



Asian Journal of
Poultry Science

ISSN 1819-3609



Academic
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Research Article

Effect of Feeding Time Restriction During the Growing Period on Growth Performance of Broiler Chickens

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Abstract

Background and Objective: Feeding time restriction is an alternate, lower intensity type of feed restriction and is less stressful than other types. It is important to achieve beneficial effects from feed restriction without adverse effects on growth. This study aimed to determine the impact of feeding time restriction on growth performance of broiler chickens. **Materials and Methods:** Three hundred seven days old unsexed broiler chickens of the Lohmann commercial strain were used in a completely randomized design with 4 treatments and 5 replications. The treatments were the following: Broilers being fed *ad libitum* as a control group (P-0) and broilers having free access to feed during 9 h/day (P-1), 12 h/day (P-2) and 15 h/day (P-3). The feeding time restriction was done from 21-35 days of age. All data was analyzed based on a completely randomized design using SAS software. **Results:** Broilers had lower body weight gain, body weight and feed consumption due to feeding time restrictions P-1 and P-2, however, broilers that had access to feed during 15 h/day had a similar performance to broilers fed *ad libitum*. Feed conversion rates of broilers fed during 9 h/day were better than other treatments during the 1st week of feed restriction (21-28 days), however, there were no significant differences among the treatments during 29-35 days of age and the overall period of feed restriction (21-35 days of age). **Conclusion:** Broiler chickens with a feeding time restriction of free access to feed during 15 h/day during the grower period, had a similar performance at market age as broiler chickens with *ad libitum* feeding.

Key words: Broiler chickens, feeding time restriction, growth performance, *ad libitum*, growth period

Citation: Abdul Azis and Afriani, 2017. Effect of feeding time restriction during the growing period on growth performance of broiler chickens. Asian J. Poult. Sci., 11: 70-74.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Raising broiler chickens in tropical countries such as Indonesia is problematic owing to the direct effect of high ambient temperatures. In poultry production, environmental temperatures above 30°C result in heat stress that is considered one of the most common stresses. This stress is a major factor hindering poultry farmers, especially in the summer when using conventional, open-sided houses to control the microclimate in the broiler house. Heat stress has detrimental effects on the performance of broiler chickens during 4-8 weeks of age when reared in open-sided houses^{1,2}.

Broiler chickens are susceptible to heat stress due to high ambient temperatures during their growth period. Research has shown that broilers performed best after 21 days of age if reared at an ambient temperature of 24°C or during the diurnal cycle of 18-24°C³, 25°C⁴, 23°C² and 15.6-21.1°C^{5,6}. These temperature conditions are difficult to achieve in tropical climates.

Metabolic heat production associated with feeding and digestion can be a significant contributor to heat stress on broilers, particularly during hot hours of the day. It has been shown that heat production is associated with feed intake and metabolism. Therefore, reducing feed intake helps chickens withstand heat stress by decreasing their rate of heat production. For this reason, feed restriction during hot days is recommended to address this heat stress problem and it has become a common management practice in many broiler-producing areas¹. Abu-Dieyeh⁴ reported that body weight gain of birds fed 50% *ad libitum* and reared at 35°C was higher than birds reared at a constant 25°C or at variable, natural temperatures (21-30°C). In another report, Ahmad *et al.*⁷ suggested that intermittent feeding (1 h feed and 3 h off) can be effectively applied in open-sided houses, during hot climatic conditions.

In practice, alternative feeding time restriction is easier than quantitative feed restriction. Feeding time restriction is a feed restriction schedule, where chicks have free access to feed daily for 9 h/day or 15 h/day at specific times. Feed time restriction is an alternative to feed quantity restriction and it is less stressful^{8,9}. Feed time restriction may be a possible alternative, because broilers eat to their maximum physical capacity¹⁰ during times of feed availability. De Silva and Kalubowila¹¹ found that when feed was offered after 3 h of deprivation (13:00-16:00), broilers consumed higher amounts of feed within the first 2 h (16:00-18:00) as compared to the feed intake of the *ad libitum* group of broilers during the

same time period. Moderate feed restriction strategies are more appropriate to achieve beneficial effects from feed restriction without adverse effects on growth during growing periods. It is assumed that the feeding time restriction is not severe and it allows broilers to achieve a normal body weight at market age. Therefore, the objective of this study was to determine the effect of feeding restriction time during the growing period on the growth performance of broiler chickens.

MATERIALS AND METHODS

Chickens, feed and housing: A total of 300 unsexed Lohmann broiler chicks, bought from a commercial hatchery (PT Japfa Comfeed, Lampung, Indonesia), were used in the study. Chicks were fed a commercial starter diet (crumble) from 7-21 days of age and a commercial finisher diet (pellets) from 22-42 days of age. The commercial feed (manufactured by PT Japfa Comfeed, Lampung, Indonesia) was purchased from a poultry store. The nutrient composition of the commercial feed is presented in Table 1. All the chicks were reared in a conventional open-sided house with natural cyclic temperatures (minimum 20°C, maximum 34°C). The chicks were assigned to 20 floor pens with 15 chicks/pen (1×w×h, 2×1.5×0.75 m).

Treatments and experimental design: Broiler chickens had free access to feed from 1-20 days of age. At 21 days, all birds were weighed and randomly allotted to floor pens. A completely randomized design with 4 treatments and 5 replications was used in this study. The treatments were the following: Broilers fed *ad libitum* as a control group (P-0), broilers having free access to feed during 9 h/day (07:00-10:00, 16:00-19:00, 22:00-01:00) from 21-35 days of age (P-1), broilers

Table 1: Nutrition composition of commercial starter (7-21 days) and finisher diet (22-35 days)

Nutrition composition	Feed	
	Starter	Finisher
Dry matter (%)	87.18	88.64
Crude protein (%)	22.18	20.24
Ether extract (%)	6.12	7.06
Crude fiber (%)	3.31	3.83
Nitrogen-free extract (%)	50.08	51.97
Ash (%)	5.49	5.54
Ca (%)	1.52	1.49
P (%)	0.77	0.65
NaCl (%)	0.36	0.28
GE (Kcal kg ⁻¹)	3.924	3.875

having free access to feed during 12 h/day (07:00-10:00, 16:00-20:00, 22:00-03:00) from 21-35 days of age (P-2) and broilers having free access to feed during 15 h/day (07:00-10:00, 16:00-21:00, 22:00-05:00) from 21-35 days of age (P-3).

Variable measurement and statistical analysis: All birds were weighed individually at 21, 28 and 35 days of age. The body weight of each broiler was measured between 18:00 and 19:00 on measurement days when food was still available to all groups. Feed consumption was measured based on pen values and feed conversion was calculated as the ratio of feed consumption adjusted for mortality to average weight gain. Feed consumption, body weight gains and the feed conversion ratios were calculated for the periods of 21-28, 29-35, 21-35 days and from 1-35 days.

Statistical analysis: All data were analyzed based on a completely randomized design using SAS software¹². Data are presented as Mean \pm SD. The significant differences between treatment means were determined by Duncan's multiple range test. All statements of significance are based on testing at $p < 0.05$.

RESULTS

Growth performance: The results of feeding time restriction on body weight gain and body weight are summarized in Table 2. Body weight gains and body weights of broilers that had access to feed during 9 (P-1) and 12 h/day (P-2) were lower ($p < 0.05$) than those of broilers fed *ad libitum* (P-0) during the feed restriction periods. Among the groups with feeding time restrictions, body weight gains and body weights of P-1 and P-2 broilers were not significantly different during these periods. There were no significant differences among broilers that had access to feed during 15 h/day (P-3) and broilers fed *ad libitum* (P-0).

Feed consumption and feed conversion ratio: The responses of feeding on feed consumption and the feed conversion ratio are shown in Table 3. Feed consumption by broilers that had access to feed during 9 h/day (P-1) and 12 h/day (P-2) was lower ($p < 0.05$) than that of broilers fed *ad libitum* (P-0) during feed restriction periods. However, there were no differences among broilers that had access to feed during 15 h/day (P-3) and those with *ad libitum* feeding (P-0). The feed conversion ratio of P-1 was lower ($p < 0.05$) than that of

Table 2: Body weight (BW) and body weight gain (BWG) of broiler chickens subjected to feeding time restriction

Performance	Treatments			
	P-0	P-1	P-2	P-3
BW (g/chick) (days)				
21	767.25 \pm 3.11	767.45 \pm 1.44	767.944 \pm 3.41	767.11 \pm 3.23
28	1450.72 \pm 24.44 ^a	1412.01 \pm 15.33 ^{bc}	1385.97 \pm 23.50 ^c	1430.51 \pm 18.85 ^{ab}
35	2072.16 \pm 55.75 ^a	1966.54 \pm 23.44 ^b	1952.53 \pm 44.55 ^b	2039.56 \pm 22.40 ^a
BWG (g/chick) (days)				
21-28	683.47 \pm 21.41 ^a	644.56 \pm 14.49 ^{bc}	618.03 \pm 25.48 ^c	663.40 \pm 20.64 ^{ab}
29-35	621.44 \pm 32.87 ^a	554.52 \pm 22.04 ^b	566.56 \pm 28.05 ^b	609.05 \pm 28.02 ^a
21-35	1304.90 \pm 52.84 ^a	1199.08 \pm 23.71 ^b	1184.59 \pm 47.66 ^b	1272.44 \pm 22.41 ^a
1-35	2033.37 \pm 55.75 ^a	1927.75 \pm 23.44 ^b	1913.74 \pm 44.55 ^b	2000.77 \pm 22.40 ^a

^{a,b}Mean within a row with no common superscripts differ at $p < 0.05$, Mean \pm SD, broiler chicks fed *ad libitum* (P-0), broilers had free access to feed during 9 h/day (07:00-10:00, 16:00-19:00, 22:00-01:00) from 21-35 days of age (P-1), broilers had free access to feed during 12 h/day (07:00-10:00, 16:00-20:00, 22:00-03:00) from 21-35 days of age (P-2), broilers had free access to feed during 15 h/day (07:00-10:00, 16:00-21:00, 22:00-05:00) from 21-35 days of age (P-3)

Table 3: Feed consumption (FC) and feed conversion ratio (FCR) of broiler chickens subjected to feeding time restriction

Performance	Treatments			
	P-0	P-1	P-2	P-3
FC (g/chick) (days)				
21-28	1019.60 \pm 14.13 ^a	922.35 \pm 30.11 ^b	918.87 \pm 44.49 ^b	1006.33 \pm 33.06 ^a
29-35	1048.09 \pm 41.34 ^a	1000.24 \pm 18.67 ^b	991.92 \pm 32.45 ^b	1062.60 \pm 16.89 ^a
21-35	2067.69 \pm 50.37 ^a	1922.59 \pm 47.95 ^b	1910.79 \pm 75.07 ^b	2068.94 \pm 41.81 ^a
1-35	3024.37 \pm 50.37 ^a	2879.27 \pm 47.95 ^b	2867.47 \pm 75.07 ^b	3025.62 \pm 41.81 ^a
FCR (g/g) (days)				
21-28	1.49 \pm 0.05 ^a	1.43 \pm 0.02 ^b	1.49 \pm 0.04 ^a	1.52 \pm 0.03 ^a
29-35	1.69 \pm 0.06	1.81 \pm 0.10	1.75 \pm 0.06	1.75 \pm 0.08
21-35	1.58 \pm 0.05	1.60 \pm 0.05	1.61 \pm 0.02	1.62 \pm 0.04
1-35	1.49 \pm 0.03	1.50 \pm 0.03	1.50 \pm 0.01	1.51 \pm 0.02

^{a,b}Mean within a row with no common superscripts differ at $p < 0.05$, Mean \pm SD, broiler chicks fed *ad libitum* (P-0), broilers had free access to feed during 9 h/day (07:00-10:00, 16:00-19:00, 22:00-01:00) from 21-35 days of age (P-1), broilers had free access to feed during 12 h/day (07:00-10:00, 16:00-20:00, 22:00-03:00) from 21-35 days of age (P-2), broilers had free access to feed during 15 h/day (07:00-10:00, 16:00-21:00, 22:00-05:00) from 21-35 days of age (P-3)

other treatments during 21-28 days of age, however, there were no significant differences between the treatments during 29-35 days of age and during the overall period of feed restriction (21-35 days of age).

DISCUSSION

In this study, free access to feed during 9 and 12 h/day resulted in lower body weight gains, final body weights and feed consumption compared with the effects of *ad libitum* feeding. However, broilers with a free access to feed during 15 h/day had a similar response to broilers fed *ad libitum*. This result may be attributed to the time of feed availability and increased feed intake during cooler temperatures at night, which allows the broilers to meet their nutrient requirements for growth. The results from this study agreed with those in the previous study of Banong and Hakim¹³, who found that a fasting program of up to 4 h daily (11:00-15:00) from 14-35 days of age had no effect on body weight gain and body weight at 35 days of age. Farghly and Hassanien¹⁴ reported that feeding broiler chicks over once a day (3 times/day) in a 4 h period improved growth performance. The restricted broilers could adapt quickly to the feeding time restriction, as indicated by the similar body weight gains for broilers fed *ad libitum* and feed restricted broilers during growth periods^{15,16}. In line with these results, Svihus *et al.*¹⁷ concluded that broiler chickens quickly adapt to intermittent feeding without a reduction in final body weight.

Feed conversion rates of broilers fed during 9 h/day were higher than rates for other treatments during the 1st week of feed restriction (21-28 days of age), however, there were similar feed conversion rates among the treatments during 29-35 days of age and the overall period of feed restriction (21-35 days of age). In the current study, the feeding time restriction did not improve feed utilization. Our assumption that feeding time restrictions can reduce feed consumption was not supported. A reduction in feed consumption may not occur because of longer periods of feed availability during the night, allowing birds to compensate by consuming more feed and spending more time with feed¹⁷. Another study showed that a fasting program up to 4 h daily (11:00-15:00) from 14-35 days of age had no effect on feed intake and feed conversion ratios¹⁸. However, when feed was removed for 6, 8 or 10 h during the day from 8-28 days of age and was followed by *ad libitum* feeding until market age, feed intake was reduced and feed efficiency was improved and the longer the period of feed removal the better the efficiency of utilization. In another report, Svihus *et al.*¹⁷ concluded that broiler chickens adapt to intermittent feeding by increasing the use

of their crop as an intermittent storage organ, which appears to have some beneficial effects on feed utilization. The differences in the findings may be due to the difference in the methods of feed restriction or the duration of feed restriction.

CONCLUSION

Based upon the findings of this study, broiler chickens that have a feeding time restriction with free access to feed 9 h/day during the growing period had better results than those in other treatment groups during 1st week of feed restriction, however, a feeding time restriction of 15 h/day during the growing period had a similar effect as the control treatment at market age.

SIGNIFICANCE STATEMENTS

This study focuses on feeding time restriction as a tool of feed restriction for broiler chickens. This study discovered that growth performance of broiler chickens that had free access to feed during 15 h/day had better results than those with access for 9 or 12 h/day.

ACKNOWLEDGMENTS

This study was supported by Program Hibah Bersaing, Directorate General of Higher Education Indonesia and financial support from DIPA Jambi University, 2013 No. 023.04.2.415103/2013.

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