Egypt. Poult. Sci. Vol (31) (I): (19-27)

EFFECT OF FEED RESTRICTION ON PRODUCTIVE PERFORMANCE OF BROILER CHICKS

By

A. M. A, Osman *; M. A. Toson*;

S. A. Abdel-Latif*; H. H. M, Hassanien**; T. M. A, MARWAN**

Department of Animal Production, Faculty of Agriculture, Minia University, Minia , Egypt.*

** Department of Animal and poultry production Dep. Fac. Of Agrici. South valley Unvi.

.Received: **25/11/2010** Accepted: **20/02/2011**

Abstract :*Two hundred twenty- five, 7-day old, Hubbard broiler chicks were randomly distributed into five experimental groups. Each group included three replicates of fifteen chicks per each. Chicks in the first group were fed ad libitum while those in the second, third, fourth and fifth groups were fasted 4 (from 16.00 to 20.00), 6 (from 14.00 to 20.00), 8 (from 12.00 to 20.00) and 10 hours/day (from 10.00 to 20.00) respectively during the experimental period. During the first three weeks of age, chicks were fed a commercial starter diet of 22% crude protein and 3059 Kcal ME/Kg diet, however, from 4 to 6 weeks of age, chicks were fed a commercial grower diet of 20% crude protein and 3152 Kcal ME/Kg diet. The result revealed that feed deprivation for 4, 6, 8 or 10 hours/day decreased body weight of broiler chicks by about 2.55, 3.90, 6.02 and 10.60% compared to those fed ad libitum only at 3 weeks of age. Feed intake was progressively decreased ($P<0.05$) with increasing feed deprivation during starting period (from 1 to 3 weeks of age) and at the whole experimental period (from 1 to 6 weeks of age). The depression in feed intake represented about 2.55, 3.83, 5.6 and 8.36% for broiler chicks fasted 4, 6, 8 and 10 hours/day respectively, compared to those fed ad libitum during the whole experimental period. Feed conversion ratios were insignificantly improved with increasing fasting time during the whole experimental period (from 1 to 6 weeks of age). Feed restriction had insignificant effect on carcass weight and dressing percentage. Dressing percentage fluctuated between 78.87 and 79.67%. Also, abdominal fat percentage was insignificantly decreased by feed deprivation. Cost of diet/bird was progressively decreased ($P<0.05$) with increasing fasting time in broiler chicks, however, net revenue/bird and mortality rate were not significantly affected by limiting eating time*

From these result it can be concluded that fasting broiler chicks can decrease the cost of feed / bird , improved feed conversion ratio and lower of abdominal fat (%) .At the same time with no detrimental effect on live body weight or carcass trait at marketing age

INTRODUCTION

Quantative and qualitative feed restriction are procedures that can be applied to manipulate the feeding strategies of poultry in order to decrease growth and metabolic rate to some extent and so alleviate the incidence of some metabolic diseases as will as improving feed conversion and reducing feed cost. Birds selected for fast growth (commercial broilers) suffer from leg disorders, organ failure and heart disease. At six weeks of age, broiler chickens have much difficulty supporting their abnormality heavy bodies as they spend 76 to 86 % of their time laying down (Weeks et al, 2000). They may suffer from respiratory diseases , big liver and spleen disease and sudden death syndrome (Tottori et al ,1997, Lippens et al 2000 and Demir et al 2004). Also, weakened immune systems making them more susceptible to a variety of diseases (Rauw et al ,1998).

Information on the effects of daily feed removal on broiler performance is limited. Petek (2000) and Ozkan et al. (2003)reported that daily feed removal for 3, 4, and 6 h significantly reduced final body weight and at the same time had insignificant effects on feed intake, feed efficiency and carcass characteristics. Also,Onbasilar et al. (2009) observed that 4-h daily feed removal had no significant effects on body weight, feed intake, feed efficiency, and carcass characteristics. In addition Demir et al. (2004) and Khetani et al. (2008) reported that even 8- and 16-h daily feed removal had no significant effects on the same traits.

Generally , the previous anthers illustrated quantative feed restriction by feeding amount of a balanced diet cannot be repeated under practical conditions, since the body weight and weight gain of broiler chicks and consequently their feed requirements at the same age are strongly variably and also the distribution of the daily rations is laborious and inaccurate .

Therefore , the present study was carried out to evaluate the effect of feed restriction productive performance of broiler chicks .

MATERIALS AND METHODS

Two hundred twenty five, 7-day old, Hubbard broiler chicks were randomly distributed into five experimental groups (control and four treatments). Each group included three replicates of fifteen birds each (5 treatments × 3 replicates × 15 chicks = 225 chicks) . Chicks in each replicate had nearly similar initial live body weight. Broiler chicks in control group were fed adlibitum throughout the experimental period (from 8 to 42 days of age).However those in the second , third , fourth and fifth groups were fasted for 4 (from 16.00 to 20.00 hours) , 6 (from 14.00 to 20.00 hours) , 8 (from 12.00 to 20.00 hours) and 10 hours/day (from 10.00 to 20.00 hours) respectively during the experimental period (from 8 to 42 days of age). Chicks in each replicate were brooded and reared on floor provided with litter of wheat straw. The birds received commercial starter diet during the first three weeks of age and then subjected to commercial grower diet from 4 to 6 weeks of age according to NRC requirements (1994). The chemical composition of the starter and grower diets is shown in Table (1). All birds were maintained under continuous light and were full-access to drinking water throughout the experimental period.

The average minimum and maximum indoor temperature at 5.00h and 14.00h were 22 and 28° C, respectively during the experimental period . All managerial and hygienic regimes were similar to all groups. The weight of birds in each replicate at 7, 21 and 42 days of age was receded. The average body weight, weight gain and feed consumption for each

replicate calculated at 3 and 6 weeks of age. Feed conversion (g, feed /g, gain) was calculated for each replicate within each period . Dead chicks were recoded daily and mortality rate was calculated for the entire experimental period (from 1 to 6 weeks of age).

At the end of the experiment period (at 42 day old), three birds from each treatment were taken; as a representative sample around the average weight of the group and individually weighed and slaughtered for carcass evaluation. Carcass and abdominal fat were calculated as percentage of live body weight.

Cost of one-kilogram feed for each diet (starter and grower), cost of feed /kg gain and the cost of feed /bird were calculated. Net revenue was calculated by subtracting feed cost from bird price. The relative economic returns were calculated in relation to the control group.

Table (1): Calculated composition of the commercial broiler diets.

Items	Starter diet	Grower diet
ME (Kcal/Kg diet)	3059	3152
Crude protein (%)	22	20
Crude fiber (%)	3	3.1
Crude fat (%)	4.5	5.5
Calcium %	1.00	1.00
Avail. Phos. (%)	0.45	0.45
Lysine (%)	1.20	1.20
Methionine + cystine (%)	0.93	0.93

Data obtained were statistically analyzed by using one-way analysis of variance procedure (Randomized complete block design). The statistical analysis was done using Biostat (2007) Computer program (Copyright © 2001-2007 AnalystSoft).

The following model was used:

$$Y_{ij} = \mu + R_i + T_j + e_{ij}$$

Where: Y_{ij} = the observed value of the concerned trait ij.

μ = the overall mean for the concerned trait.

R_i = the fixed effect of i^{th} replicate (i=1---3).

T_j = the fixed effect of j^{th} treatment (j=1---5).

e_{ij} = random error.

All statements of significance are based on alpha = 0.05. Comparisons between means were performed using Tukey's HSD Procedure (The Honestly Significantly Different test **(Martin 1995)**

RESULTS AND DISCUSSION

1. Body weight

The results presented in Table (2) showed that, body weight at 3 weeks of age decreased (P<0.05) with increasing of fasting time. Broiler chicks fasted for about 8 or 10 hours/day recorded lower (P<0.05) body weight compared to those fed *ad libitum* (control) at three weeks of age. However, those fasted for about 4 or 6 hours/day had intermediate body weight at the previous mentioned age.The decrease in body weight of broiler chicks at 3 weeks of age represented about 2.56, 3.90, 6.02 and 10.63% for those fasted 4, 6, 8 or 10 hours /day, respectively compared to those fed *ad-libitum* This could be attributed to that feed intake decreased (P<0.05 with increasing fasting time (Table, 4).

At 6 weeks of age, broiler chicks were able to compensate the depression in

body weight occurred at 3 weeks of age as a result of limiting eating time (Table 4) So the differences in body weight among treatments became insignificant.. The present results are in agreement with those achieved for commercial female broiler subjected to feed restriction **(FAWN, 1996).** Also **Ibrahim and Al-Hammami (2005)** studied the effect of 6 hours/day fasting (from 28-56 days of age) on productive performance of male broilers and showed that, body weight of fasting broiler chicks was depressed (P<0.05) at 5 weeks of age. However, the differences in body weight at 6 and 8 weeks of age became insignificant compared to the *ad libitum* (control group).

Table (2): Averages (±) SE of live body weight (g) of broiler as affected by feed restriction.

Treatment	Age (week)		
	1	3	6
Control	135.11±1.55	808.22^{a}±7.32	2444.22±15.73
4 hours fasting	134.00±1.68	787.55^{ab}±3.27	2440.89±11.80
6 hours fasting	134.22±2.12	776.70^{ab}±9.23	2394.81±43.65
8 hours fasting	134.89±1.78	759.56^{bc}±11.78	2367.11±20.54
10 hours fasting	134.22±1.60	722.34^{c}±15.95	2367.67±26.47
Significance	NS	**	NS

Means within each column have not the same letters are significantly different (P<0.05).

2. Body weight gain

The results in (Table, 3) indicated that during the period from 1 to 3 weeks of age, birds fed *ad libitum* (control) recorded higher (P<0.05) body weight gain than those fasted for about 8 or 10 hours/day. However, broiler chicks fasted for about 4 or 6 hours/day achieved similar body weight gain to those in the control during the period from 1 to 6 weeks of age. Also, similar insignificant differences in body weight gain were observed among broiler chick groups fasted for about 4, 6 or 8 hours/day during the previously mentioned period. The differences in body weight gain among treatments were not significant during the period from 1 to 6 weeks of ageand from 3 to 6 weeks of age and the whole experimental period. These results are in agreement with those reported by **Demir *et al.*** (2004). The treatments were *ad libitum*, 25 and 50 % feed-restricted or 8 hours and 16 hours feed withdrawal regimen. The 16 hours regime significantly (P<0.05) reduced weight gain at 21 days of age compared to *ad libitum* or 25% feed restricted regime. However, the overall weight gains between 9 days and 42 days of age were not significantly affected by the treatments.

Table (3): Averages (±) SE of daily body weight gain (g/bird/day) of broiler as affected by feed restriction.

Treatment	Age (week)		
	1-3	3-6	1-6
Control	48.08^{a} ±0.41	77.90± 0.41	65.97±0.41
4 hours fasting	46.68^{ab} ±0.28	78.73±0.42	65.91±0.33
6 hours fasting	45.89^{ab} ±0.58	77.05±1.99	64.59±1.28
8 hours fasting	44.62^{bc} ±0.72	76.55±0.92	63.78±0.57
10 hours fasting	42.01^{c} ±1.02	78.35±1.18	64.20±0.46
Significance	**	NS	NS

Means within each column have not the same letters are significantly different (P<0.05).

3. Feed consumption

Results in Table (4) showed that, the feed restriction had highly (P<0.01) significant effect on daily feed intake from 1 to 3 and from 1 to 6 weeks of age, but the differences among treatments during the period from 3 to 6 weeks of age were insignificant. During starting period (from 1 to 3 weeks of age) and the whole experimental period (from 1 to 6 weeks of age) daily feed intake was decreased (P<0.05) with limiting eating time (Table, 4). However, during the period from 3 to 6 weeks of age, the differences in feed intake among treatments were insignificant. The present results are in agreement with those reported by **Lee and Leeson (2001).** Who, showed that, birds subjected to feed restriction generally ate less feed than *ad libitum* control birds.

Table (4): Averages (±) SE of daily feed consumption (g/bird/day) of broiler as affected by feed restrictio

Treatment	Age (week)		
	1-3	3-6	1-6
Control	69.84 ^{a} ±0.32	153.08±1.91	119.79 ^{a}±1.26
4 hours fasting	69.75 ^{a} ±0.26	148.05±1.21	116.73 ^{a}±0.79
6 hours fasting	66.63 ^{ab} ±0.95	147.97±1.57	115.20 ^{ab}±1.32
8 hours fasting	63.52 ^{b} ±1.37	147.19±1.71	113.73 ^{ab}±0.97
10 hours fasting	59.38 ^{c} ±0.74	145.15±4.94	109.77 ^{b}±2.17
Significance	**	NS	**

Means within each column have not the same letters are significantly different (P<0.05).

4. Feed conversion ratio (, feed / gain, kg)

The obtained data in Table (5) revealed that the feed restriction had highly (P<0.01) significant effect on feed conversion ratio from 1 to 3 weeks of age, whereas from 3 to from 1 to 6 weeks of age the differences were not significant . During starting period (from 1 to 3 weeks of age), broiler chicks fasted 8 and 10 hours/day had better (P<0.05) feed conversion ratio than those fasted 4 hours/day. However, broiler chicks fed *ad libitum* (control) or those fasted 4 or 6 hours/day recorded similar feed conversion ratios during the previous mentioned period. During growing period (from 3 to 6 weeks of age) and whole experimental period (from 1 to 6 weeks of age), there were insignificant improvement in feed conversion ratio with increasing fasting time. **Deaton (1995)** showed significant improvement in feed conversion in restricted birds (90, 75, or 60 % feed consumption of *ad libitum* fed controls). While **Tottori *et al.* (1997)** found an improvement in feed conversion rates with restriction feeding than that of full feeding (control).

Table (5): (±) SE of feed conversion ratio (feed/ gain, Kg) of broiler as affected by feed restriction.

Treatment	Age (week)		
	1-3	3-6	1-6
Control	1.45 ^{ab}±0.017	1.96±0.020	1.82±0.012
4 hours fasting	1.49 ^{a}±0.003	1.88±0.023	1.77±0.017
6 hours fasting	1.45 ^{ab}±0.007	1.92±0.065	1.79±0.044
8 hours fasting	1.42 ^{b}±0.015	1.92±0.007	1.78±0.006
10 hours fasting	1.41 ^{b}±0.018	1.85±0.034	1.71±0.020
Significance	**	NS	NS

Means within each column have not the same letters are significantly different (P<0.05).

5. Carcass characteristics:

Results in (Table 6) showed that, feed restriction had insignificant effect on carcass weight (g), and abdominal fat percentages. Dressing percent fluctuated between 78.27 and 79.67% and was it within the normal range. The insignificant effect of feed restriction on dressing % could be attributed to the similarity of live body weight among different treatments. **(Saleh, 1992)** found that, there was a strong relationship between live body weight and carcass weight (r=0.98) and between carcass weight and dressing percentage (r=0.33),. The results present are in agreement with those found by **El-Sagheer and Makled (2005a).** They showed that no significant differences in carcass weight and dressing percentage among all restricted groups compared with control groups

Table (6): Averages (±) SE of carcass weight (g), carcass (%) and abdominal fat (%) as affected by feed restriction.

Treatment	Average ± (SE)			
	Live body weight (g)	Carcass weight (g)	carcass (%)	Abdominal fat (%)
Control	2423.33±21.86	1909.47±17.85	78.83±0.57	2.10±0.06
4 hours fasting	2413.33±49.10	1921.89±24.24	79.67±0.66	1.93±0.29
6 hours fasting	2386.67±26.67	1868.62±23.83	78.27±0.12	2.07±0.03
8 hours fasting	2383.33±18.56	1881.35±5.68	78.97±0.84	1.73±0.12
10 hours fasting	2360.00±30.55	1850.52±16.90	78.43±0.57	1.83±0.23
Significance	NS	NS	NS	NS

Means within each column have not the same letters are significantly different (P<0.05).

6 Economical efficiency

Broiler chicks fasted for 4 hours/day recorded higher (P<0.05) cost of starter diet/kg gain than those fasted 8 and 10 hours/day (Table 7). However, cost of starter diet/kg gain for broiler chicks fed *ad libitum* or those fasted 4 or 6 hours/day was similar. Also, similar trend was observed in the cost of starter diet/bird. Broiler chicks fasted 8 or 10 hours/day recorded lower (P<0.05) cost of starter diet / bird than those fed *ad libitum* (control) or those fasted 4 or 6 hours/day and this effect was more pronounced in broiler chicks fasted 10 hours/day.

The total cost of diet / bird was decreased (P<0.05) with increasing feed deprivation (*ad libitum* vs. fasting 10 hours/day). The decrease in feed cost/bird represented 2.57, 3.58, 4.92 and 7.37 % for broiler chicks fasted 4, 6, 8 or 10 hours/day, respectively compared to those fed *ad libitum* (control) . This depression in the cost of diet/bird was mainly due to progressively decrease of feed intake with increasing fasting time. Net revenue/bird was not significantly influenced as a result of the positive effect of feed restriction on the total cost of feed / bird,. Also, this could be attributed to the insignificant effect of feed restriction on live body weight of birds (Table, 2).

Table (7): Economical efficiency and mortality rate of broiler chicks as affected by feed restriction.

Treatment	Cost of diet/Kg gain (LE.)			Cost of diet/bird (LE.)			Live body weight (Kg)	Bird price (LE.)	Net revenue per bird (LE.)	Relative economical efficiency (%)	Mortality (%)
	Starter	Grower	Total	Starter	Grower	Total					
Control	3.03^{ab}	4.22	3.63	2.04^{a}	6.91	8.95^{a}	2.444	18.33	9.38	100.00	0
4 hours fasting	3.11^{a}	4.04	3.58	2.04^{a}	6.68	8.72^{ab}	2.441	18.31	9.59	102.24	0
6 hours fasting	3.03^{ab}	4.13	3.58	1.95^{a}	6.68	8.63^{ab}	2.395	17.96	9.33	99.47	0.33
8 hours fasting	2.97^{b}	4.14	3.56	1.86^{b}	6.65	8.51^{ab}	2.367	17.75	9.24	98.51	0
10 hours fasting	2.95^{b}	3.98	3.47	1.74^{c}	6.55	8.29^{b}	2.368	17.76	9.47	100.96	1
Significance	**	NS	NS	**	NS	*	NS	NS	NS		

Means within each column have not the same letters are significantly different ($P<0.05$).
Price of 1kg of starter diet, September 2007 = 2.09 LE. Price of 1kg of grower diet, September 2007 = 2.15 LE. Price of 1kg of live bodyweight, October 2007 = 7.5 LE. LE.=Egyptian pound.

Mortality rate

Mortality rate was not significantly affected by feed restriction (Table, 7). This may be due to the higher viability of Hubbard strain and good managerial conditions. These results are agreement with those recorded by **Tottori *et al.* (1997),** Who, stated that economic performance with restriction feeding was better than that with full feeding as a result of improvements in viability and feed conversion rates. Also, **El-Sagheer and Makled (2005a, b)** found that, all restricted groups of broiler chicks (3, 6, or 9 hours fasting/day from 2 to 7 weeks of age) had better net revenue/bird and economical efficiency compared with *ad libitum* control group. Moreover, **Beer and Coon (2007)** showed that mortality rate was not significantly affected by feed restriction.

It could be concluded that feed deprivation for 4, 6, 8 or 10 hours/day decreased body weight, body gain (g/day) and feed intake. However, feed restriction had insignificant effect and net revenue/bird on carcass weight, abdominal fat, dressing percentage and mortality rate.

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الملخص العربى

تأثير تحديد الغذاء على الاداء الانتاجى فى دجاج انتاج اللحم

أحمد محمد أحمد عثمان * , محمود عباس طوسون*, شاكر عبد التواب عبد اللطيف*

, حسام حسين محمد حسانين**، تغريد عبد الله محمد أحمد مروان**

* قسم الانتاج الحيوانى – كلية الزراعة - جامعة المنيا

** قسم الانتاج الحيوانى و الدواجن - كلية الزراعة - جامعة جنوب الوادى

استخدم في هذه التجربة عدد ٢٢٥ كتكوت من سلالة الهبرد عند عمر أسبوع. تم تقسيم الطيور عشوائيا إلى خمس مجموعات؛ كل مجموعة احتوت على ثلاث مكررات (١٥ كتكوت في كل مكررة). غذيت المجموعة الأولى من الطيور حتي الشبع، بينما تم تصويم المجموعة الثانية لمدة ٤ ساعات، والمجموعة الثالثة لمدة ٦ ساعات، والمجموعة الرابعة لمدة ٨ ساعات، والمجموعة الخامسة لمدة ١٠ ساعات في اليوم. غذيت الطيور علي عليقة بادئ تجارية تحتوي على ٢٢ ٪ بروتين و٣٠٥٩ كيلو كالورى طاقة ممثلة لكل كيلو جرام عليقة؛ خلال الثلاثة أسابيع الأولى من العمر، ثم غذيت الطيور علي عليقة نامي تجارية تحتوي على ٢٠ ٪ بروتين و٣١٥٢ كيلو كالورى طاقة ممثلة لكل كيلو جرام عليقة؛ من الأسبوع الرابع حتى السادس من العمر. أدى منع الغذاء لمدة ٤ ، ٦ ، ٨ ، ١٠ ساعات في اليوم إلي نقص وزن الجسم لكتاكيت التسمين بمقدار ٢.٥٥ و٣.٩٠ و٦.٠٢ و١٠.٦٠٪ علي التوالي بالمقارنة بتلك المغذاه حتي الشبع عند عمر ٣ أسابيع. بينما أصبحت الفروق بين المعاملات غيرمعنوية في وزن الجسم عند عمر ٦ أسابيع. تناقص استهلاك الغذاء بدرجة معنوية بزيادة فترة تحديد الغذاء خلال فترة البادىء (من ١ إلي ٣ أسابيع من العمر) وخلال فترة التجربة الكلية (بادىء + ناهى) من عمر١ إلي ٦ أسابيع بحوالي ٢.٥٥ و٣.٨٣ و ٥.٠٦ و ٨.٣٦٪ للطيورالتي تم تصويمها لمدة ٤ ، ٦ ، ٨ ، ١٠ ساعات في اليوم علي التوالي بالمقارنة بتلك المغذاه حتي الشبع خلال فترة التجربة.تحسن معدل تحويل الغذاء في الفترة من عمر ١ إلي ٦ اسابيع بدرجة غير معنوية بزيادة فترة التصويم. كان تأثيرتحديد الغذاء غير معنوي علي وزن الذبيحة ونسبة التصافى. وتراوحت نسبة التصافى بين ٧٨.٨٧ و ٧٩.٦٧ ٪. وتناقصت نسبة دهن البطن بدرجة غير معنوية بتحديد فترة التغذية. انخفضت تكلفة الغذاء لكل طائر بزيادة فترة التصويم؛ بينما لم يتأثر الربح الصافي لكل طائر ومعدل النفوق بدرجة معنوية بتحديد فترة التغذية.

ومن هذة النتائج نستخلص ان التصويم كتاكيت التسمين له فى تاثير مفيد خفض تكلفة الغذاء / طائر وتحسين معدل التحويل الغذائى مع خفض نسبة دهن البطن وبدون ان يكون له اثر سلبى على وزن الجسم ومواصفات الذبيحة عند عمر التسويق