

Effect of Stocking Density on Feed Efficiency of Caged Broilers Under Hot Climatic Conditions

Abstract

The present study investigates the effect of stocking density on feed consumption and feed conversion ratio (FCR) in caged broilers under hot climatic conditions. Total 72 day-old broiler chicks, randomly distributed in three groups as treatments of stocking density were further sub-divided as eight chicks in each to serve as replicates. The birds in different treatments of stocking density at 1 sq. ft., 1.33 sq. ft. and 2 sq. ft. per bird were evaluated. The results indicated that stocking density did not significantly affect feed consumption and Feed Conversion Ratio (FCR), with a trend suggesting that moderate stocking density (1.33 sq. ft./ bird) supported better feed utilization. These findings align with several studies which reported non-significant impact of stocking density on feed intake and FCR. While higher stocking densities can lead to concern regarding heat stress, the present study suggests that with appropriate heat stress management, good performance may be achieved, across different stocking densities. Effective management practices are crucial in optimizing feed efficiency and bird welfare in hot climates. This study highlights the importance of balancing stocking density and environmental conditions to achieve sustainable broiler production.

***Key words:** Heat Stress, FCR, Feed Consumption, Stocking Density and Summer Season*

Introduction

India is the world's second largest emerging economy. Poultry sector is one of the fastest growing sectors in India. It has an immense scope for better income generation. India has witnessed, average growth rate of 6 % in egg production and 12 % for broiler production per annum. Total poultry population in India has increased by 16.81% (851.81 million in 2019) than 729.21 million poultry in 2012. (BAHS, 2019). At present poultry industry is one of the fastest growing subsectors of animal husbandry in India. Indian broiler industry is growing at the rate of 7-8%. India stands on 3rd position in egg production; however, it is still growing in terms of poultry meat production and stands on 6th position in the world in terms of broiler production. Rise in consumer demand for poultry is responsible for driving the recent growth of the Indian poultry sector (BAHS, 2018).

Poultry meat provides good quality protein, minerals and vitamins to the diet of person consuming it. Also, rearing of poultry involves low investment cost, less land and less risk as compared to other enterprises and produces quick return with good FCE and protein source (**Bhagat, 2016**). Commercial poultry producers frequently consider increasing the stocking density of breeding birds per pen as a strategy to minimize costs associated with housing, equipment and labour. However, existing literature suggests that elevated stocking densities adversely impact both the economic viability and welfare standards of poultry production. Adverse outcomes associated with high stocking densities include increased mortality rates, higher prevalence of leg disorders and disruptions to normal resting behavior. Moreover, chickens reared under such conditions exhibit slower growth rates, reduced egg production, and elevated mortality (**Van Kampen, 1981; Deaton, 1983 and Hall, 2001**).

High stocking densities have been associated with reduced growth rates, impaired feed conversion efficiency, increased mortality and behavioural issues such as reduced resting time and aggression (**Estevez, 2007**). These challenges are exacerbated in hot climates, where heat stress further compromises bird performance and welfare. Heat stress disrupts thermoregulation, leading to decreased feed intake, reduced nutrient absorption and heightened susceptibility to diseases (**Cahaner et al., 2008**). The overcrowding are mostly done in an attempt to cover the costs incurred in housing, feeding and medication of poultry birds, also, most farmers do not have the knowledge of adequate stocking density to use (**Muniz et al., 2006 and Adebisi et al., 2011**). India being in sub-tropical region of the world, the prevailing macro-climatic conditions is mostly congenial to poultry production. Among the many sub-sectors of agriculture, livestock sector is gaining momentum in India and within the livestock sector, poultry occupies premium position (**Prabakaran, 2012**).

Understanding the interaction between stocking density and environmental factors, such as temperature, is crucial for optimizing feed efficiency in broiler production. Feed efficiency, a key economic indicator in poultry farming, is directly influenced by stocking density through its effects on feed intake, body weight gain, and energy expenditure (**Dozier et al., 2006**). Therefore, this study aims to evaluate the effect of stocking density on the feed efficiency of caged broilers reared under hot climatic conditions.

Materials and Methods

Experimental Design and Management

The study was carried out on 72 one-day-old broiler chicks raised in battery cages until they were five weeks old. These chicks were randomly assigned to three different treatments, with each treatment further divided into sub-groups with eight chicks in each to serve as replicates. These chicks were housed in 24 cages, each measuring 2 feet by 2 feet, providing 4 square feet of space per cage. The treatments were as follows: T₁ with 2 square feet per bird, T₂ with 1.33 square feet per bird and T₃ with 1 square foot per bird.

Data Collection

Data of feed consumption and feed conversion ratio were collected on weekly basis at early morning. Feed consumption per bird was calculated by sum of daily feed consumption divided by seven whereas Feed conversion ratio was calculated by dividing total feed consumed by bird with body weight gain. The data was collected from each replicate within the treatments.

Statistical Analysis

The data collected were analysed statistically using Analysis of variance (ANOVA) technique as per **Snedecar and Cochran (2004)**.

Results and Discussion

Feed consumption:

The data presented in Table 1 indicate that the average feed consumption of chicks was highest in T₂ (523.54 g) followed by T₃ (504.67 g) and T₁ (491.27 g). However, there was non-significant difference in feed consumption of broiler chicks among different treatments of stocking density. Chicks in T₂ (1.33 sq. ft per bird) exhibited significantly higher average feed consumption compared to those in T₁ (2 sq. ft per bird) and T₃ (1 sq. ft per bird). However, **Wenjia et al., (2019)** reported that stocking density did not have any significant impact on feed consumption of caged broiler at 15 birds /m² and 18 birds /m². **Bruno et al., (2017)** observed that during the first week of age, the feed consumption of broiler chicks was found to be non-significant. This may be attributed to lower feed consumption during the brooding period, adequate feed space, low ammonia levels, and reduced microbial load during the initial period. Whereas, **Nawarathne et al., (2010)** reported that the increasing stocking density resulted in a decrease in average feed intake. However, following the

brooding period, when uniform conditions were provided across all treatments, no significant differences ($p > 0.05$) in feed intake were observed among three treatment groups.

Table 1: Average feed consumption of broilers chicks.

Treatments	Weekly average feed consumption of broilers (g.)					Mean
	Week 1	Week 2	Week 3	Week 4	Week 5	
T ₁	123.75	333.3	495.37	613.75	889.62	491.27
T ₂	142.87	330.5	544.87	690.5	909	523.54
T ₃	143	339.37	530.37	628.62	882	504.67
Mean	136.54	334.58	523.53	644.29	893.54	506.49
Results	S*	NS**	S*	NS**	NS**	NS**

* Significant

** Non-significant

Feed conversion ratio

The data presented in Table 2 indicate that the average feed conversion ratio of broiler chicks was highest in the T₃ (1.40) followed by T₂ (1.37) and T₁ (1.37). There were non-significant differences in average mean feed conversion ratio of broiler chicks among different treatments of stocking density. Chicks in T₂ (1.33 sq. ft per bird) exhibited significantly higher average feed conversion ratio compared to those in T₁ (2 sq. ft per bird) and T₃ (1 sq. ft per bird). In a comparable study, **Vanhonacker et al., (2009)** reported that consumer perceptions on broiler welfare and noted that increasing stocking density did not significantly impact weekly feed conversion ratio. **Silas et al., (2014)** found that stocking density had non-significant effect on feed conversion ratio in broiler in different stocking density. **Kumar et al., (2016)** observed that upto five weeks, the feed conversion ratio remained non-significant. However, a significant difference was observed in the weekly mean feed conversion ratio. Whereas, some other studies reported conflicting results compared to this study. **Petek et al., (2014)** reported non-significant difference in the feed conversion ratio ($P > 0.05$) among groups with different stocking densities. On the other hand, **Qaid et al., (2016)** found that birds housed at lower stocking densities significantly converted feed more efficiently compared to those stocked at higher densities.

Table 2: Average feed conversion ratio of broilers chicks

Treatments	Weekly average feed conversion ratio of broilers (g.)					Mean
	Week 1	Week 2	Week 3	Week 4	Week 5	
T ₁	1.11	1.2	1.16	1.45	1.96	1.37
T ₂	1.22	1.15	1.19	1.46	1.87	1.37
T ₃	1.21	1.14	1.24	1.35	2.07	1.40
Mean	1.18	1.16	1.19	1.42	1.96	1.38
Results	NS**	S*	S*	NS**	S*	NS**

* Significant

** Non-significant

Conclusion

The findings of the present study indicate that stocking density has non-significant effect on feed consumption and feed conversion ratio (FCR) of caged broilers reared under hot climatic conditions. Broilers reared at a moderate stocking density showed a trend towards higher feed consumption and better feed conversion ratio compared to those reared at lower or higher densities. Although statistically non-significant differences were observed in different treatments of stocking density in present study and the results revealed that moderate stocking density provides an optimal balance between resource utilization and bird welfare. The results are consistent with the idea that stocking density alone may not significantly influence feed intake or FCR when managed properly. With effective heat stress management strategies in place, good performance can be achieved even at higher stocking densities. Optimizing management practices under hot climatic conditions, is essential to ensure efficient feed utilization and maintain sustainable broiler performance across varying stocking densities.

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