



The impact of quantitative feed limitation on broiler female chick production performance

Shahla Muhammad Saeed², Zainab Omer Hama¹, Sarood Samal Shawkat^{1*},
Rozhgar Baiz Saeed¹ and Hemin Nuradden Mohammed¹

¹ Animal Science Department, Agriculture College, University of Sulaimani, Sulaimani, Iraq

² Veterinary Techniques, Kalar Technical Institute- University of Garmian Polytechnic, Kalar, Iraq

*Corresponding author e-mail: sarood.shawkat@univsul.edu.iq

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Received: Feb. 24, 2025	Abstract Two hundred sixty female chicks, of the Ross 388 breed, have been acquired. The study participants consisted of two-week-old chicks. Following a random selection of twenty groups, each including thirteen chicks with a mean body weight, the groups were assigned to one of four treatments, with five replicates for each treatment. The research was conducted in the Department of Animal Science within the College of Agricultural Engineering Sciences at the University of Sulaimani, Iraq from September 2, 2023, to November 15, 2023. The treatments included T0, which did not involve removal, T1 Remove feed for 6 hours within 24 hours (from 9 am to 3 pm), T2 feed removal for 9 hours within 24 hours (from 9 am to 6 pm), and T3 feed removal for 12 hours within 24 hours (from 9 am to 9 pm). Between 15 and 42 days of age, there were no discernible fluctuations in any of the treatments for productive performance markers, except feed intake, which exhibited a significant disparity ($P \leq 0.05$). T3 and T2 (control) had the lowest amounts of food consumption were (3683.66 and 3905.75) g, while T0 was (4324.52) g the highest amount. The Production Index and the Economic Figure differed significantly in their characteristics. However, the changes in treatments mostly pertained to the age categories of 15-21, 22-28, and 29-42 days, particularly about live body weight and weight gain. These inequalities affected the attributes that contribute to successful performance. This study aimed to examine the influence of feed deprivation on the efficiency of female broiler chicks at different stages of development.
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Introduction

Genetic improvements, better feeding, and climatic control have reduced the time it takes for female chicks to reach their ultimate body weight of around 2 kg to 33 days. This is an enormous increase in growth rate over the last few decades [1]. Commercial broiler chicken genetic traits raised chosen for their quick growth and



high breast yield in rigorous rearing systems to produce meat. [2]. Health and welfare are compromised in these extreme circumstances. There may be a high prevalence of metabolic disorders such as ascites, lameness, mortality, and sudden death syndrome [3 and 4]. Feed restriction can be applied in quantitative and qualitative ways, each with its impact on output efficiency [5 and 6]. Due to quantitative feed constraints, birds are significantly faster-growing broilers and are restricted in acquiring the nutrients necessary for average growth and development. Birds are fed primarily mixed with inert fibers to limit their intake of nutrients, which is a qualitative feed constraint. On the other hand, a quantitative feed limitation restricts the birds' ability to physically reach food and water during specific time intervals [7 and 8]. Nevertheless, due to the increasing expenses associated with feed, there is a discernible trend toward adopting feed limitation and other techniques to enhance feed quality and minimize the buildup of belly fat [9]. Quantitative feed limitation is used as a technique to control chicken development by reducing the growth rate, hence reducing the occurrence of metabolic illnesses and improving the effectiveness of feed [10]. Although research on feed limitation and compensatory growth was concluded two decades ago, genetic companies continue to augment the growth capacity of broilers in their efforts [11]. Furthermore, it was observed that the chick's gender had a pivotal effect, as only the female chicks that received a restricted diet showed a significant rise in fat content by day 42. Rapid growth has been demonstrated to have detrimental effects on the quality of meat [12], particularly about increased abdominal fat and decreased levels of polyunsaturated fatty acids and intramuscular fat. [13] claim that abdominal fats are the primary source of waste in slaughterhouses. How these facts are disposed of will determine how much waste is produced from the carcass and how polluted the environment is. The present study aimed to ascertain the impact of feed removal on the body's productive performance and reduce the feed cost for female broiler chicks.

Materials and Methods

The Bakrajo Poultry Farm, Department of Animal Science, College of Agricultural Engineering Sciences, University of Sulaimani, Iraq, was the site of this study. 20 groups of 13 female broiler chicks, with average body weight in each pen, were created from 260 initial broiler chicks (Ross 308 weight). These chicks were divided into four treatments, each with five duplicates at random. Following a period of unrestricted feeding for two weeks, the female broiler chicks were transitioned to a daily restricted diet to assess the impact of feed withdrawal on their production. Following the trial, a design with four treatments was implemented using complete randomization: T0: Maintain current feeding schedule. T1: Cease feeding for six consecutive hours daily, from 9 am to 3 pm. T2: Cease provides nine consecutive hours daily, from 9 am to 6 pm. T3: Cease feeding for 12 hours daily, from 9 am to 9 pm. The formulation of diets was conducted by the National Research Council in 1994 [14].

Table (1): Composition of nutrients

Ingredient % as feed-basis	Starter diet (1-14hdays) %	Growth diet (15-28hdays) %	Finisher diet (36-42hdays) %
Wheat	23.6	23	27.5
Corn	35.5	34.8	39.7
Meat and bone meal (40%)	3	0.6	0.4
Soybean meal (%44)	29.9	33.04	23.28
Sunflower seed Oil	4	5	5
Dual-calcium phosphate	2.3	1.94	1.86
Limestone	1.15	1.16	1.11
Salt	0.25	0.25	0.25
Methionine	0.2	0.11	0.8
Premix1	0.1	0.1	0.1
Total	100	100	100
Feed subjected to chemical analysis			
** Crud protein %	22	20	17
* Metabolizable energy Kcal/kg	2919	3056	3079
** Ether extract %	5.3	6.05	6.12
* Crude fibre %	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 premix contains the following ingredients: 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)

Two, The nutritional requirement is calculated based on (2). * Computed, ** Analytical examination of substances.

Traits

Live body weight: The birds were weighed before the experiment began and at (15, 22, 28, 35, and 42 days of age) according to [15]. Bodyweight gain and feed intake were calculated according to [16]. The feed conversion ratio was calculated according to [17]. At the same time, production index and economic figures were calculated according to (18).

Methods of data analysis

Excel software was used to analyze all the data obtained during the experiment. Calculations for the parameters of the various therapies were performed. Data were



analyzed using SAS [19], and CRD design. Significant treatment differences were found at the $P \leq 0.05$ level [20].

Results and Discussion

Table 2 displays the feed restriction in terms of quantity on the live body weight (g) of female broiler chicks at various age periods. The findings showed that the age ranges of (22-28), (29-35), and (36-42) between the feed removals, there were no significant in live body weight between the treatments. Birds in treatment T0 (control) possessed a considerably ($P \leq 0.05$) higher live body weight (909.50 g) than those found in other treatments when they were between 15 and 21 days old. During the most recent age period (36-42 days), T2 birds had the highest live body weight (2892.50 g), while T3 birds had the lowest mean (2767.50 g).

Table (2): The effect of treatments on live body weight (g/bird) of broiler female chicks ($M \pm S.E.$).

T.	Age (days)			
	15-21	22-28	29-35	36-42
T0	909.50 ± 01.50a	1461.00 ± 39.00a	2079.00 ± 10.00a	2790.00 ± 175.00a
T1	854.50 ± 27.50ab	1392.50 ± 50.50a	2042.00 ± 33.00a	2815.00 ± 175.00a
T2	853.00 ± 07.00ab	1400.50 ± 17.50a	2082.50 ± 17.50a	2892.50 ± 152.50a
T3	833.50 ± 02.50b	1365.00 ± 18.00a	1910.50 ± 86.50a	2767.50 ± 122.50a

- Certain letters ($P \leq 0.05$) have different values within the columns.

The influence of quantitative feed restriction on body weight gain (g) is shown in Table 3. The results show no significant differences in body weight gain observed between the treatments, except for the (15–21 days of age) period. Throughout the entire (15–21) day treatment, the birds in T0 gained more weight—a total of 477.50 g than those in other treatments.

Table (3): The effect of treatments on body weight gain (g/bird) of broiler female Chicks ($M \pm S.E.$)

T.	Age (days)				
	15-21	22-28	29-35	36-42	15-42
T0	477.50 ± 10.50a	551.50 ± 40.50a	618.00 ± 38.00a	711.00 ± 174.00a	2358.00 ± 175.00a
T1	437.00 ± 10.00ab	538.00 ± 23.00a	649.50 ± 17.50a	773.00 ± 42.00a	2397.50 ± 157.50a
T2	424.50 ± 14.50ab	547.50 ± 10.50a	682.00 ± 35.00a	810.00 ± 35.00a	2464.00 ± 145.00a
T3	367.50 ± 32.50b	531.50 ± 15.50a	545.50 ± 38.50a	857.00 ± 36.00a	2301.50 ± 152.00a

- Certain letters ($P \leq 0.05$) have different values within the columns.

The feed intake (in grams per bird) of broilers under quantitative feed limitation in different age groups is shown in Table 4. No notable disparities were seen between the treatments in both age cohorts (22–28 and 29–35). However, the findings indicate that there were significant variations in the quantity of feed eaten among the treatments over the age periods of (15–21) days, (36-42) days, and the total period of (15–42) days ($P \leq 0.05$). The birds that belonged to treatment T0 (control) consumed the



most diet in the age group (15–42) days, weighing 4324.52 g. Conversely, the birds in treatment T3 consumed the least amount of diets (3683.66).

Table (4): The effect of treatments on feed intake (g/bird) of broiler female chicks (M±S.E.).

T.	Age (days)				
	15-21	22-28	29-35	36-42	15-42
T ₀	760.44 ± 31.87a	946.02 ± 42.45a	1222.23 ± 55.56a	1395.84 ± 04.17a	4324.52 ± 14.60a
T ₁	644.01 ± 09.48b	903.71 ± 49.87a	1135.42 ± 89.59a	1401.47 ± 70.73a	4084.72 ± 78.20b
T ₂	630.35 ± 08.95b	896.40 ± 10.70a	1066.50 ± 37.50a	1312.50 ± 16.50ab	3905.75 ± 73.65b
T ₃	633.66 ± 08.66b	810.17 ± 25.55b	1066.49 ± 45.95a	1173.36 ± 30.50b	3683.66 ± 08.66c

- Certain letters (P≤0.05) have different values within the columns.

Table 5 displays the influence of quantitative feed limitation on the feed conversion ratio (g feed/g weight) across several age groups in the treatments. Upon analyzing the data, it was found that there were no significant differences in the age ranges of (15–21), (29–35), (36-42), and (15–42) days, respectively, among the treatments. Throughout 22 to 28 days, notable differences (P≤0.05) were seen across the treatments. After analyzing data obtained over 28 days, we found that birds treated with T3 performed better than birds treated with other methods regarding feed conversion ratio. On average, T3 treatment birds had a feed conversion ratio of 1.53, whereas birds in the control group (T0 treatment) had a higher ratio of 1.72, indicating worse feed conversion.

Table (5): The effect of treatments on feed conversion ratio (feed/g weight) of broiler female chicks (M±S.E.).

T.	Age (days)				
	15-21	22-28	29-35	36-42	15-42
T ₀	1.60 ± 0.07a	1.72 ± 0.05a	1.99 ± 0.04a	2.10 ± 0.52a	1.85 ± 0.13a
T ₁	1.48 ± 0.01a	1.68 ± 0.02a	1.76 ± 0.19a	1.83 ± 0.19a	1.71 ± 0.01a
T ₂	1.49 ± 0.03a	1.64 ± 0.01a	1.58 ± 0.14a	1.63 ± 0.09a	1.59 ± 0.06a
T ₃	1.75 ± 0.18a	1.53 ± 0.01b	1.99 ± 0.24a	1.38 ± 0.10a	1.61 ± 0.11a

- Certain letters (P≤0.05) have different values within the columns.

Figure 1 reports the effects of quantitative feed restriction on the economic figure and production index of broiler female chicks at different ages. The study's findings showed significant differences (P≤0.05) across all periods. During the 15–21 day age range, T1 had the highest production index measure (276.85), while T0 (control) had the lowest mean (227.24). The lowest mean (345.27) was recorded in T1, while the highest mean (375.15) for the period of age (22-28) was attained in T3. The highest mean of T2 during the period of (29–35) days was (429.91), while the lowest mean in T3 was (358.13). T2 (462.16) has the highest mean for the period (36-42) days of age, while T0 (control) has the lowest mean (364.90).

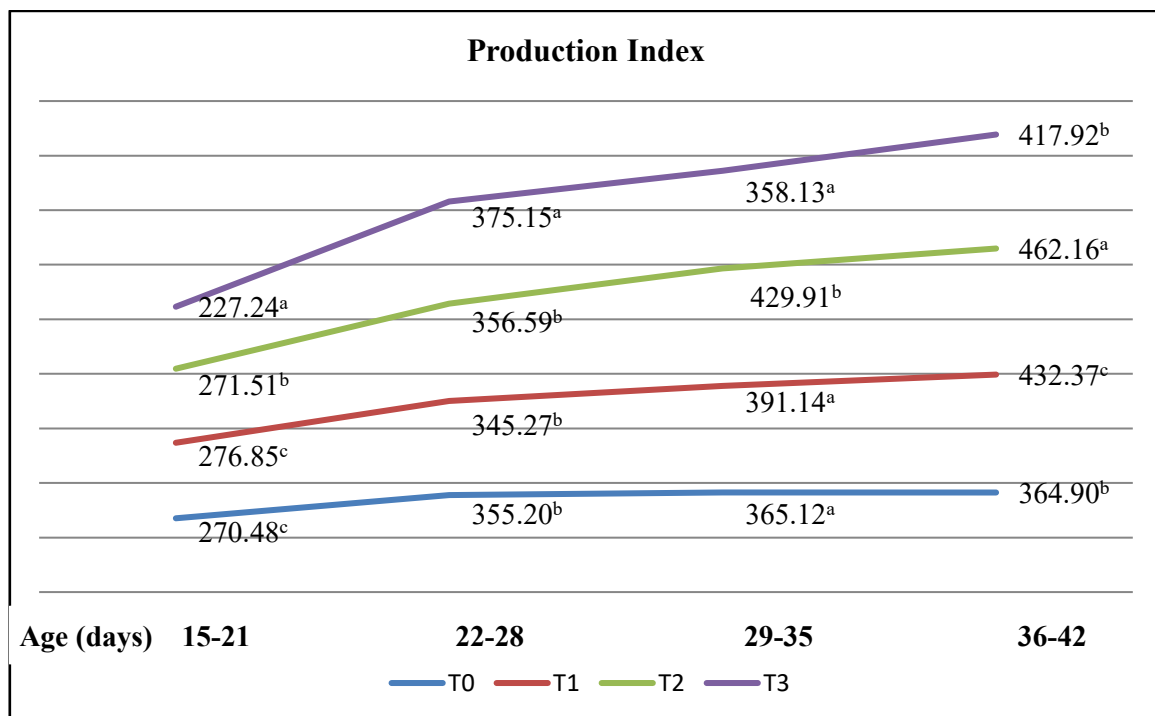


Figure 1. The effect of treatments on the production index of broiler female chicks

Figure 2 displayed the economic findings of the investigation, revealing highly significant variations ($P \leq 0.05$) in the financial implications across the different treatments. The T2 chicks had a higher economic value of 41.53 than the T0 (control) birds' monetary value of 36.41.

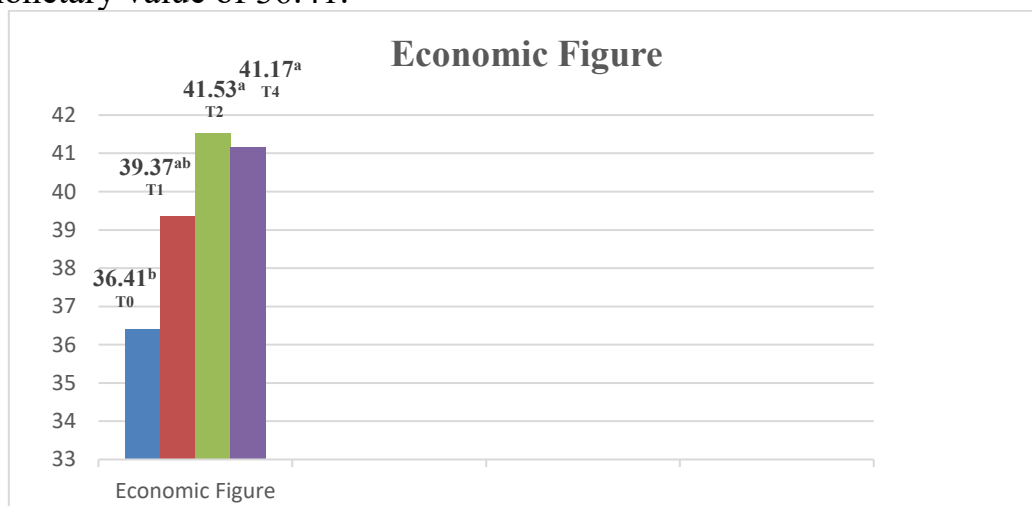


Figure (2): The effect of treatments on the economic figure of broiler female chicks

The experiment's findings showed that the ultimate body weight, overall body weight gain, and feed conversion ratio at 15-42 days generally were significantly unaffected by feed restriction. On 15-42 days, all treatments had different results for body weight gain; these results may be due to the fact that during development,

chickens need to allocate their available energy between maintenance, growth, and maturation, and food availability consequently plays a vital role during this period [21]. The results of this study's body weight analysis are in line with those of [22], who found that neither the levels of restriction nor the time intervals had a significant impact ($P \leq 0.05$) on the live body weight. However, these findings differ from those of [23], who found that the body weight of broilers decreased as the level of feed restriction increased, with a significant decline observed for 10% feed restriction. The weight gain obtained in the experiment for the age range of 15 to 21 agrees with the findings of [24], who reported that the control birds showed significantly ($p \leq 0.05$) higher weight gain than the restricted ones. The weight gain obtained in the experiment also agrees with the findings of [23], who suggested that feed restriction had no significant effect on the body weight gain of broilers during the 1-42 day period. In their investigation into the effects of feed restriction, [22] found no differences in weight gain between the treatments. According to [25], during the finisher and overall phases, the body weight gain in the birds fed a 90% diet was significantly higher than that of the control diet. During the starter period, the opposite was true.

The findings of the current investigation were corroborated by earlier findings [23, 26 and 27]. These findings conflicted with those reported by [28], who stated that ration restriction would disrupt the growth of the hens but restore average growth once the hens resumed regular dietary intake. This phenomenon can be explained by the chickens not getting enough protein and energy from their diet rations. There was a significant difference in the feed intake of birds fed in restricted and unrestricted conditions. The responses observed in the present study partially did not agree with those reported by [29]; in contrast, they found that feed limitation led to an increase in feed intake, which is consistent with the findings of [21 and 30]. The increased feed intake may be attributed to the enlargement of the gastrointestinal tract after the restriction when the birds are provided unrestricted access to feed. The feed conversion had no significant difference in 15-42 days. This observation agreed with [23 and 31].

[32] observed no significant effects of feed restriction on average daily feed intake. The physical form of the feed, the degree of feed restriction, and the length of the feed restriction and refeeding period are just a few of the variables that may interact reciprocally to cause the reasons [33]. However, [24] have announced that the lowest overall feed conversion ratio was reported significantly in the birds fed with a 70% diet.

The index is regarded as one of the most critical aspects in evaluating bird production performance since a higher production index provides an economic indicator for excellent breeding, thus dependent on the productive efficiency of the T4 index, is associated with the supremacy of the same treatment in increasing body weight and weight gain, which is considered one of the critical factors in the calculating of the factor productivity efficiency, [34]. [35] reported that there were no statistical differences in the production index among the treatments. The production index is considered vital in evaluating bird production performance due to its correlation with the T4

index's productive efficiency. A higher production index serves as an economic signal for improved breeding. Moreover, a correlation exists between more significant production indices and the same therapy's effectiveness in promoting body weight and weight increase. This is considered a crucial component in evaluating the efficiency of factor productivity [34].

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