.39 ± 1.10

CF = Continuous feed; IF = Intermittent feed; FW = Feed withdraw; 3% = Fat supplementation; 0% = Ration without fat supplementation; Means sharing similar letters in a column are statistically non-significant. Capital alphabets (A, B) are used for feeding methods.

Table II. Relative abdominal fat (g), relative intestine weight (g) and intestine length (feet) of broilers kept under different feeding management practices

Feeding Method	Abdominal Fat Pad (RBW)	Intestine Weight (RBW)	Intestine Length
CF	1.11±0.147^{B}	3.28 ± 0.099	7.74±0.141
IF	1.23±0.095^{AB}	2.90 ± 0.118	7.48±0.210
FW	1.41±0.096^{A}	3.27 ± 0.240	7.52±0.242
Fat Supplement			
0%	1.18±0.064	3.00 ± 0.120	7.88±0.135^{X}
3%	1.32±0.086	3.29 ± 0.149	7.28±0.119^{Y}
Interaction			
CF x 0%	1.19±0.070	3.18 ± 0.049	7.95 ± 0.176
CF x 3%	1.04±0.083	3.38 ± 0.191	7.53 ± 0.159
IF x 0%	1.05±0.078	2.79 ± 0.189	7.87 ± 0.252
IF x 3%	1.40±0.093	3.01 ± 0.147	7.10 ± 0.100
FW x 0%	1.29±0.156	3.04 ± 0.310	7.82 ± 0.344
FW x 3%	1.52±0.090	3.50 ± 0.378	7.22 ± 0.290

CF = Continuous feed; IF = Intermittent feed; FW = Feed withdraw; 3% = Fat supplementation; 0% = Ration without fat supplementation; RBW = Relative Body Weight; Means sharing similar letters in a column are statistically non-significant. Capital alphabets (A, B) are used for feeding methods and (X, Y) for Fat supplementation.

to the feeding methods used (Table II). This indicated that feed restriction methods did not influence these characteristics of the broilers when compared with those fed *ad libitum* during summer. The results of the present study are compatible with those reported by Mizubuti *et al.* (2000), who observed non-significant effect of feed restriction on the carcass characteristics of broilers.

Abdominal fat calculated on the basis of relative body weight was markedly affected (P < 0.05) in the birds kept under feed withdrawal system (Table II). These birds showed higher value of abdominal fat than those fed continuously. More fat deposition in the birds kept under feed restricted system (feed withdrawal) may probably be due to less energy requirements of the birds for the process of thermoregulation where more energy remained spared and was utilized for the synthesis of fat. Whereas, birds kept under intermittent feeding system did not show any difference in this regard when compared to the birds kept under continuous feeding or feed withdrawal system. The results of the present study are partially in line with the findings of Sheila *et al.* (1993) and Deaton (1995), who reported a non-significant effect of feed restriction of the birds on the abdominal fat as compared to those fed *ad libitum*. Whereas, Zhong *et al.* (1995), Santoso (1995) and Gonzalez *et al.* (2000) reported a significant decrease in the abdominal fat due to feed restriction. Probable explanation of this contradiction in case of feed withdrawal system may be the difference in the intensity of feed restriction used in these studies as well as the environmental conditions under which the trials were conducted.

Supplementation of fat in the ration of broilers did not influence abdominal fat deposition than those fed without fat supplementation. The results of present study are in accordance with the findings of Oliveira *et al.* (2000), who observed that dietary ME levels (3000, 3075, 3150, 3225 & 3300 kcal ME/kg diet) did not affect abdominal fat of broilers. Contradictory to the findings of present study Yalcin *et al.* (1998) and Sanz *et al.* (2000) reported a significant increase in the abdominal fat due to increase in the energy level of diet or increasing the duration of feeding high energy ration. The difference in the results of present study with regards to fat deposition may be due to the levels of fat or energy used in the rations as well as feeding methods applied in these studies.

The relative weight and length of the elementary tract did not show any difference due to the feeding systems used. Similarly the relative weight of elementary tract of the birds fed fat supplemented ration compared with those fed ration without fat supplementation remained un-affected. The results of the study are in partial agreement to the findings of Oliveira *et al.* (2000), who did not observe any effect due to dietary metabolizeable energy level on absolute and relative weight of intestine. However, length of elementary tract was significantly (P < 0.01) reduced in the experimental birds fed fat supplemented ration. This may be an adjustment of body as a result of addition of fat in ration, which may have reduced the rate of food passage in the elementary tract (Mateos *et al.,* 1982). Therefore, birds fed without fat supplemented ration extended their elementary tracts to enhance passage time in order to increase the feed uptake from the gut.

Neither feeding methods nor fat supplementation in the ration showed any influence on the relative weight of liver, gizzard, heart, lungs and kidney of the broilers (Table III). Whereas, Willis *et al.* (1996) reported that liver weights (g) were reduced significantly with the extended feed withdrawal periods. Similarly Plavnik and Yahav (1998) found that relative heart, liver and breast meat weights at 8 weeks of age were decreased significantly in the early growth restricted chicks. These contradictory results indicated that in present study, feed restriction did not affect the body organs negatively hence such feeding practices may safely be practiced during summer. The results in case of addition of fat are in line with the findings of Oliveira *et al.* (2000), who observed no effect of dietary energy on the organ weight of broilers. Contradictory to the results of present study, Latour *et al.* (1994) reported that liver weight was suppressed by the inclusion of lard in the diet. Probable

Table III. Relative weight of liver (g), gizzard (g), heart (g), lungs (g) and kidney (g) of broilers kept under different feeding management practices

Feeding Method	Liver (RBW)	Gizzard (RBW)	Heart (RBW)	Lungs (RBW)	Kidney (RBW)
CF	2.40 ± 0.092	1.39 ± 0.060	0.433 ± 0.021	0.576 ± 0.049	0.769 ± 0.016
IF	2.05 ± 0.134	1.20 ± 0.061	0.411 ± 0.015	0.622 ± 0.025	0.757 ± 0.029
FW	2.19 ± 0.087	1.27 ± 0.051	0.427 ± 0.013	0.607 ± 0.022	0..85 ±0.060
Fat Supplement					
0%	2.22 ± 0.121	1.28 ± 0.058	0.420 ± 0.012	0.594 ± 0.019	0.790± 0.040
3%	2.21 ± 0.069	1.29 ± 0.048	0.427 ± 0.014	0.609 ± 0.034	0.779 ± 0.032
Interaction					
CF x 0%	2.51 ± 0.139	1.44 ± 0.087	0.422 ± 0.035	0.548 ± 0.033	0.769 ± 0.022
CF x 3%	2.30 ± 0.114	1.34 ± 0.089	0.443 ± 0.028	0.603 ± 0.101	0.769 ± 0.027
IF x 0%	2.00 ± 0.276	1.20 ± 0.093	0.434 ± 0.015	0.612 ± 0.022	0.793 ± 0.037
IF x 3%	2.10 ± 0.104	1.20 ± 0.099	0.388 ± 0.018	0.632 ± 0.051	0.721 ± 0.038
FW x 0%	2.15 ± 0.116	1.21 ± 0.074	0.405 ± 0.013	0.623 ± 0.037	0.788 ± 0.044
FW x 3%	2.23 ± 0.151	1.33 ± 0.062	0.448 ± 0.012	0.592 ± 0.028	0.849 ± 0.076

CF = Continuous feed; IF = Intermittent feed FW = Feed withdraw; 3% = Fat supplementation; 0% = Ration without fat supplementation ; RBW = Relative Body Weight explanation of the difference in the results of the study may be the type of fat or level of fat used in the experiment.

CONCLUSION

Based on the findings of this study, it is concluded that feeding systems and fat supplementation may be a useful tool to control body weight of broilers by altering energy protein intake in order to avoid heat stress.

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(Received 16 November 2005; Accepted 12 May 2006)