Impact of different feeding programs on productive performance in broiler chicks

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Abstract

This study was conducted at the Bakrajo Poultry Farm, College of Agricultural Sciences, University of Sulaimani, Kurdistan Region, Iraq. Four hundred sixty eight day-old broiler chicks of Ross (308) were used. The experiment was applied on two weeks old chicks. The aim of the present research was to identify the effect of skip, remove and dilution of feed on broiler chick's performance. The birds randomly distributed equally into twelve treatments and each treatment subdivided into 3 replicates as follows: T1: skip 0 day + remove nothing + dilution ratio (0:100) (Control), T2: skip 0 day + remove nothing + dilution ratio (10:90), T3: skip 0 day + removing time (10:00am – 14:00pm) + dilution ratio (0:100), T4: skip 0 day + removing time (10:00am – 14:00pm) + dilution ratio (10:90), T5: skip 0 day + removing time (10:00am – 18:00pm) + dilution ratio (0:100), T6: skip 0 day + removing time (10:00am – 18:00pm) + dilution ratio (10:90), T7: skip one day + remove nothing + dilution ratio (0:100), T8: skip one day + remove nothing + dilution ratio (10:90), T9: skip one day + removing time (10:00am – 14:00pm) + dilution ratio (0:100), T10: skip one day + removing time (10:00am – 14:00pm) + dilution ratio (10:90), T11: skip one day + removing time (10:00am – 18:00pm) + dilution ratio (0:100) and T12: skip one day + removing time (10:00am – 18:00pm) + dilution ratio (10:90). The effect of interaction between skip, removal and dilution factors on productive performance characteristics are summarized as follows: significant improvement ($p \leq 0.05$) in live body weight in period (36-42) days for T6 when compared with T7 and T11, significant improvement ($p \leq 0.05$) in body weight gain in period (29-35), (36-42) days and overall for T6 when compared with T7, significant improvement ($p \leq 0.05$) in production index in period (36-42) days for T6 when compared with T1 and significant improvement ($p \leq 0.05$) in the economic value (index) for T12 when compared with T2.

Key words: feeding programs , productive performance , broiler .

Introduction

The rapid surge of demand for the poultry meat production reinforces breeders and nutritionists struggle to increase the growth rate of birds. However, some studies have come to the result that rapid growth has adverse effects on meat quality (Duclos *et al.*, 2007), especially related to the increased abdominal fat, and reduced intramuscular fat and polyunsaturated fatty acids. Abdominal fats are the main source of waste in the slaughterhouse, which affects carcass yield besides its contamination to the environment that depends on the disposition of these fats Skip-a-day feed is a technique for limiting early growth and has not been extensively examined for broiler chickens (Dozier *et al*., 2002). Skip-a-day feeding programs providing limited portions of feed and are widely used in broiler breeder's growth restriction programs. Skip-a day feeding for 3 weeks starting at age of one day would improve carcass quality and diminish sudden death syndrome which is often related with birds that are on *ad libitum* feed intake (Oyedeji and Atteh, 2005). Feed restriction has been reported as a viable method to defer early-life fast growth rate in broilers and consequently reduces the incidence of such problems (Ozkan *et al*., 2006). Different methods of feed restriction are applied in practice such as reduced nutrients intake by means of diet dilution (Camacho *et al*., 2002). Diet dilutions are accomplished by mixing feed components with non-digestible components. Feed dilutions have been used to alter the carcass composition of broiler chickens (Nielsen *et al*., 2003). Diet dilution is also used as replacement and practical method of nutrient restriction to get more consistent growth pattern within a flock (Ali and Abdalla, 2006).

Feed removal through a day time was practiced by Petek (2000) who mentioned that use of feed removal diet resulted in significantly decreased body weight, but associated with best feed conversion in the six hour feed removed group. Broiler chicks could resist a 7-day period (from 8 to 14 days) feed restriction in early age without loss in performance (Rezaei *et al*., 2006). When feed was offered after three hours of removal such as (13:00 -16:00), broilers consumed higher amounts of feed (compensatory feed intake) within first two hours (16:00-18:00), compared to the feed intake of *ad libitum* group during the same time period (De Silva and Kalubowila, 2012).

The objective of this study was to reduces early rapid growth and improve of meat yield in broiler chickens, increase weight gain and decrease feed intake, reducing the rate of abdominal fat, reducing the cost of feed and use of more than one feeding system in each treatment and its impact on the qualities of productivity is one of the essential goals of this research.

Materials and methods

This study was carried out at the Poultry Farm of Animal Production Department of College of Agricultural Sciences of University of Sulaimani. A total of 468 unsexed day-old broiler chicks of hybrid Ross-308 were used. The experiment was applied on two weeks old chicks to identify the effect of skip, remove and dilution of feed on broiler chicks' performance, where the chicks were distributed randomly. The chicks were brought up to Poultry farm consisting of several separated rooms with an area of (1.5 x 2.7) m. A total of 468 two weeks old broiler chicks (Ross-308). Chicks were distributed randomly into 36 groups of 13 chicks in each pen.

The chicks groups were assigned to twelve treatments with three replicates each. The cages floor was covered by 5 cm deep dry litter. Chicks were feed with plastic chick tray feeder and plastic handing watering 1 day to 2 weeks after that plastic hanging poultry feeder and automatic chicken watering system were used.

The chicks were fed by handing chick tray feeders of circular shape from day- old to 14th day of age, after that it was replaced by plastic hanging poultry feeders with a capacity of 10 kg. The height of the poultry feeders were increased gradually due to the height of the chicks backs as they grow older so as to avoid loss in the amount of the feed caused by the chicks.

T1: skip 0 day + remove nothing + dilution ratio (0:100) (Control),
T2: skip 0 day + remove nothing + dilution ratio (10:90),
T3: skip 0 day + removing time (10:00am – 14:00pm) + dilution ratio (0:100),
T4: skip 0 day + removing time (10:00am – 14:00pm) + dilution ratio (10:90),
T5: skip 0 day + removing time (10:00am – 18:00pm) + dilution ratio (0:100),
T6: skip 0 day + removing time (10:00am – 18:00pm) + dilution ratio (10:90),
T7: skip one day + remove nothing + dilution ratio (0:100),
T8: skip one day + remove nothing + dilution ratio (10:90),
T9: skip one day + removing time (10:00am – 14:00pm) + dilution ratio (0:100),
T10: skip one day + removing time (10:00am – 14:00pm) + dilution ratio (10:90),
T11: skip one day + removing time (10:00am – 18:00pm) + dilution ratio (0:100),
T12: skip one day + removing time (10:00am – 18:00pm) + dilution ratio (10:90).

Feed and water were given to the chicks *ad libitum* during the age between 1-14 days. The chicks were reared using three different levels of diets as follows: during the age of 15-21days including 21.32% crude protein and 2919 Kcal/kg, during the age of 22-35days including 20.59% crude protein and 2787 Kcal/kg, and during the age of 36-42days including 19.27% crude protein and 3056Kcal/kg. In this experiment it wheat bran is used as a dilution method; diet dilution was achieved by substitution of wheat bran (10:90) for the major ingredients. Ingredient composition of the diet provided to the broilers from 15 d to 42 days of age is shown in he Table (1).

Table (1) Composition of the diets			
Ingredient, % as feed-basis	*Starter diet (15-21 days) %*	*Growth diet (22-35 days) %*	*Finisher diet (36-42 days) %*
Wheat	*59.5*	*65.93*	*69.3*
Meat and bone meal (40% c.p.)	*2.5*	*0.55*	*0.4*
Soybean meal (%44 c.p.)	*30*	*25*	*21.44*
Sunflower seed Oil	*4*	*5*	*5*
Di-calcium phosphate	*2.3*	*1.94*	*1.66*
Limestone	*1.15*	*1.16*	*1.05*
Salt	*0.25*	*0.25*	*0.25*
Methionine	*0.2*	*0.07*	*0.8*
Premix	*0.1*	*0.1*	*0.1*
Total	*100*	*100*	*100*
Chemical analysis of the diet	*Before dilution*	*After dilution*	*Before dilution*
*** Crude protein %*	*21.32*	*20.59*	*19.27*
** Metabolisable energy (Kcal/kg)*	*2919*	*2787*	*3056*
	Before dilution		
*** Ether extract %*	*5.3*	*6.05*	*6.12*
** Crude fiber %*	*3.57*	*3.65*	*4.00*
*** Calcium %*	*1.19*	*1.11*	*1.22*
*** Phosphor %*	*0.76*	*0.55*	*0.57*
** Lysine %*	*1.19*	*1.2*	*1.01*

The nutritional requirement determined according to (NRC 1994). * calculated, ** chemical analysis.
Premix (Vitamin. A 800.000 IU; Vitamin. D3 170.000 IU; Vitamin. E 980 mg; Vitamin. K 95 mg; Vitamin. B1 13 mg; Vitamin. B2 220 mg; Vitamin. B6 75 mg; Vitamin. B12 800 mg; Folic acid 20 mg; Choline Chloride 12.000 mg; Antioxidant 1.900 mg; Iron 2.500 mg; Copper 400 mg; Zinc 2.600 mg; Selenium 7.5 mg; Calcium 24.00%; Sodium 5.40%; Phosphorus 8.40%; Methionine 5.40%; Methionine + Cystine 5.70% and Lysine 5.60%.

A sample of the peels was analyzed for its proximate constituents (Table 1) using standard method recommended by AOAC (2002).

Birds were weighed every week in each experimental unit throughout the experimental period. During rearing period, LBW was recorded at days 15 (start day), 21, 28, 35, 42 (finish day) of broilers age. (Mohammed, 2006)

Weight gain was calculated for each replicate after the end of each period, feed intake in each replicate was recorded and measured at the end of each week by subtracting non-eaten feed from total amount of feed supplied and daily feed intake was found by divided weekly feed intake on 7 days, feed conversion ratio is the amount of feed intake estimated to unit weight for each weight gain estimated in the same unit, mortality was recorded for each replication, if any, by the date of occurrence.

Production index calculated by the following formulas:-

$$PI = \frac{\text{average body weight (g)} \times \text{viability percentage}}{\text{number of days breeding} \times \text{feed conversion ratio} \times 10}$$

Statistical analysis

The experimental was a factorial (three factors) with a Complete Randomized Design (CRD). All data were analyze by ANOVA the liner model procedure of XLSTAT (2004, version-7.5) program to determine the effect of different treatments on the raged parameter as the following;

$$Y_{ijkl} = M + \alpha_i + \beta_j + \vartheta_k + \alpha\,\beta_{ij} + \alpha\vartheta_{ik} + \beta\vartheta_{jk} + \alpha\,\beta\vartheta_{ijk} + e_{ijkl}$$

Where:

Y_{ijkl} = Observation of the performance traits.

M = Overall mean.

α_i = Effect of skip (2 Skip).

B_j = Effect of removal (3 Removal).

ϑ_k = Effect of dilution (2 Dilution).

$\alpha\,\beta_{ij}$ = Interaction between skip and removal.

$\alpha\vartheta_{ik}$ = Interaction between skip and dilution.

$\beta\vartheta_{jk}$ = Interaction between removal and dilution.

$\alpha\,\beta\vartheta_{ijk}$ = Interaction between skip, removal and dilution.

e_{ijkl} = Experimental error assumed to be NID (0, σ^2e).

The differences between treatment means were tested by using Duncan multiple range test (1955), at probability level of 5%.

Results and discussion

Table (2) show live body weight of the end of each week of the experiment. Effect of interaction between skip, removal and dilution factors on LBW was not significant in periods (15-21), (22-28) and (29-35) days. T6 reached to (966.17g) the largest, but T11 was (894.17g) in period (15-21) days compared with T1 (control) which (918.12g). The best LBW mean was (1519.25g) in T7 for period (22-28) days whereas lowest LBW mean was (1412.84g) to T12, while T1 (control) it was (1451.22g). In the last period (29-35) days T6 was the highest mean it was (2192.99g), while T11 was the lowest mean (1986.93g), whereas T1 (control) which (2149.82g). In period (36-42 days) of the experiment, effect of interaction between skip, removal and dilution factors on LBW were significant ($p \leq 0.05$), the best mean was T6 (3014.86g) compared with T7 and T11 which were (2649.42g and 2714.98g), whereas T1 (control) was 2149.82g.

Table (2) Effect of interaction between skip, removal and dilution factors on live body weight (g/bird) of broiler chicks.

Treatments	Periods (days)			
	15-21	22-28	29-35	36-42
1	918.12[a]	1451.22[a]	2149.82[a]	2798.27[ab]
2	944.98[a]	1458.39[a]	2069.43[a]	2769.79[ab]
3	917.27[a]	1477.66[a]	2044.56[a]	2772.72[ab]
4	919.76[a]	1473.35[a]	2111.27[a]	2785.17[ab]
5	954.58[a]	1497.62[a]	2089.38[a]	2829.04[ab]
6	966.17[a]	1528.81[a]	2192.99[a]	3014.86[a]
7	937.99[a]	1519.25[a]	2021.66[a]	2649.42[b]
8	951.48[a]	1494.40[a]	2062.81[a]	2785.80[ab]
9	936.20[a]	1508.78[a]	2139.72[a]	2776.93[ab]
10	932.58[a]	1444.53[a]	2086.82[a]	2851.80[ab]
11	894.17[a]	1420.22[a]	1986.93[a]	2714.98[b]
12	903.69[a]	1412.84[a]	2087.93[a]	2852.75[ab]

The superiority of interaction treatments in restriction may be due to the development of the gastrointestinal tract as that giving a break to the digestive tract for a day and serving fodder in the second day works on the development in the gut and this will be through the elongation and development of the intestine, and this in turn leads to increased secretion of hormones of the stomach which include Cholecystokinin (CCK) hormone (Mary, 1986) as this hormone works to stimulate the digestive tract by increasing the movement and thereby increasing the secretion of hydrochloric acid and bile and enzymes such as maltase, lactase, sucrase and pepsin (Boswell, 2005). The hormone works on the decomposition of food within the digestive tract and therefore the maximum benefit of this body on one side (Pinheiro *et al.*, 2004), and on the other side may stimulate own satiety and hunger hormones which include ghrelin and leptin, for example ghrelin hormone is responsible for the state of hunger while leptin is responsible for the state of satiety (Sirotkin *et al.*, 2013).

Table (3) showed the effect of interaction between skip, removal and dilution factors on BWG, there were no significant differences during the periods (15-21) and (22-28) days. In period (15-21) the largest mean it was (429g) in T1, the lowest mean for T6 reached (487g),

whereas matched per T1 (control) which was (429g). For period (22-28) days the best mean was to T7 reached (581g), compared with T12 which the lowest mean (509.33g), while T1 (control) it was (533g). BWG means were significantly affected by treatments ($p \leq 0.05$) in period (29-35) days, higher mean represented in T1 (698.66g) did not different from others except for T7 which was (502.33g) the lowest mean, compared with T1 (control) which was (698.66g). The mean of BWG were significantly different ($p \leq 0.05$) in period (36-42) days, the higher mean was (822g) for T6 did not different from others except for T7 and T9 which were (628.33g) and (637.33g) respectively, whereas matched per T1 (control) which was (648.66g). The overall body weight gain means were significantly different ($p \leq 0.05$) the best mean was (2536g) in T6 compared with T7 which was the lowest mean (2181.33g), compared with T1 (control) which was (2309.33g).

The cause of the superiority of the treatment in the value of the weight gain is due to superiority in living body weight means and correlation between the living body weight and increase the weight gain is positive (Teimouri *et al.*, 2005). Higher body weight led to higher weight gain and this is what was observed in the treatment 6, as the superiority in living body led to its superiority in weight gain (Decuypere *et al.*, 2010). The regularity of fodder served in birds works on the regularity of the process of digestion, which in turn leads to the development of the gastrointestinal tract and thereby increasing the weight more (Benyi *et al.*, 2011).

Table (3) Effect of interaction between skip, removal and dilution factors on body weight gain (g/bird) of broiler chicken.

Treatments	Periods (days)				
	15-21	22-28	29-35	36-42	Overall
1	429.00[a]	533.00[a]	698.66[a]	648.66[ab]	2309.33[ab]
2	446.66[a]	513.66[a]	598.00[ab]	692.00[ab]	2250.33[b]
3	448.33[a]	560.33[a]	566.66[ab]	728.33[ab]	2303.67[ab]
4	449.00[a]	553.00[a]	638.00[ab]	674.33[ab]	2314.33[ab]
5	460.66[a]	543.33[a]	591.66[a]	739.66[ab]	2335.33[ab]
6	487.00[a]	562.66[a]	664.33[a]	822.00[a]	2536.00[a]
7	469.66[a]	581.00[a]	502.33[b]	628.33[b]	2181.33[b]
8	460.33[a]	543.00[a]	568.66[ab]	723.33[ab]	2295.33[b]
9	475.33[a]	572.33[a]	631.00[ab]	637.33[b]	2316.00[ab]
10	455.66[a]	512.00[a]	642.33[ab]	765.00[ab]	2375.00[ab]
11	432.33[a]	526.00[a]	566.66[ab]	728.00[b]	2253.00[b]
12	450.66[a]	509.33[a]	675.33[a]	764.66[ab]	2400.00[ab]

Table (4). Effect of interaction between of skip, removal and dilution factors on feed intake (g/bird) of broiler chicks.

Treatments	Periods (days)				
	15-21	22-28	29-35	36-42	Overall
1	558.71[a]	848.48[a]	1132.13[a]	1349.20[a]	3888.54[a]
2	609.20[a]	908.94[a]	1047.55[a]	1289.79[a]	3855.49[a]
3	584.61[a]	764.87[a]	1093.94 7[a]	1250.30[a]	3693.74[a]
4	618.46[a]	982.30 0[a]	1185.94 [a]	1208.07 [a]	3994.79[a]
5	530.51[a]	844.87[a]	1011.00[a]	1111.65[a]	3498.04[a]
6	565.32[a]	878.37[a]	1194.62[a]	1255.96[a]	3894.28[a]
7	557.94[a]	951.79[a]	974.56[a]	1158.19[a]	3642.49[a]
8	604.87[a]	903.33[a]	1149.78[a]	1253.10[a]	3911.09[a]
9	570.25[a]	767.98[a]	1114.89[a]	1218.23[a]	3671.37[a]
10	651.53[a]	1053.07[a]	1161.26[a]	1247.19[a]	4113.06[a]
11	535.64[a]	774.95[a]	983.07[a]	1142.26[a]	3435.93[a]
12	532.56[a]	864.87[a]	1169.28[a]	1168.02[a]	3734.74[a]

Effect of interaction between skip, removal and dilution factors on feed intake were not significantly differences in all periods as shown in Table (4). In period (15-21) days the maximum mean to T10 (651.53g), whereas the better mean to T5 (530.51g), while T1 (control) it was (558.71g), period (22-28) days T10 that a highest mean (1053.07g), whereas T3 was lowest mean (764.87g) compared with T1 (control) which was (848.48g). The highest feed intake mean was (1194.62g) in T6 for period (29-35) days whereas better feed intake mean was (974.56g) to T7, while T1 (control) which was (1132.13g). In period (36-42) day's end of experiment, T1 was the maximum mean reached (1349.20g), while T5 was the lowest mean reached (1111.65g), whereas compared with T1 (control) it was (1349.20g). In overall the effect of interaction between skip, removal and dilution factors on feed intake mean are not significant differences, the maximum mean was (4113.06g) in T10 and the better mean was (3435.93g) in T11, while T1 (control) which was (3888.54g). Rezaei *et al.* (2006) found effect of diluted diets on feed intake was not significant in periods (8-42 days). Dozier *et al.* (2002) noted the feed intake at the end of the starter feeding period were progressively reduced by increasing duration of skip a- day feed removal. While Govaerts *et al.* (2000) suggested the limiting food intake

decrease the growth during the period of restriction, but reduced growth can be later compensated. Consider a key mechanisms for improve feeding in broilers this agree with (Benschop, 2000). The effect of interaction between skip, removal and dilution factors on FCR is shown in Table (5). The results indicate no significant differences in all periods except the period (36-42) days, was significant differences ($p \leq 0.05$). In period (15-21) days the highest mean represent to T10 (1.44) compared with T5 which have a lower mean (1.16), while T1 (control) which was (1.3). For period (22-28) days the worst mean was (2.06) in T10, whereas the lower mean was for the T3 reaching (1.37), compared with T1 (control) which was (1.62). The worst FCR in period (29-35) was T8 (2), while T2 (1.6) was the best mean, whereas matched per T1 (control) which was (1.63). For period (36-42) days, effect of interaction between skip, removal and dilution factors on FCR were significantly differences ($p \leq 0.05$) the highest mean for T1 reached (2.06) compared with others except T5 and T6 (1.49 and 1.46 respectively), while the FCR value for T1 (control) was (2.06). For the overall FCR the effect of interaction were not significant, T5 (1.47) had the lower mean for FCR, compared with (1.65) of the T1 (control). The effect of interaction between skip, removal and dilution factors on production index are given in Table (6). The results showed not significant differences in all periods except at the last period where significant differences were found ($p \leq 0.05$). In period (15-21) day the best mean of production index up to (391.62) in T5 whereas lowest mean of production index was (308.20) in T10, whereas matched per T1 (control) which was (336.26). For period (22-28) days the highest mean represent in T9 up to (389.24) compared with T10 which have lowest mean (250.34), compared with T1 (control) which was (311.91). In period (29-35) days the best mean of T1 up to (376.33) whereas lowest mean it was (286.19) in T8, while T1 (control) was (376.33). For period (36-42) days there are significant differences ($p \leq 0.05$), the better mean represent in T6 reached (484.71), and was different from others except means of T1, T2, T3, T4, T7, T8 and T9. The lowest mean was in T1 (323.50).

Table (5). Effect of interaction between of skip, removal and dilution factors on feed conversion ratio (g feed/g weight) of broiler chicken

Treatments	Periods (days)				
	15-21	22-28	29-35	36-42	Overall
1	1.30[a]	1.62[a]	1.63[a]	2.06[a]	1.65[a]
2	1.40[a]	1.77[a]	1.60[a]	1.87[ab]	1.67[a]
3	1.31[a]	1.37[a]	1.94[a]	1.72[ab]	1.58[a]
4	1.38[a]	1.78[a]	1.86[a]	1.80[ab]	1.70[a]
5	1.16[a]	1.52[a]	1.71[a]	1.49[b]	1.47[a]
6	1.25[a]	1.57[a]	1.92[a]	1.48[b]	1.55[a]
7	1.19 [a]	1.64[a]	1.95[a]	1.86[ab]	1.66[a]
8	1.32[a]	1.67[a]	2.00[a]	1.74[ab]	1.68[a]
9	1.20[a]	1.35[a]	1.77[a]	1.92[ab]	1.56[a]
10	1.44[a]	2.06[a]	1.80[a]	1.66[ab]	1.74[a]
11	1.24[a]	1.49[a]	1.74[a]	1.57[ab]	1.51[a]
12	1.19[a]	1.70[a]	1.77[a]	1.53[ab]	1.54[a]

Table (6). Effect of interaction between skip, removal and dilution factors on production index of broiler chicken.

Treatments	Periods (days)			
	15-21	22-28	29-35	36-42
1	336.26[a]	311.91[a]	376.33[a]	323.50[c]
2	321.08[a]	294.59[a]	367.50[a]	350.14[c]
3	333.33[a]	385.03[a]	301.03[a]	383.72[bc]
4	317.11[a]	295.54[a]	324.27[a]	368.38[bc]
5	391.62[a]	343.19[a]	349.20[a]	452.54[ab]
6	375.81[a]	347.36[a]	313.63[a]	484.71[a]
7	375.35[a]	330.79[a]	296.11[a]	339.22[c]
8	343.07[a]	319.50[a]	286.19[a]	380.26[bc]
9	371.42[a]	389.24[a]	345.60[a]	344.61[c]
10	308.20[a]	250.34[a]	322.94[a]	408.34[abc]
11	343.31[a]	331.88[a]	326.76[a]	412.04[abc]
12	361.34[a]	296.63[a]	328.10[a]	443.97[ab]

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