A Comparative Analysis of the Growth Rate, Body Weight Gain, and Feed Conversion Ratio of Broilers Raised Under Ad Libitum and Restricted Feeding Programs

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ABSTRACT

Background: Among the various feeding strategies employed, two predominant methods have emerged as the primary focus of research and industry implementation: ad libitum and restricted feeding programs.

Objectives: This comparative study aimed to assess the growth rate, body weight gain, and feed conversion ratio (FCR) of broilers raised under ad libitum and restricted feeding programs.

Methods: A total of 350-day-old broiler chicks were assigned to two groups. The broilers under ad libitum feeding exhibited higher growth rates throughout the six-week study period, with average weight gains of 165.2 grams, 427.5 grams, 864.7 grams, 1405.5 grams, 2008.8 grams, and 2330.7 grams in successive weeks. In contrast, the broilers under restricted feeding showed lower growth rates, ranging from 140.7 grams to 2020.1 grams in the corresponding weeks.

Results: The ad libitum group also consumed consistently higher amounts of feed compared to the restricted group. However, there were no statistically significant differences in FCR between the two feeding programs.

Conclusion: These findings highlighted the importance of providing broilers with continuous access to feed to optimize their growth, while further research is needed to validate the results and explore FCR variations.

Keywords: Broilers; Feed conversion ratio; Feed intake; Growth rate; Nutrition; Production efficiency.

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INTRODUCTION

In the quest to meet the growing demand for poultry products worldwide, the broiler industry constantly seeks innovative approaches to optimize production efficiency and ensure sustainable practices. One crucial aspect of broiler management lies in determining the most effective feeding program to achieve maximum growth and economic profitability. Among the various feeding strategies employed, two predominant methods have emerged as the primary focus of research and industry implementation: ad libitum and restricted feeding programs.

The ad libitum feeding program, also known as free-choice feeding, involves providing broilers with unrestricted access to feed throughout the day. This approach mimics the natural feeding behavior of broilers, where they can eat whenever they feel hungry. Broilers raised under this program have the liberty to consume feed as per their appetite, allowing them to meet their nutritional requirements and satiate their hunger. The ad libitum feeding method aims to create a feeding environment that closely resembles the natural foraging behavior of broilers in the wild.

On the other hand, the restricted feeding program imposes limitations on broilers' access to feed by providing them with a predetermined amount of feed within specific time intervals. This method involves controlling the feed intake of broilers by regulating the frequency and quantity of feed provided. Typically, broilers are fed at regular intervals, such as once or twice a day, and their feed allocation is limited. The restricted feeding program aims to optimize feed utilization, minimize wastage, and achieve more precise control over the broilers' growth rate and body weight gain.

Both feeding programs have their unique advantages and considerations. The ad libitum feeding program allows broilers to exhibit their natural feeding behavior, promoting higher feed intake, and potentially maximizing their growth potential. However, it may also result in excessive feed consumption, leading to increased feed costs and potential issues like obesity or uneven weight distribution within a flock.

The aim of this research study is to conduct a comparative analysis of the growth rate, body weight gain, and feed conversion ratio (FCR) between broilers raised under ad libitum and restricted feeding programs. These factors are essential indicators of broiler performance and overall productivity.

MATERIAL AND METHODS

Experimental Design

The study utilized a randomized complete block design, with the feeding program (ad libitum and restricted) as the main treatment factor. Each treatment was assigned to a separate group of broilers, and the experiment was conducted at the National Agriculture Research Council in Islamabad, Pakistan during the 2022-23 period.

Broiler Selection and Housing

A total of 350-day-old broiler chicks were obtained from a commercial hatchery. The broilers were of the same breed and similar initial body weights to ensure homogeneity within each
treatment group. The broilers were housed in small scale farm at National Agriculture Research Council, Islamabad, Pakistan, which provided adequate ventilation, temperature control, and appropriate lighting conditions throughout the study.

**Feeding Programs**

Two feeding programs were implemented:

a) Ad libitum Feeding: Broilers in this group had continuous access to feed throughout the study period. Feeders were filled with a nutritionally balanced diet, and feed intake was monitored regularly.

b) Restricted Feeding: Broilers in this group were provided with a predetermined amount of feed at fixed intervals. Feed was offered in measured quantities to ensure uniformity of intake across individuals. The feed allocation was adjusted based on the broilers' age and growth rate.

**Feed Composition**

A commercially available broiler feed was used for both feeding programs. The feed composition met the nutritional requirements recommended for broilers at each growth stage, providing adequate energy, protein, vitamins, and minerals.

**Data Collection**

The following parameters were measured throughout the study:

a) Growth Rate: The body weights of broilers were recorded weekly to calculate the average daily weight gain (ADG) and overall growth rate.

b) Body Weight Gain: The difference in body weight between the start and end of the study period was determined to assess the total weight gain.

c) Feed Intake: The amount of feed consumed by each group was measured daily, considering both refusals and spillage.

d) Feed Conversion Ratio (FCR): The FCR was calculated by dividing the total feed intake by the total weight gain for each treatment group.

**Statistical Analysis**

The obtained data were subjected to statistical analysis using appropriate methods, such as Chi-square tests. Mean values and standard deviations were calculated, and significant differences between treatment means were determined. The significance level was set at $p < 0.05$.

**Data Interpretation**

The results obtained from the analysis were interpreted to evaluate the effects of the feeding programs on the growth rate, body weight gain, and feed conversion ratio of broilers. The findings were discussed in the context of existing literature and practical implications for the broiler industry.
Ethical Considerations

The study adhered to ethical guidelines and regulations for animal experimentation. To ensure adequate statistical validity and robustness of the results.

Limitations

Any potential limitations or constraints encountered during the study were acknowledged and discussed to provide a comprehensive understanding of the research outcomes.

RESULTS

In the study, the growth rate of broilers raised under ad libitum and restricted feeding programs was examined over a period of six weeks. During the first week, broilers in the ad libitum feeding group exhibited a growth rate of 165.2 grams, while those in the restricted feeding group had a slightly lower growth rate of 140.7 grams. This suggested that broilers provided with unlimited access to feed experienced higher weight gain compared to those on a restricted feeding regimen. Moving on to the second week, the broilers in the ad libitum feeding program continued to demonstrate a higher growth rate, with an average weight gain of 427.5 grams. Conversely, the restricted feeding group showed a slightly lower growth rate of 397.8 grams. As the study progressed to the third week, the trend persisted. Broilers under the ad libitum feeding program recorded a growth rate of 864.7 grams, while those under restricted feeding achieved a slightly lower growth rate of 830.2 grams. Once again, the ad libitum feeding program appeared to contribute to higher weight gain in the broilers compared to the restricted feeding program. In the fourth, fifth, and sixth weeks, similar patterns emerged. The broilers in the ad libitum feeding group consistently displayed higher growth rates, reaching 1405.5 grams, 2008.8 grams, and 2330.7 grams, respectively. Meanwhile, the restricted feeding group exhibited lower growth rates, with weight gains of 1330.6 grams, 1840.2 grams, and 2020.1 grams in the corresponding weeks. Overall, the findings from the study indicated that broilers raised under the ad libitum feeding program experienced higher growth rates throughout the six-week period compared to those on a restricted feeding regimen. This suggested that providing broilers with continuous access to feed may lead to enhanced weight gain and overall growth (Table 1).

Feed intake data for broilers raised under ad libitum and restricted feeding programs was also recorded. The findings indicated that broilers provided with ad libitum feeding consumed consistently higher amounts of feed compared to those under restricted feeding throughout the six-week study period. In each week, broilers in the ad libitum feeding group consumed more feed than their counterparts in the restricted feeding group. This trend remained consistent as the study progressed, with the ad libitum group consistently demonstrating higher feed intake. Overall, the results suggested that unrestricted access to feed allowed broilers to consume a greater quantity of feed, potentially contributing to their overall growth and development. The findings highlighted the influence of feeding programs on feed intake and emphasized the importance of considering the impact of feeding strategies on broiler production efficiency (Table 2).

Feed conversion ratio of broilers that were raised under ad libitum and restricted feeding programs. The FCR is a crucial measure of feed efficiency, calculated as the ratio of feed intake to weight gain. By analyzing the data, valuable insights can be gained regarding the efficiency of
feed utilization for the broilers in each feeding program. Examining the results, we can observe variations in the FCR values for each week. During the first week, broilers under the ad libitum feeding program had an average FCR of 1.63, while those under the restricted feeding program exhibited a slightly higher FCR of 1.74. Similarly, in the second week, the ad libitum group recorded an FCR of 1.87, compared to 1.94 for the restricted feeding group. As the study progressed, the FCR values continued to fluctuate. In the third week, broilers in the ad libitum feeding program showed an FCR of 1.96, while the restricted feeding group had a slightly lower FCR of 1.71. Week 4 witnessed an FCR of 1.92 for the ad libitum group and 1.61 for the restricted feeding group. Moving on to the fifth week, broilers in the ad libitum feeding program exhibited an FCR of 1.64, whereas the restricted feeding group displayed a lower FCR of 1.36. Finally, in the sixth week, the ad libitum group recorded an FCR of 1.75, while the restricted feeding group had a similar FCR of 1.68. The results suggested that there were variations in feed efficiency between the two feeding programs. However, to determine the significance of these differences, statistical tests were conducted. The Chi-square test and p-values were calculated, but no statistically significant differences were found (p > 0.05) for all the weeks, indicating that the observed variations in FCR values between the ad libitum and restricted feeding programs were not statistically significant (Table 3).

Table 1: Growth rate of broilers raised under ad libitum and restricted feeding programs

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Ad Libitum feeding</th>
<th>Restricted Feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>165.2±11.19</td>
<td>140.7±9.78</td>
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<tr>
<td>Week 2</td>
<td>427.5±9.65</td>
<td>397.8±9.10</td>
</tr>
<tr>
<td>Week 3</td>
<td>864.7±18.37</td>
<td>830.2±15.45</td>
</tr>
<tr>
<td>Week 4</td>
<td>1405.5±23.09</td>
<td>1330.6±20.21</td>
</tr>
<tr>
<td>Week 5</td>
<td>2008.8±30.01</td>
<td>1840.2±34.27</td>
</tr>
<tr>
<td>Week 6</td>
<td>2330.7±76.15</td>
<td>2020.1±64.17</td>
</tr>
</tbody>
</table>

Table 2: Feed intake of broilers raised under ad libitum and restricted feeding programs

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Ad Libitum feeding</th>
<th>Restricted Feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>270.3±13.23</td>
<td>245.7±8.74</td>
</tr>
<tr>
<td>Week 2</td>
<td>802.6±17.90</td>
<td>775.7±27.43</td>
</tr>
<tr>
<td>Week 3</td>
<td>1700.2±43.98</td>
<td>1420.3±30.39</td>
</tr>
<tr>
<td>Week 4</td>
<td>2700.9±77.89</td>
<td>2150.7±67.90</td>
</tr>
<tr>
<td>Week 5</td>
<td>3300.3±311.1</td>
<td>2520.2±190.1</td>
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Table 3: Feed conversion ratio of broilers raised under ad libitum and restricted feeding programs

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Ad Libitum Feeding</th>
<th>Restricted Feeding</th>
<th>χ²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>1.63</td>
<td>1.74</td>
<td>0.1823</td>
<td>0.6688</td>
</tr>
<tr>
<td>Week 2</td>
<td>1.87</td>
<td>1.94</td>
<td>0.0659</td>
<td>0.7974</td>
</tr>
<tr>
<td>Week 3</td>
<td>1.96</td>
<td>1.71</td>
<td>0.8891</td>
<td>0.3457</td>
</tr>
<tr>
<td>Week 4</td>
<td>1.92</td>
<td>1.61</td>
<td>1.4486</td>
<td>0.2287</td>
</tr>
<tr>
<td>Week 5</td>
<td>1.64</td>
<td>1.36</td>
<td>1.3676</td>
<td>0.2422</td>
</tr>
<tr>
<td>Week 6</td>
<td>1.75</td>
<td>1.68</td>
<td>0.0722</td>
<td>0.7882</td>
</tr>
</tbody>
</table>

DISCUSSION

The present study aimed to compare the growth rate, body weight gain, and feed conversion ratio (FCR) of broilers raised under ad libitum and restricted feeding programs. The results demonstrated distinct differences between the two feeding programs in terms of growth rate and feed intake, while no statistically significant differences were observed in FCR.

The findings indicated that broilers provided with ad libitum feeding exhibited higher growth rates throughout the six-week period compared to those on a restricted feeding regimen. This result is consistent with previous studies that have shown unrestricted access to feed leads to increased weight gain in broilers. The continuous availability of feed allows broilers to consume according to their appetite, ensuring optimal nutrient intake and supporting their growth and development. On the other hand, broilers under restricted feeding programs may experience limited nutrient availability, which can hinder their growth potential. The observed differences in growth rates between the two feeding programs highlight the importance of adequate feed availability for maximizing broiler performance.

Furthermore, the data on feed intake confirmed that broilers provided with ad libitum feeding consumed consistently higher amounts of feed compared to those under restricted feeding. This finding is in line with expectations, as the ad libitum group had unlimited access to feed, whereas the restricted group had their feed intake limited by predetermined amounts. Higher feed intake in the ad libitum group is expected to contribute to their superior growth rates. It is worth noting that the increased feed intake in the ad libitum group might also be attributed to factors such as increased appetite stimulation and reduced competition for feed resources. Nevertheless, the findings emphasize the importance of providing adequate feed availability to optimize broiler growth and productivity.

In terms of FCR, no statistically significant differences were observed between the ad libitum and restricted feeding programs. Although the FCR values fluctuated between the two groups...
throughout the study, the differences were not statistically significant. This suggests that both feeding programs were equally efficient in converting feed into body weight gain. It is important to note that FCR is influenced by multiple factors, including genetics, diet composition, and management practices. While the present study did not find significant differences in FCR, further investigations with larger sample sizes and longer study durations may be needed to confirm these results. Moreover, considering other economic factors such as feed cost and market prices of broilers would provide a more comprehensive understanding of the cost-effectiveness of each feeding program.\textsuperscript{17}

The findings of this study have practical implications for the broiler industry. Ad libitum feeding, which allows broilers to consume feed according to their appetite, appears to be a favorable strategy for achieving higher growth rates. However, it is important to consider the potential drawbacks of ad libitum feeding, such as increased feed wastage and the risk of obesity in broilers. A well-managed ad libitum feeding program, coupled with regular monitoring of feed intake, can help optimize broiler performance while minimizing wastage and associated costs.\textsuperscript{18}

It is worth mentioning that the present study has certain limitations. Firstly, the study duration of six weeks may not capture the long-term effects of different feeding programs on broiler performance. Longer-term studies can provide a more comprehensive understanding of the impact of feeding strategies on broiler growth and efficiency. Additionally, the study was conducted in a specific location (National Agriculture Research Council, Islamabad, Pakistan), which may limit the generalizability of the findings to other geographical regions or production systems. Future studies encompassing diverse locations and production settings would provide more robust and representative results.\textsuperscript{19-20}

CONCLUSION

The comparative analysis of broilers raised under ad libitum and restricted feeding programs revealed that ad libitum feeding led to consistently higher growth rates and increased feed intake throughout the six-week study period. The findings highlight the importance of providing broilers with continuous access to feed in order to maximize their growth potential. Although no statistically significant differences were observed in feed conversion ratio (FCR) between the two feeding programs, further research is needed to validate these results. Overall, the study emphasizes the significance of feed availability in optimizing broiler performance and provides practical implications for the industry to enhance production efficiency.

CONFLICT OF INTEREST

None.

REFERENCES: