EFFECTS OF DIFFERENT FEED RESTRICTION REGIMES ON PERFORMANCE AND ASCITES DEVELOPMENT IN BROILER CHICKENS

HOSSEIN MOHEBODINI

Department of Animal Sciences, University of Mohaghegh Ardabili, Ardabil, Iran.
E-mail: mohebodini@yahoo.com

Abstract- The present study was conducted to evaluate the effects of early feed restriction or meal feeding on performance and ascites (pulmonary hypertension syndrome) parameters in male broiler chickens. One-day-old broilers were fed a commercial corn-soybean meal based diet meeting NRC (1994) requirement. The treatments were ad libitum (AL), Feed restriction (provide daily maintenance energy requirement) from 7 to 14d, Feed restriction (support 50% of the normal growth rate) from 7 to 14 d, Meal feeding from 7 to 14 d and Meal feeding from 7 to21d. Body weight, feed intake, and feed conversion ratio were measured weekly. Heart weight as a percentage of body weight (PHWT) and right/total ventricle weight ratio (RV/TV) was recorded at the end of the experiment. Five replicate groups of 12 broilers were allocated to each treatment. Results indicated that feed restriction reduced weight gain compared to AL or MF regimes ($P<0.05$) at the end of experiment. Broilers subjected to feed restriction regimes consumed less feed than either AL or MF ($P<0.05$). There were no significant differences between MF and AL groups in weight gain and feed intake. At the end of experiment, Feed conversion was improved for birds in MF14. Heart and RV/TV values were not significantly affected by the feed restriction (FR and MF) regimes.

Keywords- Feed Restriction, Performance, Ascites, Broiler Chickens.

I. INTRODUCTION

Nowadays, broiler chickens have a very fast growth rate and generally are fed ad libitum throughout their rearing period. An increasing incidence of metabolic disorders has been observed in large male broilers grown for further processing. These include ascites, sudden death syndrome, and various types of leg disorders. These undesirable conditions are closely related to high metabolic rate and higher nutrient intake due to increase of feed consumption. Feed restriction programs have been recommended to minimize these losses and improve production efficiency. Different methods of feed restriction programs are applied in practice such as reduced nutrients intake by means of diet dilution (Leeson et al., 1992; Camacho-Fernandez et al., 2002), appetite suppressant (Oyawoye and Krueger, 1990), limiting the time of the feed access as skip-a-day feeding (Khajali et al., 2007), meal feeding (Susbilla et al., 2003) or limiting quantity of feed offered to the birds daily (Lee and Leeson, 2001; Saleh et al., 2005; Ozkan et al., 2006; Ocack and Sivri, 2008).

This experiment was conducted to compare the severity of feed restriction (energy allowance to support maintenance or 50% of the normal growth rate) and meal feeding on the performance and ascites development of broiler chickens.

I. MATERIAL AND METHODS

Three hundred 1-day-old male broiler chickens (Ross 308) purchased from a local hatchery and transferred to a control environment poultry house. Broiler chickens randomly assigned to 25 floor pens with 12 birds per pen and reared for 42d. A corn-soybean meal diet was formulated to meet NRC (1994) nutrient recommendations for each period. Broiler chickens had free access to starter diet from 1 to 7 day of age. At 7d, all birds were weighed after overnight fasting and randomly allotted to each of five experimental treatments. Birds in treatment 1 were fed ad libitum (AL) throughout the experiment period. Broilers in treatment 2 and 3 were subjected to quantities feed restriction from 7 to 14d of age based on maintenance (QFRM) or 50% of growth (QFRG) energy requirements, respectively. The following equation was used to calculate daily feed intake in QFRM treatment based on daily maintenance energy requirements (Plavnik and Hurwitz, 1990):

ME (kcal/day) = 1.5 × BW0.666. Where BW = mean body weight (g) at d7.

Daily feed intake in QFRG treatment was calculated based on energy requirement to support 50% of the normal growth rate according to the following equation reported by Ozkan et al., (2006):

ME (kcal/day) = 1.5 × BW0.666 + G × GA. Where BW = mean body weight (g) at d7, G=energy requirement for 1 g of growth (2 kcal/g), and GA = growth allowance (15 g/d).

Birds in treatments 4 and 5 were subjected to feed restriction based on a meal feeding schedule. These birds had free access to feed during four periods of 2h (06:00 to 08:00, 12:00 to 14:00, 18:00 to 20:00 and 00:00 to 02:00) from 7 to 14d in treatment 4 (MF14) and 7 to 21d in treatment 5 (MF21). Birds were weighed and feed intake measured on a pen basis at the end of the starter (21d) and grower (42d) periods. At the end of the experiment, birds were humanely

killed to detect ascites according to right heart enlargement [right ventricle weight per total ventricle weight (RV: TV) ratio > 0.28]. (Ozcan et al., 2006). Blood in heparinized microcapillary tubes was centrifuged for 7 min for hematocrit (HCT) measurements. Data were analyzed in a completely randomized design using the GLM procedure of SAS software.

III. RESULTS AND DISCUSSION

Broiler performance in relation to different levels of feed restriction is shown in table 1. Throughout the overall period (7-42d), the QFRM and QFRG treatments had significantly lower weight gain and feed intake than other treatments (P<0.05). These finding showed that the severity of feed restriction in QFRM and QFRG treatments were high and so these birds were unable to attain compensatory growth at 42d. In agreement with our results, Saleh et al. (2005) found no evidence of compensatory gain in birds were fed based on daily maintenance energy requirement during restricted period from 7 to 14d. In contrast with our finding, Tumova et al. (2002) reported birds were fed daily 8g feed from 7 to 14 d able to show accelerated growth at 42d. In the present experiment, birds were fed based on meal feeding schedules (MF14 and MF21) were able to attain body weight gain similar to those birds fed AL. The feed conversion ratio was significantly lower for MF14 than for QFRG (P<0.05), but there were no significant differences between other treatments. Little information is available about the effect of meal feeding on the performance of broiler chickens.

Table1. Broiler performance in relation to feed restriction

Treatment[1]	(7 – 42 d) BW gain (g)	Feed intake (g)	Feed intake:weight gain (FCR)
AL	2084.8[a]	4074.5[a]	1.95[ab]
MF14	2072.8[a]	4001.6[a]	1.93[b]
MF21	2057.5[a]	4065.3[a]	1.98[ab]
QFRG	1861.0[b]	3806.6[b]	2.05[a]
QFRM	1842.8[b]	3612.7[c]	1.96[ab]
SEM	48.53	61.99	0.03

a,bMeans within a column with no common superscripts differ significantly (P □□0.05).

1AL= ad libitum feeding.

MF14= Meal feeding from 7 to 14d.

MF21= Meal feeding from 7 to 21d.

FRM= Feed restriction (provide daily maintenance energy requirement) from 7 to 14d.

FRG= Feed restriction (support 50% of the normal growth rate) from 7 to 14d.

Heart weight as a percentage of body weight (PHWT) and right/total ventricle weight ratio (RV/TV) were not significantly affected by feed restriction treatments (P<0.05; Table 2). A significant effect of ascites on HCT was observed at 42 d of age (P<0.05; Table 2). Hematocrit levels were significantly lower for QFRM and QFRG broilers than AL or MF14 broilers.

Table 2. Effect of feeding regimen on right ventricle per total ventricular weight (RTV) ratios, heart weight as a percentage of body weight (PHWT) hematocrit (HCT) at 42 d of age.

Treatment[1]	RV:TV ratio	PHWT	HCT (%)
AL	0.24	0.470	31.95[a]
MF14	0.23	0.509	31.55[a]
MF21	0.26	0.476	30.35[b]
QFRG	0.26	0.479	29.90[bc]
QFRM	0.25	0.480	29.00[c]
SEM	0.015	0.034	0.96

a,b,c Means within a column with no common superscripts differ significantly (P □□0.05).

1AL= ad libitum feeding.

MF14= Meal feeding from 7 to 14d.

MF21= Meal feeding from 7 to 21d.

FRM= Feed restriction (provide daily maintenance energy requirement) from 7 to 14d.

FRG= Feed restriction (support 50% of the normal growth rate) from 7 to 14d.

A higher hematocrit is associated with sustained hypoxia (Yersin et al., 1992), and is correlated with ascites susceptibility (Wideman et al., 1997). Hematological changes in response to systemic

hypoxemia may occur more rapidly than cardiac hypertrophic responses, explaining the differences fiend in hematocrit values but not in RV/TV (Lorenzoni and Ruiz-Feria, 2006). If growth is slowed by restricting feed, fewer cases of ascites will develop, probably because of the reduced metabolic rate and lower oxygen requirement (Julian et al., 1986).

CONCLUSION

Feed restriction has been proposed to minimize metabolic disorders and may be improved production efficiency. However, birds were subjected to quantitative feed restriction for 1 week on maintenance or 50% of growth energy requirements, unable to achieved compensatory growth. Meal feeding regimes (MF14 and MF21) decreased rapid early growth while achieving similar final body weight gain and meat recovery compared with birds fed ad libitum. However, our results show that high hematocrit values are not necessarily linked with increased ascites sensitivity.

REFERENCES

[1] Camacho-Fernandez D., Lopez C., Avila E., Arce J. 2002. Evaluation of different dietary treatments to reduce ascites syndrome and their effects on corporal characteristics in broiler chickens. J. Applied Poult. Res., 11: 164-174.

[2] Julian, R. J., Friars G. W., French H., Quinton M. 1986. The relationship of right ventricular hypertrophy, right ventricular failure, and ascites to weight gain in broiler and roaster chickens. Avian Dis. 31:130–135.

[3] Khajali, F., Zamani-Moghaddam A., Asadi-khoshoei E. 2007. Application of an early skip-a-day feed restriction on physiological parameters, carcass traits and development of ascites in male broilers reared under regular or cold temperatures at high altitude. Anim. Sci. J., 78: 159–163.

[4] Lee, K.H., Leeson S. 2001. Performance of broilers fed limited quantities of feed or nutrients during seven to fourteen days of age. Poult. Sci., 80: 446-454.

[5] Leeson, S., Sumrners J.D., Caston L.J. 1992. Response of broilers to feed restriction or diet dilution in the finisher period. Poult Sci. 71: 2056-2064.

[6] Lorenzoni, A.G., Ruiz-Feria C.A. 2006. Effects of vitamin E and L-arginine on cardiopulmonary function and ascites parameters in broiler chickens reared under subnormal temperatures. Poult Sci. 85: 2241-2250.

[7] NRC. 1994. Nutrient requirements of poultry. 9th rev. ed. National Academy Press, Washington DC.

[8] Ocak, N., Sivri F. 2008. Liver colorations as well as performance and digestive tract characteristics of broilers may change as influenced by stage and schedule of feed restriction. J. Anim. Physio. Anim. Nutr., 92: 546-553.

[9] Oyawoye, E.O., Krueger W.F. 1990. Potential of chemical regulation of food intake and body weight of broiler breeder chicks. Br. Poult. Sci., 31: 735-742.

[10] Ozcan, S., Plavink I., Yahav S. 2006. Effect of early feed restriction on performance and ascites development in broiler chickens subsequently raised at low ambient temperature. J. Applied Poult. Res., 15: 9-19.

[11] Plavnik, I., Hurwitz S. 1990. Performance of broiler chickens and turkey poults subjected to feed restriction or to feeding of low-protein or low-sodium diets at an early age. Poult. Sci., 69:945-952.

[12] Saleh. E.A., Watkins S.E., Waldroup A.L., Waldroup P.W. 2005. Effect of early quantitative feed restriction on live performance and carcass composition of male broilers grown for further processing. J. Applied Poult. Res., 14: 87-93.

[13] Susbilla, J.P., Tarvid I., Gow C.B., Frankel T.L. 2003. Quantitative feed restriction or Meal-feeding of broiler chickens alters functional development of enzymes for protein digestion. Br. Poult. Sci. 44: 698-709.

[14] Tumova, E., Skrivan M., Skrivanova V., Kacerovska L. 2002. Effect of early feed restriction on growth in broiler chickens, turkeys and rabbits. Czech. J. Anim. Sci., 47: 418-428.

[15] Wideman, R. F., Kirby Y. K., Owen R. L., French H. 1997. Chronic unilateral occlusion of an extrapulmonary primary bronchus induces pulmonary hypertension syndrome (ascites) in male and female broilers. Poult. Sci. 76:400–404.

[16] Yersin, A. G., Huff W. E., Kubena L. F., Elissalde M. H., Harvey R. B., Witzel D. A., E.Giroir L. 1992. Changes in hematological, blood gas, and serum biochemical variables in broilers during exposure to stimulated high altitude. Avian Dis. 36:189–196.

★★★