University of Thi-Qar Journal of agricultural research

Thi-Qar Journal of agricultural research

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 1 (2025) PP 98-104

https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/cxy7fd13*

Effect Of Early Quantitative Feed Restriction On Growth And Production Indicators Of Broiler Chickens

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Abstract

This study was conducted in the poultry field, College of Agricultural Engineering Sciences / University of Baghdad, during the period from 1/5/2023 to 5/6/2023. The aim of the study is to investigate the effects of feed restrictionsat an early age on the production performance of broiler chickens. Three hundred one-day-old Ross 308 chicks with an average initial weight of 46 g were used for the study and divided into four treatments. Each treatment consisted of seventy-five birds divided into three replicates of twenty-five birds each. The four treatments included the following: The first treatment (T1): Ad libitum feeding during the study period of 1 to 35 days. The second, third and fourth treatments (T2, T3 and T4): Ad libitum feeding during the first week of life (1-7 days), restriction of feed by 15, 25 and 35% respectively during the period of 8-21 days, then ad libitum feeding during the remaining period (22-35 days). The results showed a significant decrease ($P<0.01$) in body weight at 35 days of age and weight gain over the entire period (1-35 days) at T2, T3 and T4 compared to T1, with T3 having an advantage over T2 and T4. With a significant decrease ($P<0.01$) in T2, T3 and T4 in feed intake over the entire period (1-35 days) compared to T1, with a significant decrease in T3 and T4 compared to T2. At the same time, no significant differences were observed in feed utilization, dressing percentage and percentage of carcass parts and some internal organs. These results therefore indicate the possibility of reducing nutritional and production costs through early feed restrictions without negatively affecting production performance.

Keywords: feed restriction, performance,broiler chicks

I. Introduction

The poultry industry in general has experienced great and rapid development in its various production chains. This development and the sharp increase in production have been accompanied by many negative factors, such as the increase in production costs and the increase in the percentage of deaths due to pathogenic and metabolic causes (Ibrahim, 2013). Therefore, researchers have started to use methods to reduce diseases due to metabolic processes while reducing production costs. Feed rationing is considered one of these important methods and means to improve the production performance of birds and reduce production costs by reducing the amount of feed consumed and the fat content of bird carcasses (Ibrahim, 2004 and Ocak and Sivi, 2007).

Feed restriction is one of the methods in which the amount of feed consumed by the bird is reduced compared to the amount it can consume when fed freely (ad libitum) at an early age in order to achieve compensatory growth in later periods, i.e. immediately after rationing (Yu et al., 1990; Rincon and Leeson, 2002). Since modern commercial breeds of broiler chickens are characterized by a high growth rate and high feed conversion ratio, which is associated with the occurrence of metabolic problems and cases of sudden death syndrome, weak legs, and high fat content of the carcass. It is also necessary to control feed intake in the early growth phase to manage growth, reduce mortality and allow for better compensatory growth (Tumova et al., 2002).

Zulkifli et al (2002) pointed out that the use of three systems of early rationing in feeding broiler chickens, namely 40%, 60% and 80% of free feeding in the first 4, 5 and 6 days of life, resulted in a significant decrease in body weight

University of Thi-Qar Journal of agricultural research

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https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

in the rationing treatments and at 14 days of age, and that no significant differences were found for this trait in the rationing treatments and the control treatment at 21 and 42 days of age.

Aflab and Khaa (2005) found a significant decrease in weight gain in treated animals at (4-11) (7-14) days of age in broilers and a decrease in weight gain in lambs at 17 days of age compared to the control treatment. Oeak and Sivri (2007) found a significant decrease in body weight of broilers on a feed ration treatment (25%) at (7-17), (14-24) and (31-41) days of age compared to the control treatment at 49 days of age.

Al-Fayyadh et al (2011) found that an early feed restriction (8-21) days and a late feed restriction (21-34) days and a rate of 20% with and without the addition of the probiotic and a rate of 0.3%, a significant improvement in feed conversion in the early and late feed ration with or without the addition of the probiotic compared to the control and a reduction in mortality rate in the late feed ration without the addition of the probiotic and a reduction in abdominal fat percentage in the early and late feed ration with or without the addition of the probiotic.

The aim of this study is therefore to determine the effect of early quantitative nutrient restriction from 8-21 days and at different restrictions (15, 25, 35%) for broiler diets and the extent of its effect on the productive performance of the animals and some qualitative characteristics of the carcass.

II. Materials and methods

The experiment was conducted in the poultry field of the College of Agricultural Engineering Sciences / University of Baghdad for the period from 1 January 2024 to 30 January 2024 to determine the effects of quantitative feed restriction for broiler chickens on the characteristics of productive performance. Three hundredone-day-old Ross broiler chicks with an initial weight of 46 g at 35 days of age were used for the experiment. The chicks came from a private hatchery (name of hatchery). The chicks were reared in a floor rearing hall divided into twenty-one rooms. Each room is equipped with an inverted 3-litre plastic trough, a scale, and a round floor feeder for the first week of the experiment. These troughs were then replaced with 5-litre troughs and hanging cylindrical plastic feeders. The intermittent lighting program was used, 23 hours of light, 1 hour of darkness, and the fans and desert cooling system were used to maintain the temperature in the hall.

The chicks were fed with commercial pellet feed in three stages, starter diet (1-11) days with an energy content of 3000 kcal/kg feed and 22.5% protein, growth diet (12-25) days with an energy content of 3100 kcal/kg feed and 21% protein and finisher diet with an energy content of 3200 and 19% protein (Table 1). According to the schedule,the feeding restriction of the birds started from the second week of rearing until the 21st day, after which the feed was given continuously ad-libitum. The chicks were randomly allocated to four treatments, with each treatment comprising three replicates of twenty-five birds each. The treatments were as follows:

1. Control treatment (T1): Birds were fed the diet recommended in the Ross 308 guide.
2. Second treatment (T2): Feed was restricted by 15%.
3. Third treatment (T3): Feed was restricted by 25%.
4. Fourth treatment (T4): feed was restricted by 35%

Table 1: Chemical analysis of diets

Content	Starter diet (1 – 11 day)	Grower diet (12 – 25 day)	Finisher diet (26 - 35 day)
Energy (Kcal/kg.)	3000	3100	3200
Crude protein	22.5	21	19
Ca	0.95	0.87	0.8

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https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

P	0.48	0.43	0.4
Lysin	1.28	1.15	1.03
Methionin-Systin	0.95	0.87	0.8
Thrionin	0.86	0.77	0.69
Valin	0.96	0.87	0.78
Na	0.16	0.16	0.16
Cl	0.21	0.21	0.21

The birds were weighed from the first to the fifth week (35 days) using a sensitive electronic scale and body weight, weight gain, feed consumption and feed conversion ratio were calculated according to Al-Zubaidi (1986). The net percentage and major carcass parts and internal organs of the animals were calculated according to Al-Fayyadh and Naji (1989). Samples were taken 35 days of age from two birds per replicate, i.e.,six birds for each treatment. After the birds had not been fed for 4 hours, they were slaughtered.

A complete randomizeddesign (CRD) was used to analyses the experimental results and the significant differences between the means were compared using Duncan's test.

III. Results and discussion

Table (2) shows the effects of a feed restriction of 15, 25 and 35% on the live weight of broiler chickens. The table shows no significant differences (P<0.01) in average live weight at one week of age, while the table shows significant differences (P<0.01) in average body weight at 2, 3, 4 and 5 weeks of age. The results show that feed restrictions decreased significantly in the T2, T3 and T4 treatments, with restrictions of 15, 25 and 35%, respectively, compared to the control treatment. At 3.2 weeks of age, T4 had the lowest weight rate, followed by T2 and then T3. This continued at 4 and 5 weeks of age, when T4 and T2 had the lowest body weight rate compared to the control treatment T1, followed by T3 (P<0.01).

Table 2: Effect of difference treatments/ quantitative rationing in average of Body weight

Treatment/ Quantitative rationing	Mean ±SE of Body weight (gm)				
	Week one	Week two	Week three	Week four	Week five
T1	222.47 ±1.00	564.06 ±6.07 a	1063.80 ±3.67 a	1732.14 ±40.66 a	2517.50 ±17.50 a
T2	209.29 ±11.85	418.53 ±8.47 c	783.33 ±8.65 c	1485.81 ±9.69 c	2338.00 ±3.15 c
T3	221.87 ±1.01	469.83 ±3.57 b	908.17 ±17.32 b	1576.15 ±5.86 b	2411.00 ±22.51 b
T4	210.97 ±5.14	387.64 ±5.69 d	715.78 ±11.05 d	1449.62 ±25.79 c	2305.00 ±11.54 c
Level of sig.	N.S.	**	**	**	**

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Means having the different letters in same column differed significantly. ** (P≤0.01).

Table (3) shows the effects of feed restriction on weekly and total weight gain (0-5) weeks in broiler chickens. The table shows a significant decrease (P<0.05) for this trait in all treatments with feed restriction T2, T3, T4 at 3.2 weeks of age compared to the control treatment where feed was not rationed as T4 recorded the least weight gain followed by T2 and then T3. In the fourth and fifth week, T4 continued to show the lowest rate and weight gain but was not significantly different from T2 and T3. As for total weight gain, the value of this trait continued to decrease with the increase in the percentage of feed restriction, as T4, T2 recorded the lowest weight gain, followed by T4, compared to the control treatment T1, which had the highest weight gain.

Table 3: Effect ofdifferent treatments/ quantitative rationing in Body weight gain

Treatment/ Quantitative rationing	Mean ±SE of Body weight gain (gm)					
	Week one	Week two	Week three	Week four	Week five	Total
T1	175.42 ±1.19	346.38 ±5.61 a	525.04 ±25.29 a	641.98 ±33.92 b	800.13 ±19.92 a	2488.96 ±20.15 a
T2	163.29 ±11.86	209.24 ±3.82 c	364.80 ±2.20 c	702.47 ±3.84 ab	852.19 ±9.54 ab	2292.00 ±2.14 c
T3	175.87 ±1.01	247.97 ±4.57 b	438.33 ±14.91 b	667.98 ±22.85 ab	834.85 ±16.90 ab	2365.00 ±22.51 b
T4	164.98 ±5.14	176.67 ±2.88 d	328.13 ±5.67 c	733.84 ±31.72 b	855.37 ±16.05 b	2259.01 ±11.54 c
Level of sig.	N.S.	**	**	*	*	**

Means having the different letters in same column differed significantly.
* (P≤0.05), ** (P≤0.01).

Table (4) shows that there were no significant differences (P<0.01) in the consumption rate between the experimental treatments at 5, 4 and 1 week of age. The table shows that this trait decreased significantly (P<0.05) in all feedrestricted treatments (T2, T3 and T4) at 2, 3 and total (0-5) weeks of age as feed intake decreased significantly (P<0.01) with increasing feed restriction. T4 had the lowest feed intake, followed by T2 and T3, compared to the control treatment, which had the highest feed intake

Table 4: Effect of different treatments/ quantitative rationing in Feed intake

Treatment/ Quantitative rationing	Mean ±SE of Feed intake-FI (gm/bird)					
	Week one	Week two	Week three	Week four	Week five	Total
T1	188.49 ±2.84	393.62 ±10.73 a	682.74 ±19.47 a	898.19 ±40.32	1150.00 ±28.86	3313.05 ±19.85 a
T2	173.11 ±10.21	321.20 ±1.05 b	553.35 ±2.05 b	917.48 ±11.68	1175.00 ±2.89	3140.14 ±18.09 b
T3	178.53 ±7.06	291.78 ±6.79 c	488.25 ±2.06 c	923.45 ±18.04	1192.00 ±1.15	3074.02 ±22.54 c
T4	177.42 ±7.45	246.93 ±1.05 d	423.15 ±2.07 d	908.53 ±17.78	1183.00 ±4.04	2939.04 ±18.47 d
Level of sig.	N.S.	**	**	N.S.	N.S.	**

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Means having with the different letters in same column differed significantly. ** (P≤0.01).

Regarding feed conversion, table (5) showed that there were no significant differences between the treatments at 1 and 5 weeks of age. However, at 2 and 3 weeks of age, there was a significant improvement (P<0.05) in feed utilization at T1 and 3T compared to T2 and T4 treatments. T4 showed a significant improvement (P<0.05) compared to treatment T2, which showed a deterioration in feed utilization in the fourth week. T4 showed a significant improvement (P<0.01) in this trait compared to the control treatment T1, but did not differ significantly from T2 and T3. These two treatments did not differ significantly from treatment T1 in the total utilization coefficient (0-5) weeks. There was a significant improvement (P<0.05) in treatment T3 compared to treatments T1, T2 and T4. T1 and T4 were not significantly different, but they were significantly different from T2.

Table 5: Effect of difference treatments/ quantitative rationing in Feed conversion ratio-FCR

Treatment/ Quantitative rationing	Mean ±SE FCR (kg FI/ kg weight gain)					
	Week one	Week two	Week three	Week four	Week five	Total
T1	1.073 ±0.02	1.136 ±0.02 c	1.307 ±0.08 b	1.403 ±0.02 a	1.436 ±0.01	1.271 ±0.02 b
T2	1.067 ±0.04	1.533 ±0.03 a	1.520 ±0.01 a	1.310 ±0.02 ab	1.380 ±0.02	1.362 ±0.01 a
T3	1.013 ±0.04	1.177 ±0.02 c	1.116 ±0.04 c	1.386 ±0.07 ab	1.426 ±0.03	1.224 ±0.01 c
T4	1.073 ±0.03	1.396 ±0.02 b	1.290 ±0.02 b	1.243 ±0.03 b	1.383 ±0.03	1.277 ±0.01 b
Level of sig.	N.S.	**	**	*	N.S.	**

Means having with the different letters in same column differed significantly. * (P≤0.05), ** (P≤0.01).

Table (6) shows the quantitative feed rationing in relation to average carcass weight, percentage of dressing, brisket, and leg. The results showed significant differences in average live weight and carcass weight of birds of different treatments as live weight of birds of treatments T2, T3 and T4 fed 15, 25 and 35% feed ration respectively decreased significantly (P<0.01) compared to control treatment. The average carcass weight also decreased significantly at T4 and T2 compared to the control treatment, while T3 was not significantly different (P<0.05) from T1, T2 and T4. There were no significant differences between the different treatments in terms of percentage of dressing, percentage of leg and percentage of brisket.

Table 6: Effect of difference treatments/ quantitative rationing in percentage of main cuts

Parameters	Mean ±SE				Level of sig.
	T1	T2	T3	T4	
Live body weight (gm)	2492.67 ±63.42 a	2238.67 ±36.41 b	2314.67 ±20.34 b	2180.00 ±76.74 b	**
Carcass weight (gm)	1918.00 ±43.09 a	1690.67 ±20.79 b	1784.00 ±73.65 ab	1655.33 ±51.56 b	*
Dressing (%)	76.95 ±0.26	75.53 ±0.34	77.13 ±3.81	75.96 ±0.69	N.S.
Thigh (%)	27.65 ±1.03	28.07 ±0.68	28.07 ±0.31	27.20 ±0.51	N.S.

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Breast (%)	38.52 ±1.57	36.96 ±1.27	37.01 ±1.68	36.65 ±0.48	N.S.

Means having with the different letters in same row differed significantly.
* (P≤0.05), ** (P≤0.01).

The table (7) showing the effects of quantitative feed ration on the percentage of internal organs for the different treatments shows that there were no significant differences (P<0.01) between all experimental treatments in terms of percentage of abdominal fat, heart and liver, and weight and length of small intestine. The table shows that the percentage of stomach was significantly increased in animals in treatment T3 compared to treatment T4 (P<0.01). These two treatments did not differ significantly (P<0.01) from T1 and T2.

Table 7: Effect of different treatments/ quantitative rationing in percentage of internal organs

Parameters	Mean ±SE				Level of sig.
	T1	T2	T3	T4	
Lipid (%)	1.09 ±0.13	1.17 ±0.04	1.25 ±0.09	1.13 ±0.33	N.S.
Heart (%)	0.457 ±0.06	0.529 ±0.01	0.546 ±0.05	0.506 ±0.05	N.S.
Liver (%)	2.61 ±0.28	2.67 ±0.19	2.36 ±0.11	2.37 ±0.21	N.S.
Gizzard (%)	1.18 ±0.12 ab	1.09 ±0.10 ab	1.40 ±0.09 a	1.03 ±0.04 b	*
Small Intestine weight (%)	1.49 ±0.04	1.47 ±0.09	1.69 ±0.11	1.42 ±0.13	N.S.
Small Intestine length (cm)	118.67±4.40	106.67 ±3.84	107.17 ±2.92	113.28 ±5.52	N.S.

Means having with the different letters in same row differed significantly.
** (P≤0.01).

The results showed a significant decrease in body weight and weight gain in the rationing treatments and in all ratios. The reason for these decreases could be that the chicks consume less feed during the rationing phase (8-21 days). As a result, the birds do not receive the full requirement of nutritional elements necessary for growth. These results confirm what Al-Hamoud (2009) found. The table ()shows that during free feeding (fourth and fifth week) there are no significant differences in the amount of feed consumed between the rationing treatments and the control treatment. This could be since the birds fed with the quantitative rationing program have a high ability to consume quantities of feed during the freefeeding period to compensate for the lack of feed consumed in the previous period. This was demonstrated by Ibrahim et al (2007). The significant improvement in feed conversion factor in the quantitative rationing treatments during and after the rationing period and throughout the period with the increase in rationing percentage may be due to the maximum benefit of feed ingested for growth purposes (Novel et al. al, 2008). The long time the feed remains in the digestive tract gives the bird a high ability to utilize the feed, improve digestion and intake and then benefit from the feed.

I. References

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 1 (2025) PP 98-104

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ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 14, Issue 1 (2025) PP 98-97

https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*