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Effect of Different Feeding Programs on Carcass Traits of Broiler Chicks

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Abstract

Four handrad sixty eight day-old broiler chicks of Ross (308) were used during two stages, first a field experiment from 21st September 2015 to 2nd November 2015. Second lab analysis from 10th November 2015 to 8th January 2016. 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 carcass 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).
Significant improvement ($p \leq 0.05$) in the breast percentage for T2 in male and T1 in female when compared with T3 in both sexes, the thigh percentage significant improvement ($p \leq 0.05$) for T3 in both sexes when compared with T7. Significant decrease ($p \leq 0.05$) in the abdominal fat percentage T3 for male and T4 for female when compared with T11 for male and T9 for female. Significant increased ($p \leq 0.05$) in glucose concentration for T4 in both sexes when compared with T6 for male and T5 for female.

Introduction

The rapid surge of demand for the poultry meat production reinforces breeders and nutritionist 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 [1], 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 [2]. Broiler chicken production has undergone extreme changes and developments over the last few decades, constant enhancements in nutrition and genetic selection over the last two decades have caused a fast growth rate in modern broiler strains so far that it has reduced the average time required for a broiler chicken to reach 2 kg by half (from 63 days to 37 days). The high rate of growth of birds will cause stress that led to metabolic diseases besides skeletal disorders that leads to economic losses due to weak performance, high rates of mortality and carcass condemnation at slaughterhouses [3].

Skip-a-day feed is a technique for limiting early growth and has not been extensively examined for broiler chickens [4]. 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 [5]. 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 [6].
Different methods of feed restriction are applied in practice such as reduced nutrients intake by means of diet dilution [7]. 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 [8]. Diet dilution is also used as replacement and practical method of nutrient restriction to get more consistent growth pattern within a flock [9].

Feed removal through a day time was practiced by [10] 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 [11]. 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 [12].
The objective of 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 Science Department of College of Agricultural Sciences of University of Sulaimani, through two stages. The first field experiment from 21st September, 2015 to 2nd November, 2015. Second lab analysis from 10th November 2015 to 8th January 2016. A total of 468 unsexed day-old broiler chicks of hybrid Ross-308 was 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.
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).

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%)	*2.5*		*0.55*		*0.4*	
Soybean meal (%44)	*30*		*25*		*21.44*	
Sunflower seed Oil	*4*		*5*		*5*	
Dual-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*	*After*	*Before*	*After*	*Before*	*After*
	dilution		*dilution*		*dilution*	
*** Crude protein %*	*21.32*	*20.59*	*19.27*	*18.74*	*17.8*	*17.42*
** Metabolisable energy (Kcal/kg)*	*2919*	*2787*	*3056*	*2910*	*3079*	*2931*
			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*	
** Methionine + Cysteine %*	*0.89*		*0.92*		*0.89*	

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%.

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.

Feed and water were given to the chicks in an *ad libitum* manner 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 19.27% crude protein and 3056 Kcal/kg, and during the age of 36-42days including 17.8% crude protein and 3079Kcal/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.
Slaughtering process was achieved manually using a sharp knife after a period of starvation, and followed the method of hand scalding after 1.5 minutes of slaughter, where caught by the hands from legs and dipped carcass in the basin scalding 1.5 for 2 minutes. They were de-feathered and then legs manually been cut from the knee joint. It then has to evisceration viscera manually by incision about 5 cm abdominal areas. Finally, the carcass was cut up into parts separately following the same method for each carcass and their parts weighed. Then samples were taken from the breast and thigh muscles after removing the skin from different areas and put in a small nylon bags for the purpose of analyzing the chemical composition and stored inside a freezer (temperature -5 ^{0}C).

One male and one female were chosen randomly from each replication (three males and three females from each treatment) on the basis of body weight, weighed alive and sacrificed to estimate weight for dressing, breast, and thigh percentage. The dressing percentage calculated by the equation:

$$\text{Dressing percentage (without edible viscera)} = \frac{\text{weight of carcass (g)}}{\text{live weight (g)}} \times 100$$

$$\text{Breast percentage} = \frac{\text{weight of breast (g)}}{\text{carcass weight (without edible viscera) (g)}} \times 100$$

$$\text{Thigh percentage} = \frac{\text{weight of thigh (g)}}{\text{carcass weight (without edible viscera) (g)}} \times 100$$

$$\text{Weight of viscera organs \%} = \frac{\text{weight liver,gizzard or heart (g)}}{\text{live body weight (g)}} \times 100$$

$$\text{AFP percentage} = \frac{\text{weight of AFP (g)}}{\text{live body weight (g)}} \times 100$$

The method mentioned in the [13] was followed to estimate the protein, fat, moisture and ash using Micro-kjeldal by finding percentages of all nitrogen in meat samples.

The experimental was a factorial (three factors) with a Complete Randomized Design (CRD). All data were analyze by ANOVA the liner model procedure of [14] (version-7.5) program to determine the effect of different treatments on the raged parameter as the following;

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

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 [15] multiple range tests, at probability level of 5%.

Results and discussion

The effect of interaction between skip, removal and dilution factors on dressing percentage of male showed in Table (2). The results was significantly differences among treatments ($P \leq 0.05$), the highest mean was (79.580%) for T11, compared (75.055%) for T3, whereas mean of T1 (control) was (78.737%). The effect of interaction between skip, removal and dilution factors on dressing percentage of female, were significantly differences ($P \leq 0.05$), the best mean was T8 (80.137%) compared with T2 and T3 which were (76.837% and 76.982%). The value of T1 (control) was (79.256%).

The increase in both sexes dressing percentage may be due to the significant ($p \leq 0.05$) increase in live body weight in comparison with another treatments, as dressing percentage positively related with a live body weight of the bird [16].

The effect of interaction between skip, removal and dilution factors on heart, liver and gizzard was showed in Table (3). Heart percentage of male and female showed no significant differences, in male, the largest percentage was T7 (0.77%) and the lowest percentage was T4 (0.56%), while T1 (control) was (0.62%). In female, the best parentage represent in T9 up to (0.73%), whereas the lowest percentage it was (0.58%) in T4, whereas T1 (control) was (0.69%). Liver percentage showed no significant differences in both sexes, in male, the highest percentage in T12 (2.80%), while the lowest percentage in T2 (2.22%), compared with T1 (control) which was (2.39%). In female, the highest percentage of T10 up to (2.80%), whereas the lowest percentage was (2.27%) in T2, whereas T1 (control) was (2.54%). For gizzard percentage there were no significant differences in male, the largest percentage was (1.36%) in T2, while the lowest percentage was (0.98%) in T1. In the female, there are significant differences ($p \leq 0.05$), the highest percentage was in T2 (1.36%), did not different from others except T7, which had the lowest percentage (0.85%), while T1 (control) was (0.97%).

Restriction increase the amount of feed intake and increase the amount of feed means full gizzard and this leads to increased frequency of gizzards contractions and this leads to increased gizzards muscle, and eventually to then large the size of gizzard [17, 18]. [19] noted the heart weight also shows no significant difference when compared to the control group. The result contradicts with that of [20] who concluded that heart weight was significantly higher in feed restricted broilers. [19, 21] found significant differences in the liver weight, gizzard and proventiculus. The proventiculus increases gradually as the duration of restriction increases.

Table (4) showed that effect of interaction between skip, removal and dilution factors on breast, thigh and abdominal fat percentage in male and female broiler chickens. Significant differences were found among breast percentage of ($p \leq 0.05$) both sexes. In male, the largest percentage was (34.48%) in T2, with no difference from others except T3, which had the lowest percentage (29.07%), compared with T1 (control) which was (34.33%). In female, the highest percentage was T1 (35.39%), with no difference from others except T3, which had the lowest percentage (30.48%), while T1 (control) was (35.39%). Significant ($p \leq 0.05$) differences were also found for thigh percentage in both sexes. In male, the highest percentage was (29.62%) in T3, with no different from others except T7, which had the lowest percentage (25.88%), whereas T1 (control) was (28.44%). In female, the largest percentage was for T4 (29.60%), which was not different from others except of T7 and T9. The lowest percentage was for T7 (25.40%), while T1 (control) was (26.71%).

The abdominal fat percentage significantly differed among treatments ($p \leq 0.05$) in both sexes. In male, the largest percentage was (1.58%) in T11, with no different from others except of T3, which was the lowest percentage (0.83%), compared with T1 (control) which was (1.14%). In the female, the highest percentage was T9 (1.57%), with no different from others except of T4, which was the lowest percentage (0.98%), whereas T1 (control) was (1.07%).

Represents the proportion of the breast piece which is the largest piece in the body and the most desirable by consumers, and its superiority is resulted from the increase in body weight [22]. As the pieces of the body are positively related to the living body weights especially the main pieces which are mainly the breast since the increase in weight is the result of its containing large portion of meat and a small portion of bone [23, 24].

Represents the proportion of the thigh piece which is the largest piece after breast, and its superiority is resulted from the increase in body weight [25] as the pieces of the body are positively related with the living body weight, that's any increase in living body weight increases the thigh proportion since the increase is due to its large portion of meat and small portion of bone [26]. One of the properties of the restriction is to reduce the harmful fat in the body, by preventing the accumulation of fat as a result of weight gain, since raising broiler chickens depends on the production birds of high weight, the mean in weight is a full carcass meat and not fat [27], restriction leads to reduce the proportion of harmful fat in the body, and this is done through regulation of the digestive tract and consumption of all food in it regularly [28]. The restriction led to comfort and well-being of the birds and this reduces the secretion of stress hormones which include corticosterone which works to increase abdominal fat of body fat through getting on energy from non-carbohydrate sources [29].

Table (5) show the effect of interaction between skip, removal and dilution factors on moisture, protein, ash and fat percentage of breast. Moisture, protein, ash and fat percentage in breast were not significantly affected by treatments in both sexes. For male, the highest percentage was (75.61%) in T4, whereas the lowest percentage was in T1 (73.75%). In female, the largest percentage was T2 (75.88%), and the smallest percentage it was (73.8%) in T5, while T1 (control) was (74.89%). Protein percentage in male, the highest percentage was (20.43%) in T4, the lowest percentage was T1 (19.93%). For female, the highest percentage was T2 (20.50%), whereas the lowest percentage was (19.94%) in T5, compared with T1 (control) which was (20.24%). Ash percentage in male, the largest percentage represent in T12 (1.13%) compared the smallest percentage (1.02%) in T8, while it was (1.02%) in T1 (control). In female, the highest percentage was T7 (1.13%), whereas the lowest percentage was T6 (1.02%), whereas T1 (control) was (1.07%). Fat percentage in male, the largest percentage was (0.86%) in T9, whereas the lowest percentage was (0.39%) in T5, compared with T1 (control) which was (0.64%). For female, the highest percentage was T4 (0.86%) and the smallest percentage was T8 (0.45%), while T1 (control) was (0.61%).

Table (6) show the effect of interaction between skip, removal and dilution factors on moisture, protein, ash and fat percentage of thigh. Moisture, protein, ash and fat percentage in thigh were not significantly affected in both sexes. For male, the largest percentage was T4 (76.78%), whereas the lowest percentage was T7 (75.52%), compared with T1 (control) which was (76.18%). For female, the highest percentage was (76.03%) in T1, and the smallest percentage was (75.24%) in T4. For protein percentage in male, the largest percentage was in T1 up to (20.54%), the lowest percentage was (19.93%) in T2. For female, the highest percentage was (20.75%) in T4, whereas the lowest percentage was (20.21%) in T12, whereas matched per T1 (control) was (20.59%). Ash percentage in male, the highest percentage it was (1.09%) in T10 and the lowest percentage it was (1.01%) in T11, compared with T1 (control) which was (1.06%). In female, the highest percentage was T8 (1.10%), whereas the lowest percentage was T6 (0.99%), while T1 (control) was (1.08%). Fat percentage in male, the highest percentage was T4 (0.78%), whereas the lowest percentage was (0.51%) in T2, whereas compared with T1 (control) which was (0.60%). For female, the highest percentage was (1.03%) in T9 and the lowest percentage was (0.62%) in T5, while T1 (control) was (0.78%).

Table (2). Effect of interaction between skip, removal and dilution factors on dressing percentage of both sexes (male and female) of broiler chicken (Mean ± S.E)

T	*Dressing %*	
	Male	*Female*
T1	*78.73 ± 1.32[a]*	*79.25 ± 0.43[ab]*
T2	*77.97 ± 0.09[ab]*	*76.83 ± 1.49[b]*
T3	*75.05 ± 0.94[b]*	*76.98 ± 1.27[b]*
T4	*76.21 ± 0.72[ab]*	*77.81 ± 0.93[ab]*
T5	*77.35 ± 1.59[ab]*	*78.92 ± 0.44[ab]*
T6	*78.28 ± 0.47[ab]*	*77.76 ± 0.78[ab]*
T7	*77.38 ± 0.70[ab]*	*78.15 ± 0.69[ab]*
T8	*79.40 ± 0.38[a]*	*80.13 ± 0.45[a]*
T9	*77.10 ± 0.73[ab]*	*80.10 ± 0.22[a]*
T10	*78.18 ± 0.81[ab]*	*79.69 ± 0.33[a]*
T11	*79.58 ± 0.41[a]*	*78.48 ± 0.60[ab]*
T12	*77.82 ± 2.00[ab]*	*7.79 ± 0.66[ab]*

-Values within columns within different letters are different (P≤0.05)

Table (3). The effect of interaction between of skip, removal and dilution factors of heart, liver and gizzard percentage of male and female broiler chicken (Mean ± S.E)

T.	*Heart %*		*Liver %*		*Gizzard %*	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
T1	0.62 ± 0.09^{a}	0.69 ± 0.04^{a}	2.39 ± 0.10^{a}	2.54 ± 0.25^{a}	0.98 ± 0.04^{a}	0.97 ± 0.03^{ab}
T2	0.64 ± 0.06^{a}	0.62 ± 0.04^{a}	2.22 ± 0.25^{a}	2.27 ± 0.32^{a}	1.36 ± 0.40^{a}	1.36 ± 0.31^{a}
T3	0.58 ± 0.04^{a}	0.61 ± 0.05^{a}	2.26 ± 0.05^{a}	2.47 ± 0.13^{a}	1.11 ± 0.14^{a}	1.28 ± 0.08^{ab}
T4	0.56 ± 0.01^{a}	0.58 ± 0.01^{a}	2.50 ± 0.18^{a}	2.40 ± 0.12^{a}	1.13 ± 0.17^{a}	1.21 ± 0.08^{ab}
T5	0.77 ± 0.09^{a}	0.62 ± 0.03^{a}	2.28 ± 0.08^{a}	2.30 ± 0.05^{a}	1.02 ± 0.04^{a}	0.97 ± 0.07^{ab}
T6	0.61 ± 0.07^{a}	0.73 ± 0.08^{a}	2.76 ± 0.06^{a}	2.78 ± 0.08^{a}	1.01 ± 0.04^{a}	1.10 ± 0.06^{ab}
T7	0.77 ± 0.03^{a}	0.60 ± 0.02^{a}	2.64 ± 0.05^{a}	2.76 ± 0.18^{a}	1.24 ± 0.04^{a}	0.85 ± 0.13^{b}
T8	0.61 ± 0.04^{a}	0.71 ± 0.07^{a}	2.55 ± 0.22^{a}	2.63 ± 0.19^{a}	1.16 ± 0.07^{a}	0.89 ± 0.14^{ab}
T9	0.66 ± 0.04^{a}	0.73 ± 0.04^{a}	2.49 ± 0.16^{a}	2.39 ± 0.19^{a}	1.02 ± 0.03^{a}	1.12 ± 0.29^{ab}
T10	0.73 ± 0.04^{a}	0.63 ± 0.04^{a}	2.70 ± 0.26^{a}	2.80 ± 0.11^{a}	1.09 ± 0.03^{a}	1.05 ± 0.03^{ab}
T11	0.59 ± 0.02^{a}	0.62 ± 0.01^{a}	2.71 ± 0.24^{a}	2.59 ± 0.15^{a}	1.21 ± 0.06^{a}	1.09 ± 0.02^{ab}
T12	0.64 ± 0.08^{a}	0.64 ± 0.04^{a}	2.80 ± 0.17^{a}	2.62 ± 0.28^{a}	1.01 ± 0.09^{a}	1.08 ± 0.04^{ab}

-Values within columns within different letters are different ($P \leq 0.05$)

Table (4). The effect of interaction between of skip, removal and dilution factors of breast, thigh and abdominal fat percentage of male and female broiler chicken (Mean ± S.E)

T	*Breast %*		*Thigh %*		*Abdominal fat*	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
T1	34.33 ± 1.32[a]	35.39 ± 1.26[a]	28.44 ± 1.12[ab]	26.71 ± 1.04[ab]	1.14 ± 0.30[ab]	1.07 ± 0.32[ab]
T2	34.48 ± 1.52[a]	31.59 ± 0.96[bc]	26.42 ± 1.10[ab]	28.15 ± 1.49[ab]	1.09 ± 0.18[ab]	1.24 ± 0.21[ab]
T3	29.07 ± 0.66[b]	30.48 ± 0.35[c]	29.62 ± 0.64[a]	29.55 ± 0.80[a]	0.83 ± 0.03[b]	1.31 ± 0.26[ab]
T4	32.56 ± 1.93[ab]	32.65 ± 1.13[bc]	27.55 ± 1.11[ab]	29.60 ± 1.89[a]	1.01 ± 0.25[ab]	0.98 ± 0.04[b]
T5	32.44 ± 1.11[ab]	33.19 ± 0.69[abc]	28.43 ± 1.30[ab]	28.97 ± 1.20[ab]	1.048 ± 0.05[ab]	1.08 ± 0.04[ab]
T6	30.99 ± 1.37[ab]	32.83 ± 0.65[abc]	27.59 ± 0.72[ab]	26.44 ± 0.60[ab]	1.26 ± 0.02[ab]	1.27 ± 0.01[ab]
T7	32.27 ± 0.96[ab]	31.76 ± 0.36[bc]	25.88 ± 0.65[b]	25.40 ± 0.38[b]	1.44 ± 0.06[ab]	1.40 ± 0.08[ab]
T8	31.58 ± 2.55[ab]	34.27 ± 0.90[ab]	28.25 ± 1.07[ab]	26.63 ± 0.99[ab]	1.15 ± 0.06[ab]	1.14 ± 0.03[ab]
T9	32.30 ± 1.87[ab]	32.64 ± 0.64[bc]	27.39 ± 1.15[ab]	25.52 ± 1.49[b]	1.29 ± 0.02[ab]	1.57 ± 0.27[a]
T10	30.29 ± 1.29[ab]	32.15 ± 1.00[bc]	28.71 ± 0.08[ab]	28.10 ± 0.50[ab]	1.45 ± 0.39[ab]	1.48 ± 0.13[ab]
T11	31.65 ± 0.39[ab]	32.44 ± 0.52[bc]	28.49 ± 0.38[ab]	27.88 ± 1.34[ab]	1.58 ± 0.12[a]	1.17 ± 0.21[ab]
T12	34.21 ± 1.09[a]	3.41 ± 0.52[ab]	27.39 ± 1.48[ab]	28.19 ± 0.36[ab]	1.21 ± 0.21[ab]	1.02 ± 0.12[ab]

-Values within columns within different letters are different (P≤0.05)

Table (5). Effect of interaction between of skip, removal and dilution factors of chemical composition percentage of breast of male and female broiler chicken (Mean ± S.E).

T.	Chemical composition percentage of breast							
	Moisture %		Protein %		Ash %		Fat %	
	Male	Female	Male	Female	Male	Female	Male	Female
T1	73.75± 1.01[a]	74.89 ± 0.61[a]	19.93 ± 0.27[a]	20.24 ± 0.16[a]	1.02 ± 0.05[a]	1.07 ± 0.05[a]	0.64 ± 0.09[a]	0.61 ± 0.20[a]
T2	75.26 ± 0.27[a]	75.88 ± 0.60[a]	20.34 ± 0.07[a]	20.50 ± 0.16[a]	1.07 ± 0.05[a]	1.04 ± 0.07[a]	0.71 ± 0.24[a]	0.52 ± 0.09[a]
T3	75.01 ± 0.48[a]	74.28 ± 0.39[a]	20.27 ± 0.13[a]	20.07 ± 0.10[a]	1.06 ± 0.05[a]	1.03 ± 0.06[a]	0.55 ± 0.15[a]	0.65 ± 0.09[a]
T4	75.61 ± 1.18[a]	74.25 ± 0.97[a]	20.43 ± 0.32[a]	20.06 ± 0.26[a]	1.08 ± 0.06[a]	1.07 ± 0.02[a]	0.85 ± 0.43[a]	0.86 ± 0.29[a]
T5	75.15 ± 0.90[a]	73.80 ± 0.54[a]	20.31 ± 0.24[a]	19.94 ± 0.14[a]	1.07 ± 0.04[a]	1.09 ± 0.06[a]	0.39 ± 0.03[a]	0.46 ± 0.02[a]
T6	75.34 ± 0.57[a]	74.27 ± 0.51[a]	20.36 ± 0.15[a]	20.07 ± 0.14[a]	1.11 ± 0.04[a]	1.02 ± 0.01[a]	0.54 ± 0.02[a]	0.73 ± 0.12[a]
T7	74.83 ± 0.14[a]	74.11 ± 0.55[a]	20.22 ± 0.03[a]	20.03 ± 0.15[a]	1.04 ± 0.06[a]	1.13 ± 0.03[a]	0.57 ± 0.14[a]	0.65 ± 0.07[a]
T8	74.83 ± 0.46[a]	73.93 ± 1.00[a]	20.22 ± 0.12[a]	19.98 ± 0.27[a]	1.02 ± 0.02[a]	1.11 ± 0.05[a]	0.79 ± 0.15[a]	0.45 ± 0.06[a]
T9	74.48 ± 0.34[a]	74.49 ± 0.49[a]	20.13 ± 0.09[a]	20.13 ± 0.13[a]	1.07 ± 0.0 1[a]	1.05 ± 0.05[a]	0.86 ± 0.33[a]	0.47 ± 0.04[a]
T10	74.25 ± 0.56[a]	74.71 ± 0.81[a]	20.06 ± 0.15[a]	20.19 ± 0.22[a]	1.09 ± 0.04[a]	1.12 ± 0.09[a]	0.44 ± 0.03[a]	0.76 ± 0.24[a]
T11	75.19 ± 0.32[a]	75.47 ± 0.87[a]	20.32 ± 0.08[a]	20.39 ± 0.23[a]	1.12 ± 0.03[a]	1.02 ± 0.03[a]	0.52 ± 0.12[a]	0.49 ± 0.21[a]
T12	74.82 ± 0.76[a]	75.07 ± 0.59[a]	20.22 ± 0.20[a]	20.29 ± 0.16[a]	1.13 ± 0.02[a]	1.06 ± 0.02[a]	0.66 ± 0.12[a]	0.46 ± 0.06[a]

-Values within columns within different letters are different (P≤0.05)

Table (6). Effect of interaction between of skip, removal and dilution factors of chemical composition percentage of thigh of male and female broiler chicken (Mean ± S.E).

T.	Chemical composition percentage of thigh							
	Moisture %		Protein %		Ash %		Fat %	
	Male	Female	Male	Female	Male	Female	Male	Female
T1	76.18 ± 0.58[a]	76.03 ± 0.38[a]	20.54 ± 0.15[a]	20.59 ± 0.10[a]	1.06 ± 0.06[a]	1.08 ± 0.05[a]	0.60 ± 0.04[a]	0.78 ± 0.11[a]
T2	76.36 ± 0.39[a]	75.24 ± 0.72[a]	20.33 ± 0.10[a]	20.63 ± 0.19[a]	1.06 ± 0.08[a]	1.01 ± 0.05[a]	0.51 ± 0.10[a]	0.71 ± 0.10[a]
T3	76.13 ± 0.57[a]	75.44 ± 0.67[a]	20.38 ± 0.15[a]	20.57 ± 0.18[a]	1.05 ± 0.07[a]	1.02 ± 0.03[a]	0.75 ± 0.06[a]	0.70 ± 0.09[a]
T4	76.78 ± 0.53[a]	75.24 ± 0.25[a]	20.33 ± 0.14[a]	20.75 ± 0.06[a]	1.07 ± 0.05[a]	1.01 ± 0.07[a]	0.78 ± 0.11[a]	0.76 ± 0.19[a]
T5	76.66 ± 1.23[a]	75.35 ± 0.55[a]	20.36 ± 0.33[a]	20.71 ± 0.15[a]	1.04 ± 0.02[a]	1.05 ± 0.07[a]	0.63 ± 0.07[a]	0.62 ± 0.01[a]
T6	76.09 ± 0.65[a]	75.97 ± 0.21[a]	20.53 ± 0.17[a]	20.56 ± 0.05[a]	1.05 ± 0.02[a]	0.99 ± 0.04[a]	0.81 ± 0.13[a]	0.79 ± 0.13[a]
T7	75.52 ± 0.30[a]	75.35 ± 0.43[a]	20.36 ± 0.08[a]	20.41 ± 0.11[a]	1.01 ± 0.04[a]	1.04 ± 0.02[a]	0.82 ± 0.11[a]	0.67 ± 0.29[a]
T8	76.47 ± 0.34[a]	75.87 ± 0.06[a]	20.50 ± 0.09[a]	20.66 ± 0.01[a]	1.03 ± 0.03[a]	1.10 ± 0.05[a]	0.58 ± 0.08[a]	1.01 ± 0.04[a]
T9	75.69 ± 0.35[a]	75.85 ± 0.53[a]	20.5 ± 0.09[a]	20.45 ± 0.14[a]	1.03 ± 0.06[a]	1.01 ± 0.02[a]	0.68 ± 0.08[a]	1.03 ± 0.04[a]
T10	75.93 ± 0.83[a]	75.48 ± 0.28[a]	20.40 ± 0.22[a]	20.52 ± 0.07[a]	1.09 ± 0.07[a]	1.03 ± 0.07[a]	0.66 ± 0.13[a]	0.84 ± 0.21[a]
T11	76.30 ± 0.76[a]	75.68 ± 0.42[a]	20.45 ± 0.20[a]	20.62 ± 0.11[a]	1.01 ± 0.02[a]	1.02 ± 0.03[a]	0.57 ± 0.16[a]	0.96 ± 0.01[a]
T12	74.78 ± 0.12[a]	75.49 ± 0.17[a]	20.40 ± 0.03[a]	20.21 ± 0.04[a]	1.06 ± 0.06[a]	1.08 ± 0.05[a]	0.61 ± 0.04[a]	0.98 ± 0.04[a]

-Values within columns within different letters are different ($P \leq 0.05$)

References

[1] Duclos, M. J.; C. Berri, and E. L. Bihan-Duval, Muscle growth and meat quality. Appl. Poult. Res. 16:107–112. (2007).

[2] Musa, H. H.; G. H. Chen; J. H. Cheng; B. C. Li, and D. M. Mekki, Study on carcass characteristics of chicken breeds raised under the intensive condition. Int. J. Int. J. of Poult. Sci. 5: 530–533. (2006).

[3] Cuddington, S., High energy diets affect broiler chicken welfare. (2004).

[4] Dozier, W. A.; R. J. Lien; J. B. Hess; S. F. Bilgili; R. W. Gordon; C. P. Laster and S. L. Vieira, Effects of Early Skip-a-Day Feed Removal on Broiler Live Performance and Carcass Yield. Journal of Applied Poultry Research. 11:297–303. (2002).

[5] Oyedeji, J. O. and J. O. Atteh, Response of broilers to feeding manipulations. Inter. J. of Int. J. of Poult. Sci. 4(2): 91-95. (2005).

[6] Ozkan, S.; I. Plavnik and S. Yahav, Effects of early feed restriction on performance and ascites development in broiler chickens subsequently raised at low ambient temperature. J. Appl. Poult. Res. 15: 9-19. (2006).

[7] Camacho, D. F.; C. Lopez; E. Avila and J. Arce, Evaluation of different dietary treatments to reduce ascites syndrome and their effects on corporal characteristics in broiler chickens. J. Appl. Poult. Res. 11; 164-174. (2002).

[8] Nielsen, B. L.; M. Litherland and F. Nøddegaard, Effect of qualitative and quantitative feed restriction on the activity of broiler chickens. Applied Animal Behaviour Science, 83: 309-323. (2003).

[9] Ali, S. M. and H. O. Abdalla, Effect of diet dilution and quantitative feed restriction on the gastrointestinal tract of broiler chickens. University of Khartoum Journal of Agricultural Science. 14: 289-300. (2006).

[10] Petek, M., The effects of feed removal during the day on some production traits and blood parameters of broilers. Turkey Journal Veterinary Animal Science. 24:447-452. (2000).

[11] Rezaei, M.; A. Teimouri; J. Pourreza; H. Sayyahzadeh and P.W. Waldropup, Effect of diet dilution in the starter period on performance and carcass characteristics of broiler chicks. Journal of Central European Agriculture. 7:63-70. (2006).

[12] De Silva, P. H. G. J. and A. Kalubowila, Influence of feed withdrawal for three hour time period on growth performance and carcass parameters of later stage of male broiler chickens. Iranian J. Appl. Anim. Sci., 2: 191-197. (2012).

[13] AOAC. Association of Official Analytical Chemist, Appendix G: Guidelines for Collaborative Study Procedures to Validate Characteristics of a Method of Analysis, Official Methods of Analysis, 12p. (2002).

[14] XLSTAT, Addinsoft Pro version 7.5.3. http: // WWW.Xlstat.com/en/ho. (2004).

[15] Duncan, D. B., Multiple range test. Biometrics, 11: 1-42. (1955).

[16] Fayad, H. A. A. and S. A. H. Naji, Technology Poultry Products. The first edition, the printing press directorate of the Ministry of Higher Education. Baghdad. (1989).

[17] Fujita, M. and S. Yamamoto, Effects of Behavior Restriction on Gizzard Motility in Growing Layer Chickens. Nihon Chikusan Gakkaiho. 61 (8) P: 725-729. (1990).

[18] Okuda, Y.; M. Ono; I. Shibata; S. Sato and H. Akashi, Comparison of the polymerase chain reaction-restriction fragment length polymorphism pattern of the fiber gene and pathogenicity of serotype-1 fowl adenovirus isolates from gizzard erosions and from feces of clinically healthy chickens in Japan. J Vet Diagn Invest. ; 18(2):162-7. (2006).

[19] Nwabuzor, C., Quantitative Feed Restriction on Broiler Chickens; Effect on the growth performance and carcass characteristics. Agriculture diary. (2008).

[20] Apeldoorn, E. J.; J. W. Scharama; M. M. Machaly and H. K. Parmentier, Effect of melatonin and lighting schedule on energy metabolism in broiler chickens. Int. J. of Poult. Sci., 78: 223229. (1999).

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

[22] Sahraei, M. and, F. Shariatmadari, Effect of different levels of diet dilution during finisher period on broiler chickens performance and carcass characteristics. International Journal of Int. J. of Poult. Sci. 6: 280–282. (2007).

[23] Yang, Y. X; J. Guo and S. Y. Yoon,: Early energy and protein reduction: Effects on growth, blood profiles and expression of genes related to protein and fat metabolism in broilers. Brit. Int. J. of Poult. Sci. 50: 218–227. (2009)

[24] Sahraei, M., Feed restriction in broiler chickens production: A review. Global Veterinaria 8: 449–458. (2012).

[25] Dozier, W. A.; R. J. Lien; J. B. Hess and S. F. Bilgili, Influence of early skip-a-day feed removal on live performance and carcass yield of broilers of different sexes and strain sources. J. Appl. Poult. Res., 12:439-448. (2003).

[26] Avcilar, Ö. V. and E. E. Onbasilar, Effects of breeder age and early energy restriction on fattening performance, some meat quality traits and plasma leptin concentration of broilers. Ankara Üniv Vet Fak Derg, 63; 69-76. (2016).

[27] Ghazanfari, S.; H. Kermanshahi; M. R. Nassiry; A. Golian; A. R. H. Moussavi and A. Salehi, Effects of feed restriction and different energy and protein levels of the diet on growth performance and growth hormone in broiler chickens. J. Biol. Sci. 10:25-30. (2010).

[28] Benyi, K.; O. cheampong-Boateng and D. Norris, Effects of strain and different skip-a-day feed restriction periods on growth performance of broiler chickens. Trop. Anim. Health Prod. 42:1421-1426. (2011).

[29] Abdel-Azeem, F. A.; A. A. Shafei; F. A. Mohammed and A. E. Farg, Productive and physiological performance of Saso broiler chickens as affected by different feeding systems. Egypt. Int. J. of Poult. Sci. 32 (I): (131-152). (2012).