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Effect of feed restriction on growth performance of broiler chickens

Seyyed Naeim Saber, *Naser Maheri-Sis, Abdolahad Shaddel-Telli, Keyvan Hatefinezhad, Abolfazl Gorbani, Javad Yousefi

Faculty of Animal and Veterinary Science, Shabestar Branch, Islamic Azad University, Shabestar, Iran

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ABSTRACT

This study was conducted to evaluate the effect of feed restriction time and age, on production performance of broiler chickens. A total of 420 day-old male broiler chickens (Cobb-500) were randomly assigned to 7 treatments each in 4 replicates of 15 birds per pen. Broilers were fed ad libitum through out the experiment as the control (T_0) and other six groups were fed restricted as: T_1 (8 h/day in 7-14 days of age), T_2 (16 h/day in 7-14 days of age), T_3 (8 h/day in 14-21 days of age), T_4 (16 h/day in 14-21 days of age), T_5 (8 h/day in 21-28 days of age), T_6 (16 h/day in 21-28 days of age). Results from this experiment indicated that feed intake, feed conversion ratio and body weight gain of broilers during 1-42 days as well as final body weight at 42 days were not significantly affected by feed restriction. In an overall conclusion it can be said that feed restriction resulted in compensatory growth and in turn lead to improvement of farm economy.

Key words: broiler, feed restriction, feed intake, weight gain.

INTRODUCTION

Very fast growth rate is usually increased body fat deposition, high incidence of metabolic disorders, high mortality and high incidence of skeletal diseases and those are results of continuous genetic and improvement in nutrition [15]. Early feed restriction programs used to reduce abdominal and carcass fat in broiler chickens rely on the phenomenon called compensatory growth to produce market body weight similar to control groups [5]. A period of low food availability is a challenge that young birds are likely to experience [35]. During development, chickens need to allocate their available energy between maintenance, growth and maturation, and food availability consequently plays an important role during this period [18]. Temporary feed restriction reduces growth at a critical time in a broiler chick's life cycle when it is the feeding highly concentrated energy diets without restriction of feed intake, and it increases

the incidence of metabolic disease. These diseases not only lead to economic losses for the producer, but they greatly affect the comfort of the broilers [16]. Quantitative restriction is to limiting the amount of feed daily given to the animals whereas a qualitative restriction is related to nutrient dilution in the diet [15]. Compensatory growth is defined as a recovery from a growth deficiency resulting from a limited nutrient intake [10]. The mechanism for compensatory growth has not been completely known but two theories have been proposed to explain how compensatory growth is regulated. First, compensatory growth mechanisms may involve a set-point or reference for body size appropriate for age and that the control resides in the central nervous system [38] and second theory is peripheral control which suggests that tissues, per se, control body size through cell number or by the total content of DNA [41]. Feed restriction increases enzyme secretion such as amylase, sucrase and lipase [25] and also can alters functional development of the enzymes of protein digestion such as dipeptidase and amino peptidase and may therefore influence growth rate of broilers. One of involving factors in accelerated growth may be hormonal change during the feed restriction period. It has been reported that thyroid hormones concentration decreases after feed restriction period but increases and reaches to control by refeeding [13-20]. Auckland and Morris [3] had been reported that birds subjected to feed restriction for short periods during the early growth phase show improvement of feed efficiency and reach a weight equal to that of birds fed *ad libitum* at the time of slaughte. The improvement in feed efficiency perceived in feed restricted chickens has been attributed to reduced overall maintenance requirements caused by a transient decrease in basal metabolic rate [30]. However there are several reports shown that chickens subjected to feed restriction have lower weight gain than those fed *ad libitum* at the end of experiment [6-12-15-23-24-32]. Tumova et al [37] concluded that feed restriction resulted in accelerated growth. Feed restriction mainly reduces growth rate and consequently, metabolic demands, during the critical periods of the life span of a bird [1-2-4-7-9-19-36-40] and it is associated with improvement in arterial oxygenation [29]. Feed restriction can exert negative effects on the body weight at marketing age [9] and on the relative weight of breast muscle [2]. Plavnik and Hurwitz [27] used a severe feed restriction program at 6 to 7 days of age for a one-week period in birds and indicated the birds were much reduced in weight by two weeks of age, as compared to the control birds, but they body weights in market age were equal, feed efficiency was improved. Wilson and Osbourn [38] showed compensatory growth in poultry, following a period of growth retardation by early feed restriction. The literature demonstrated that the age at which feed restriction programs are applied and their duration and severity have not been optimized for compensatory growth of feed-restricted birds [8-19]. Early growth restriction induced by feed restriction has resulted in improved feed efficiency, because of the decline in energy requirements for maintenance, and improved carcass quality resulted from the decrease in fat deposition [27-28].

MATERIALS AND METHODS

A study was conducted in the Poultry Research Unit of Islamic Azad University, Shabestar Branch (1500m altitude), Shbaestar, Iran, at the winter (2011). A total of 420 one-day-old male broilers of Cobb 500 were used for the study. One-day-old broiler chickens were randomly assigned to 7 treatments each in 4 replicates of 15 birds per pen. Broilers were fed *ad libitum* through out the experiment as the control (T_0) and other six groups were fed restricted as: T_1 (8 h/day in 7-14 days of age), T_2 (16 h/day in 7-14 days of age), T_3 (8 h/day in 14-21 days of age),

T_4 (16 h/day in 14-21 days of age), T_5 (8 h/day in 21-28 days of age), T_6 (16 h/day in 21-28 days of age). The experiments lasted 6 weeks. The birds were reared until 42 d of age, and the house temperature was controlled until the sixth week by thermostatically controlled brooders starting at 32°C and gradually decreased by 2°C per week. After the sixth week, and until the end of the experiment, the average maximum and minimum of temperature inside the house was 22 and 16°C for experiments. The experiment was consisted of starter (1-21 days) and finisher (22-42 days) periods according to the NRC [21]. A corn-soybean meal diet was formulated to meet NRC [21] nutrient recommendations for each period (Table 1).

Water was provided *ad libitum*, and incandescent light was used to provide 23h of light and 1h darkness throughout the experimental period. The variables considered at the end of each experiment were body weight gain, feed conversion and feed intake. Live BW and feed consumption were recorded manually weekly and the average of the whole group from each experimental unit at the beginning, before and after restriction, and at the end of each experiment to estimate weight gain and feed conversion. All the collected data were analyzed through the SAS [34] software.

RESULTS AND DISCUSSION

Table 1: Composition of experimental diet (%)

Ingredients	**Starter (1-21)**	**Grower (22-42)**
Yellow corn	56.9	63
Soybean meal	33.5	28.17
Corn gluten	2.9	1.77
Inert	0	0.4
Oyster shell	1.1	1.1
Dicalcium phosphate	2	1.7
Salt	0.3	0.3
Vitamin/mineral premix[1]	0.5	0.5
DL-Methionine	0.1	0.03
L-Lysine	0.0	0.03
Animal fat	2.65	3
Vitamin E	0.10	0.10
Total	100	100
Calculated nutrient content		
Crude fat	0.06	0.06
Dry matter	89.03	89
Moisture	10.97	11
ME (Kcal/Kg)	3000	3050
Protein (%)	21.5	19.5
Calcium	0.81	0.83
Available P	0.40	0.41
Lysine	1.19	1.18
Methionine	0.48	0.49
Methionine+ cystine	0.81	0.73

For each kg of the diets; vitamin A, 9,000,000 IU; vitamin D3, 2,000,000 IU; vitamin B1, 1,800 mg; vitamin B2, 6,600 mg; vitamin B3, 10,000 mg; vitamin B6, 3,000 mg; vitamin B12,15 mg; vitamin E, 18,000 mg; vitamin K3, 2,000 mg; vitamin B9, 1,000 mg; vitamin B5, 30,000 mg; folic acid, 21 mg; nicotinic acid, 65 mg; biotin, 14 mg; choline chloride, 500,000 mg; Mn, 100,000 mg; Zn, 85,000 mg; Fe, 50,000 mg; Cu, 10,000 mg; I, 1,000 mg; Se, 200 mg.

The effects of feed restriction on the performance of broiler chickens are given in Table 2. Results from this experiment indicated that feed intake, body weight gain, feed conversion ratio (FCR) and final weight at 1-42 days was not significantly affected by feed restriction. The feed intake for *ad libitum* and *ad limitum* fed birds was not significantly different. The responses observed in present study partially agree with those reported by Plavink and Hurwits [26] and [42], conversely, Hssanabadi and Moghaddam [10] and Sahraei and Shariatmadari [31] that the feed restriction increase feed intake. The higher feed intake can be related to the hypertrophy of the gastrointestinal tract that occurs after the restriction period when the birds are fed *ad libitum*. On 1-42 days, all treatments had similar body weight gain. Results of present study were supported by previous observation [22-33-37]. These result, also same with those described by Leeson and Zubair [14], when the chickens are treated ration restriction, it will cause disruption of growth, but when the chickens get back normal intake of nutrients the growth will come back normal again. This phenomenon can be explained because the chicken consuming protein and energy of diet rations less than their needs. The feed conversion had no significant difference in 1-42 day. This observation was in agreement with Jones and Farrell [11] and Mahmud et al [17].

Table2. production performance of unrestricted and feed restricted broiler chickens on whole production period (6 week ages)

Treatment	feed intake (g)	weight gain (g)	feed conversion ratio	final body weight(g)
T0	3300.9	1460.66	2.26	1503.69
T1	3206.4	1551.58	2.06	1594.61
T2	3215.8	1466.69	2.19	1509.72
T3	3175.2	1483.10	2.14	1526.13
T4	3082.2	1412.96	2.18	1455.99
T5	3220.6	1603.56	2.004	1646.59
T6	3145.2	1474.53	2.13	1517.56
SEM	125.1	46.3	0.05	46.3
P values	0.931	0.131	0.072	0.131

Experimental treatments: control (T_0) and other six groups were fed restricted as: T_1 (8 h/day in 7-14 days of age), T_2 (16 h/day in 7-14 days of age), T_3 (8 h/day in 14-21 days of age), T_4 (16 h/day in 14-21 days of age), T_5 (8 h/day in 21-28 days of age), T_6 (16 h/day in 21-28 days of age).

CONCLUSION

Based on results of this study it seems that feed restriction lead to compensatory growth in broilers with no any adverse effects on production performance.

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REFERENCES

[1] Acar, N., F. G. Sizemore, G. R. Leach, R. F. Wideman, Jr., R. L. Owen, and G. Barbato, *Poult. Sci*., **1995**, 74:833–843.

[2] Arce, J., M. Berger, and C. L. Coello, *J. Appl. Poult. Res.*, **1992**, 1:1–5.
[3] Auckland, J.N. and T.R. Morris, *Br. Poult. Sci*., **1971**, 12: 41-48.
[4] Balog, M. J., N. B. Anthony, M. A. Cooper, B. D. Kidd, G. R. Huff, W. E. Huff, and N. C. Rath, *Poult. Sci.*, **2000**,79:318–323.
[5] Cabel, M.C, and P.W. Waldroup, *Poult. Science.*, **1990**, *69:652–660.*
[6] Camacho-Fernandez, D., C. Lopes, E. Avila and J. Arce, *J. Applied Poult. Res*., **2002** 11;164-174.
[7] Coello, C. L., M. J. Arce, and G. E. Avil, Proc. XXI World's Poult. Congr. WPSA, Montreal, Canada., . **2000**.
[8] Deaton, J. W, *Poult. Sci*., **1995**, 74:1280–1286.
[9] Gonzales, E., J. Buyse, M. M. Loddi, T. S. Takita, N. Buys, and E. Decuypere, *Br. Poult. Sci*., 1998, 39:671–678.
[10] Hassanabadi, A. and H.N. Moghaddam, Int. *J. Poult. Sci*., **2006**, 5: 1156-1159.
[11] Jones, G. P. D, and D. J. Farrell, *Br. Poult. Science.*, **1992**, *33:579–587*
[12] Khajali, F., A. Zamani-Moghaddam and E. Asadi-Khoshoei, *J. Anim. Sci*., **2007**, 78:159163.
[13] Lauterio, T.J. and C.G. Scanes, **1987**. *J. Nutr*., 117: 758-763.
[14] Leeson. S., and A. K. Zubair,. *Worlds Poult. Sci*. J., **1996**, 52:189-201.
[15] Lesson, S. and A.K. Zubair, *Poult. Sci*., **1997**, 76: 992-999.
[16] Lesson, S., J.D. Summers and L.J. Caston, *Poult. Sci*., **1991**, 70: 867-873.
[17] Mahmud, A., F.M. Khattak, Z. Ali, and T N. Pasha, Department of poultry production, Lahore-Pakistan. Pp., **2004**, 484-486.
[18] Martin, T. E, *Annu. Rev. Ecol. Syst.*, **1987**, 18, 453-487.
[19] McGovern, R. H., J. J. R. Feddes, F. E. Robinson, and J. A. Hanson, *Poult. Sci*., **1999**, 78:522–528.
[20] McMurtry, J.P., I. Plavnik, R.W. Rosebrough, N.C. Steele and J.A. Proudman, Comp. *Biochem. and Physiol*., **1988**, 91: 67-70.
[21] NRC, **1994**. Nutrient requirements of poultry. 9th rev. Edn. National Academy Press, Washington Dc. http://www.nap.edu/catalog/2114.hyml
[22] Offiong, S.A., U.A. Ekepenyong, L.J. Issac, and O.O. Ojebiyl, *Tropical Aagriculture*., **2002**.
[23] Ozcan, S., I. Plavink and S. Yahva, *J. Applied Poult. Res*., **2006**, 15: 9-19
[24] Petek, M, Turk. *J. Vet. Anim. Sci*., **2000**, 24: 447-452.
[25] Pinheiro, D.F., V.C. Cruz, J.R. Sartori and M.L. Vicentini Paulino, *Poult. Sci*., **2004**, 83: 1544-1550.
[26] Plavnik, I, and S. Hurwitz, *Br. Poult. Science.*, **1991**, *32:343–352.*
[27] Plavnik, I. and S. Hurwitz, *Poult. Sci*., **1985**, 64: 348-355.
[28] Plavnik, I., and S. Hurwitz, *Poult. Sci.*, **1988**, 67:384–390.
[29] Reeves, J. T., G. Ballam, S. Hofmeister, C. Pickett, K. Morris, and A. Peacock, Comp. *Biochem. Physiol*., **1991**, 99A:481–485.
[30] Rincon, M.U. and S. Leeson, *Poultry. Sci*., **2002**, 81: 679-688.
[31] Sahraei, M. and F. Shariatmadari, Int. J. *Poult. Sci*., **2007**, 6:280-282.
[32] Saleh, E.A., S.E. Watkins, A.L. Waldroup and P.W. Waldroup, *J. Applied Poult. Res.*, **2005**, 14: 87-93.
[33] Saleh, E.A., S.E. Watkins, A.L. Waldroup and P.W Waldroup, Int. *J. Poult. Sci*., **2004**, 3:61-69.
[34] SAS software, Ver. 9.1. Sas Institute, USA.

[35] Schew, W. A. and Ricklefs, R. E. (**1998**). Developmental plasticity. In Avian Growth and Development (ed. J. M. Starck and R. E. Ricklefs), pp. 288-304. New York: Oxford University Press
[36] Shlosberg, A., E. Berman, U. Bendhaim, and I. Plavnik, *Avian Dis*., **1991**, 35:681–684.
[37] Tumova, E., M. Skrivan, V. Skrivanova and L. Kacerovska, Czech. *J. Anim. Sci*., **2002**, 47:418-428.
[38] Wilson, P.N. and D.F. Osbourn, Biol. Rev., **1960**, 35: 325-363.
[39] Yahav, S., and I. Plavnik, *Br. Poult. Sci*., **1999**, 40:120–126.
[40] Yu, M. W., and F. E. Robinson, A review. *J. Appl. Poult. Res*., **1992**, 1:147–153.
[41] Zubair, A.K, Ph. D. Dissertation. *Univ. of Guelph, Guelph, Ontario*., **1994**.
[42] Zubair, A.K, and S. Leeson, a review. *Worlds Poult. Science.J.* **1996**,*52: 189-201*.