Utilization of Restricted feed in various time on Protein and Energy Efficiency of Female Broiler Chicks

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Abstract

Considerable research has investigated the potential benefits of reducing protein content in broiler chicken diets, yielding varied outcomes. Broiler feed intake has been restricted through various regimens, which have demonstrated reductions in feeding expenses, decreased fat deposition, enhanced feed efficiency, and lowered incidence of metabolic disorders. This study aimed to elucidate the advantages of feed restriction on the energy and protein efficiency of female broiler chicks. The experiment involved four treatments, each with five replicates, conducted on 300-day-old broiler chicks. The chick groups were randomly allocated into 20 groups of 15 chicks, with similar average body weights per pen, and subjected to four distinct treatments with five replicates each. The control group received ad libitum feeding, while the second group (T1) experienced restricted feeding for 4 hours within a 24-hour period (9 am–1 pm). The third group (T2) faced restrictions from 9 am to 5 pm, and the fourth group (T3) from 9 am to 9 pm. Water was the only freely available resource. All birds were fed a standard diet following the suggested technique (NRC, 1994). Over recent decades, significant improvements have been observed in the growth rate, feed efficiency, and meat yield of broiler chickens due to advancements in genetics, nutrition, and environmental control. The imposition of feed restriction notably enhanced weight gain at the experiment's conclusion, particularly evident in the second and third treatments. These differences were statistically significant, resulting in reduced feed consumption and meaningful improvements in food conversion efficiency, protein and energy utilization, and protein and energy conversion rates.

Keywords: Feed Removal, Protein, Energy Efficiency, Female, Broiler Chicks.

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Introduction

The global production of chicken meat is expected to exceed 125.5 million tons in 2020, demonstrating the vital role that the poultry industry plays in satisfying the increasing demand for animal protein. Over the past few decades, advancements in genetics, enhanced nutrition, and regulated environments have led to notable improvements in broiler chicken growth rate, feed efficiency, and meat yield. However, there have been conflicting findings from studies that have examined the advantages and potential of lowering the protein content of broiler chicken diets. prevent fat deposition, increase feed efficiency, and lower the incidence of metabolic disorders in broilers, restricted-feeding regimens have been implemented. The evidence of restricting feed intake can lower mortality rates, fat deposition, and early growth. However, the degree, timing, and duration of the restriction have all been linked to inconsistent findings in recent research. Genetic selection and better nutrition have largely been responsible for the substantial increases in broiler chicken growth rate, feed efficiency, and meat yield over the past few decades (Zubair and Leeson, 1996). It now only takes broiler chickens 33 days to achieve their finishing body weight of roughly 2 kg, thanks in large part to genetic advancement, better feeding, and controlled environments during the past 30 years (Wilson, 2005). In recent research, while with mixed results (Attia et al., 2018; Soares et al., 2020), the benefits and potential of lowering the protein content in broiler chicken diets have been considered. As the main source of protein in field diets, soybean meal is reduced when feed protein levels are lowered. This leads to an increase in synthetic amino acids and maize and a drop in soybean oil or another lipid source (Soares et al., 2020). However, due to the extra-calorie impacts of oils and fats, poultry performance may be negatively impacted by reducing the presence of a lipid source. to limit broiler feed intake, quantitative and qualitative restricted-feeding programs have been used (Tolkamp et al., 2005; Zhan et al., 2007). These initiatives seek to enhance feed efficiency, reduce feeding expenses and fat deposition, limit the negative impacts of fat on human health, and lessen the frequency of metabolic illnesses in birds.

According to studies Navidshad et al., (2006) and Mahmud et al., (2008), feeding restrictions have been shown to decrease early growth, fat deposition, and death rates as well as the frequency with which these health issues arise. According to recent research, feed restriction can vary in intensity, timing, and length (Navidshad et al., 2006; Khajali et al., 2007). These reports have been inconsistent. Therefore, it has been suggested that feed restriction will lessen these issues. to achieve market body weight in broiler chickens that is comparable to control groups, early feed restriction programs rely on a phenomenon called compensatory growth, sometimes referred to as catch-up growth. Compensatory growth, often referred to as catch-up growth, is unusually rapid growth relative to age. Ad libitum feeding after nutritional deprivation that has inhibited growth results in an accelerated rate of growth that surpasses the normal rate of gain. It has been hypothesized that feed limiting could help to mitigate these problems. Compensatory growth, often referred to as catch-up growth, is the strategy used in early feed restriction programs to eliminate belly and carcass fat in broiler chickens and achieve market body weights comparable to control groups. Overly rapid growth relative to age is referred to as compensatory growth, or catch-up growth. Ad libitum feeding after nutritional deprivation that has inhibited growth causes an accelerated rate of growth that exceeds the normal rate of gain. The aim of This study is effect of feed restricted in various different time on production trials, protein and energy efficiency of female broiler chicks.

Materials and Methods:

Experimental Birds:

In the Animal Science Department of the College of Agricultural Engineering Sciences at the University of Sulaimani in Iraq, a poultry farm served as the study's location. For this experiment, we utilized broiler chicks (Ross 308) that were 300 days old. The chicks were divided into 20 groups of 15 birds per pen based on their average body weight and randomly assigned to one of four treatments, each treatment having five replicates. The first group was controlled (ad libitum feeding), while the second group (T1) restricted feeding for 4 hours in 24 hours (9 am–1 pm). The third group (T2) is restricted to 8 hours (9 am–5 pm), and the fourth group (T3) is restricted to 12 hours (9 am–9 pm). Only water is provided ad libitum. Every bird was given a regular, conventional diet according to the suggested schedule (NRC, 1994).

The ingredients percentage of three types of diets include: Wheat (59.23, 65.71, and 69.1), The meal of bone, and meat, (2.5, 0.55, and 0.5), Soybean meal (30, 25, and 21.44), sunflower seed oil (4, 5, and 5), Dicalcium phosphate (2.3, 1.94, and 1.66), DL-methionine (0.2, 0.07, and 0.8), Lysine HCL (0.27, 0.22, and 0.2) Limestone (1.15, 1.16 and 1.05), salt (0.25, 0.25, and 0.25) and premix (0.1, 0.1 and 0.1) for Starter, Grower and Finisher respectively. While, the calculated contents were: Energy (2919, 3056 and 3079 Kcal/kg), protein (21.32, 19.27 and 17.8), crude fiber (3.15, 3.5 and 3.7), Calcium (0.97, 0.86 and 0.85), phosphate (0.51, 0.48 and 0.47), lysine (1.45, 1.3, and 1.22), Methionine (0.52, 0.50, and 0.48) and Methionine and cystine (0.90, 0.81, and 0.73) for Starter, Grower and Finisher respectively.

Studied Characteristics:

At the end of each week, a delicate scale was used to measure the weight of each chick. Each chick's average daily body weight gain was calculated by subtracting its average end live weight from its average initial live weight throughout the same period (usu ally weekly). A particular amount of feed was given to the chicks in each duplicate once a week. Every week, the leftovers were collected, and to find out how much feed the birds ate, we divided the amount of feed that was given to them at the start of the week by the amount that was still left at the end. It is possible to calculate the feed conversion ratio (FCR) and feed intake using the method described in (FAO, 2011).

Protein and Energy intake:

At the beginning of each week, specific ration quantities were weighed and distributed to the birds for each pan. The remaining portions of the ration from each room were weighed at the end of the week and subtracted from the original portion. The consumed diet was then multiplied by the ration's proportion of protein per age stage to determine protein consumption. Each age group's amount of metabolizable energy (i.e., 1–14 days old, 15–28 days old, 29–42 days old, and the total protein and energy consumption in one to 42 days intervals old) was multiplied by the amount of food consumed to get the weekly intake of protein and energy.

Analytical techniques for data:

The trial data was analyzed using the Excel program. There were parameter calculations for the various treatments. Using XLSTAT (2004), the data were analyzed according to Duncan (1955) and at a level of 5%.

Results and Discussion:

Table 1 shows the effect of restricted feed at various time on the weight gain (g/bird/day) of broiler chickens. The third treatment gave the highest daily weight gain of 220.35 with significant differences (P≤0.05) compared to the other treatments in 1-42 days, and the fourth treatment gave the lowest weight gain compared to the control treatment, with significant differences. As for the rearing periods, the second treatment gave the highest weight gain, with significant differences with the other treatments in the period of 29–42 days.

Table1 . Utilization of restricted feed at various time on weight gain (g/bird/day) of broiler chickens (Mean ± S.E.)

	Periods (days)			
Treatment	1-14 day	15-28 day	29-42 day	1-42 day
T1	31.77a ± 0.24	78.86a ± 2.17	102.57b ± 3.68	213.20b ± 7.54
T2	31.54a ± 0.31	76.81b ± 0.95	110.41a ± 4.21	218.76a ± 5.17
T3	30.53ab ± 0.17	78.13ab ± 1.11	111.69a ± 2.17	220.35a ± 3.28
T4	29.58b ±0.43	76.21b ± 1.36	103.18b ± 3.24	208.97c ± 6.19

At the below of each table write the information as follows:

T: treatment; T1: The first group was control (ad libitum feeding); T2: restrict from feeding for 4 hours in 24 hours (9 Am – 1 Pm);; T3: restricts for 8 hours (9 Am – 5 Pm); T4: restricts for 12 hours (9 Am – 9 Pm); SEM: Standard Error of Mean; abc Means with different superscripts across the Columns significantly different (P<0.05).

Table 2 indicates that there are significant (P≤0.05) differences between the treatments and that the fourth treatment consumed the least amount of feed, 325.64 grams, during the rearing period of 1–42 days, while the control treatment consumed the highest amount of feed, 360.00 grams per day. As for the breeding periods, the control treatment consumed the highest amount, with significant differences from the other treatments.

According to the study's findings, restricting the birds' eating times led to decreased body weight, market weight, and feed intake during the restriction period. Several studies have also revealed findings similar to these (Navidshad et al., 2006; Khajali et al., 2007; Benyi et al., 2011). The feed-restricted birds gained weight more quickly following re-alimentation, but not quickly enough to make up for the weight they lost during the restriction period. These results are consistent with those of other research conducted by Dozier et al. (2002), Saleh et al. (2004), and Urdaneta-Rincon and Leeson (2002), which discovered that although previously restricted birds demonstrated rapid development upon resumed full feeding, they were not able to fully recover from the effect of the restriction.

Table 2. Utilization of restricted feed in various time on feed intake (g/bird/day) of broiler chickens (Mean ± S.E.)

	Periods (days)			
T.	1-14 day	15-28 day	29-42 day	1-42 day
T1	41.24a ± 1.85	111.84a ± 1.98	206.92a ± 8.43	360a ± 5.47
T2	40.97a ± 0.87	108.4b ± 1.34	201.16b ± 6.25	350.53b ± 6.12
T3	41.31a ± 0.60	106.11b ± 2.13	189.87c ± 9.17	337.۲۹c ± 7.18
T4	40.68a ± 0.93	101.05c ± 1.91	183.91d ± 4.18	325.64d ± 4.13

At the below of each table write the information as follows:

T: treatment; T1: The first group was control (ad libitum feeding); T2: restrict from feeding for 4 hours in 24 hours (9 Am – 1 Pm);; T3: restricts for 8 hours (9 Am – 5 Pm); T4: restricts for 12 hours (9 Am – 9 Pm); SEM: Standard Error of Mean; abc Means with different superscripts across the Columns significantly different (P<0.05).

Table 3 presents the utilization of feed removal over different time periods on the feed conversion ratio (g feed intake/g body weight gain) of broiler chickens. The results indicate that there are significant differences (P≤0.05) in the feed conversion efficiency between the treatments, with the third and fourth treatments exhibiting the best results with a decrease in food conversion efficiency. Additionally, the treatments outperformed the control group for the weeks in which they were most effective.

Table 3. Utilization of restricted feed in various time on feed conversion ratio (g feed intake/g body weight gain) of broiler chickens (Mean ± S.E.)

	Periods (days)			
T.	1-14 day	15-28 day	29-42 day	1-42 day
T1	1.30ab ± 0.06	1.42a ± 0.03	2.01a ± 0.02	1.69a ± 0.05
T2	1.29b ± 0.02	1.41a ± 0.05	1.83b ±0.06	1.61b ± 0.03
T3	1.35a ± 0.05	1.36b ± 0.02	1.70c ± 0.09	1.53c ± 0.06
T4	1.37a ± 0.09	1.33b ± 0.07	1.78bc ± 0.03	1.56c ± 0.04

At the below of each table write the information as follows:

T: treatment; T1: The first group was control (ad libitum feeding); T2: restrict from feeding for 4 hours in 24 hours (9 Am – 1 Pm);; T3: restricts for 8 hours (9 Am – 5 Pm); T4: restricts for 12 hours (9 Am – 9 Pm); SEM: Standard Error of Mean; abc Means with different superscripts across the Columns significantly different (P<0.05).

Table 4 show the effect of feed removal in various periods on protein intake (g/bird/day) of broiler chickens the first and second treatments consumed the most protein compared to the other treatments, with significant (P≤0.05) differences over the end of 1-42 days. There are considerable changes between the periods 15-28 and 29-42 days. Also, the control and second treatments consumed the most, at 21.55 and 36.83, 20.89 and 35.81, respectively.

Table 4. Utilization of restricted feed in various time on protein intake (g/bird/day)

of broiler chickens (Mean ± S.E.)

	Periods (days)			
T.	1-14 day	15-28 day	29-42 day	1-42 day
T1	8.79a ± 0.03	21.55a ± 0.31	36.83a ± 0.49	67.17a ± 0.57
T2	8.73a ± 0.05	20.89a ± 0.17	35.81a ± 0.34	65.43a ± 1.13
T3	8.81a ±0.09	20.45a ± 0.26	33.80b ± 0.71	63.06b ± 0.94
T4	8.67a ± 0.04	19.48b ± 0.24	32.74b ± 0.68	60.89c ± 0.87

At the below of each table write the information as follows:

T: treatment; T1: The first group was control (ad libitum feeding); T2: restrict from feeding for 4 hours in 24 hours (9 Am – 1 Pm);; T3: restricts for 8 hours (9 Am – 5 Pm); T4: restricts for 12 hours (9 Am – 9 Pm); SEM: Standard Error of Mean; abc Means with different superscripts across the Columns significantly different (P<0.05).

Table 5 shows how the timing of feed withdrawal impacts broiler chickens' energy intake (Kcal/bird/day). The results showed. Over 1-42 days, the first and second treatments required significantly more energy than the other treatments (P≤0.05). There are significant differences between the durations of 15 and 28 days. Furthermore, the control treatments consumed the highest (341.78), and after 29-42 days, the control and second treatments consumed 637.11 and 619.37, respectively, compared to treatment.

Table 5. Utilization of feed restricted feed in various time on energy intake (Kcal/bird/day)

of broiler chickens (Mean ± S.E.)

	Periods (days)			
T.	1-14 day	15-28 day	29-42 day	1-42 day
T1	120.37a ± 5.14	341.78a ± 21.11	637.11a ± 95.32	1099.26a ± 90.21
T2	119.59a ± 9.21	331.27b ± 33.12	619.37a ± 108.14	1070.23a ± 102.34
T3	120.58a ± 6.44	324.27c ± 9.94	584.61b ± 76.81	1029.46a ± 78.13
T4	118.74a ± 3.17	308.81d ± 37.41	566.26b ± 102.74	993.81a ± 95.37

At the below of each table write the information as follows:

T: treatment; T1: The first group was control (ad libitum feeding); T2: restrict from feeding for 4 hours in 24 hours (9 Am – 1 Pm);; T3: restricts for 8 hours (9 Am – 5 Pm); T4: restricts for 12 hours (9 Am – 9 Pm); SEM: Standard Error of Mean; abc Means with different superscripts across the Columns significantly different (P<0.05).

In Tables 6 and 7, the forage removal treatments gave good and significant (P≤ 0.05) results for protein conversion efficiency, and energy conversion efficiency.

The results revealed that feed removal resulted in significant differences between the treatments, that the control treatment had a significantly higher protein conversion efficiency in a period of 1-42 days, that Table 8 also had significant differences in the energy conversion efficiency, and that the control treatment had the highest efficiency during the same time period.

Table 6. Utilization of restricted feed in various time on protein conversion efficiency (g protein intake/g body weight gain) of broiler chickens (Mean ± S.E.)

Periods (days)				
T.	1-14 day	15-28 day	29-42 day	1-42 day
T1	0.28ab ± 0.01	0.28a ± 0.02	0.36a ± 0.01	0.32a ± 0.02
T2	0.27b ± 0.02	0.27a ± 0.02	0.32b ± 0.03	0.30b ± 0.01
T3	0.29a ± 0.01	0.26b ± 0.01	0.30b ± 0.01	0.29b ± 0.01
T4	0.29ab ±0.01	0.25b ± 0.01	0.32b ± 0.02	0.29b ± 0.01

At the below of each table write the information as follows:

T: treatment; T1: The first group was control (ad libitum feeding); T2: restrict from feeding for 4 hours in 24 hours (9 Am – 1 Pm);; T3: restricts for 8 hours (9 Am – 5 Pm); T4: restricts for 12 hours (9 Am – 9 Pm); SEM: Standard Error of Mean; abc Means with different superscripts across the Columns significantly different (P<0.05).

Table 7. Utilization of restricted feed in various time on energy conversion efficiency (Kcal/g body weight gain) of broiler chickens (Mean ± S.E.)

Periods (days)				
T.	1-14 day	15-28 day	29-42 day	1-42 day
T1	3.79b ± 0.83	4.33a ± 0.90	6.21a ± 1.17	5.15a ± 2.14
T2	3.79b ± 0.97	4.31a ± 0.67	5.61b ± 2.36	4.89b ± 2.63
T3	3.95a ± 0.39	4.15b ± 1.93	5.23c ± 5.42	4.67b ± 4.41
T4	4.01a ± 1.01	4.05b ± 1.34	5.49b ± 3.13	4.75b ± 1.94

At the below of each table write the information as follows:

T: treatment; T1: The first group was control (ad libitum feeding); T2: restrict from feeding for 4 hours in 24 hours (9 Am – 1 Pm);; T3: restricts for 8 hours (9 Am – 5 Pm); T4: restricts for 12 hours (9 Am – 9 Pm); SEM: Standard Error of Mean; abc Means with different superscripts across the Columns significantly different (P<0.05).

Santoso et al. (1995) stated that the food contained 16% crude protein, which is lower than the typical 21-35% observed in diets utilized by birds without limitation or unrestricted grazing. Body weight at 43 days of re-feeding, regardless of food protein content, was faster than that of birds in the control condition with no feeding challenge. This produced birds with weights comparable to birds at 56 days of age

Benyi and Habi (1998) observed A similar impact on ultimate body weight and development rate when feeding time was reduced by two days per week. A 15% feed restriction appears to be less harmful to the bird than a 30% feed reduction in terms of quantity offered. The fact that fame through advertising governs those Despite the fact that the control birds consumed more feed than the restricted birds, the effectiveness of foraging was the same regardless of the feeding system. This runs counter to previous findings that feed restriction increased feed efficiency (Navidshad et al., 2006; Mahmud et al., 2008).

These outcomes may be attributable to the diets' reducing AA or providing enough quantities of CP. The fact that the dietary CP content was shown to have no effect on feed intake and, by extension, the weight gain of chicks is supported by the fact that the ME content was found to be constant across all diets. This finding was in strong agreement with the feed intake and weight gain outcomes observed in studies conducted by Han et al. (1992), Moran et al. (1992), Moran (1994), and Abdel-Maksoud et al. (2010). In these studies, broilers had similar outcomes when the CP content of their diet was reduced from 23% to 20% and from 20% to 17% between 0 and 3 weeks of age and 3 and 6 weeks of age, respectively. Similarly, Widyaratne and Drew (2011) found that low CP diets that are easy to digest can lead to results that are on par with high CP diets when it comes to feed intake and weight increase. Reducing the CP content of the diet from 24% to 22, 20, and 18% had no influence on feed intake, according to Cheng et al. (1997a, b).

Conclusion:

Feed restricting at different times led to an increase in weight, and the third treatment gave the highest results significant differences from the other treatments. Feed consumption, a fourth treatment, gave the lowest consumption, with significant differences from the other treatments. As for the efficiency of food conversion, the third treatment gave the best results. The treatments led to improved energy and protein consumption, as well as consumption efficiency.

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