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Research Article

Production Performance of Hubbard Broilers with Different Stocking Densities under Hot Climatic Conditions of Pakistan

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ABSTRACT: The experiment was conducted to investigate the effect of four stocking densities on the production performance i.e. weight gain, feed consumption, feed conversion ratio (FCR) and mortality of Hubbard broilers chicks under hot climate. The ambient temperature 35ºC to 45ºC caused the increase in actual experimental house temperature irrespective of set point house temperature, as naturally ventilated open sided house with extraction fans was used for the experiment. Four of the stocking density treatments; 10 birds/m², 12 birds/m², 9 birds/m² and 8 birds/m² were provided to the four groups A, B, C and D, respectively. The experiment was conducted for 2 to 6 week of age of the birds (7 days adaptation period and 35 days experimental period). Water and feed were provided *ad libitum.* Twenty-three hours light was provided. Weight gain per bird (2-6 weeks) of groups A, B, C and D was recorded as 1851.337, 1823.556, 1745.777 and 1834.663g, respectively. The average feed consumption per bird (2-6 weeks) was 3987.333, 4098.667, 4081.333 and 4123.667g for the groups A, B, C and D, respectively. Feed conversion ratio (FCR) per the bird (2-6 weeks) was 2.154, 2.248, 2.338 and 2.248 for the group A, B, C and D, respectively. Mortality for the four groups A, B, C and D was recorded as 6.667, 10.000, 3.333 and 0.000 percent, respectively. When the data calculated for weight gain, feed intake, FCR and mortality was analyzed statistically, the difference between the groups of four stocking density was found to be non-significant. However, the birds those were highly stocked showed more mortality apparently.

Keywords: Broiler Production, Performance, Stocking Density, Hot Climate

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Pakistan'da Sıcak İklim Koşullarında Farklı Yerleşim Sıklığında Yetiştirilen Hubbord Irkı Etlik Piliçlerde Üretim Performansı

ÖZ: Bu çalışmada sıcak iklim koşullarında, Hubbord ırkı etlik piliçlerde dört farklı yerleşim sıklığının üretim performansı (canlı ağırlık artışı, yem tüketimi, yemden yararlanma oranı ve ölüm oranı) üzerine etkileri araştırılmıştır. Çalışmada yanları açık, doğal olarak havalandırılan ve fanlarla hava çıkışının sağlandığı kümeste, 35ºC - 45ºC olan çevre sıcaklığı; kümes içi sıcaklığın stres oluşturabilecek düzeylere kadar artışına neden olmuştur. Denemede A, B, C ve D olmak üzere dört farklı yerleşim sıklığına göre sırasıyla, 10 piliç/m², 12 piliç/m², 9 piliç/m² ve 8 piliç/m² olacak şekilde gruplar oluşturulmuştur. Deneme 2-6 haftalık yaş arasında sürdürülmüştür (7 gün adaptasyon periyodu ve 35 gün deneme periyodu). Yem ve su *ad libitum* olarak sağlanmıştır. Günde 23 saatlik aydınlatma uygulanmıştır. A, B, C ve D gruplarında canlı ağırlık kazancı (2-6 hafta) sırasıyla, 1851.337, 1823.556, 1745.777 ve 1834.663 g ortalama yem tüketimi 3987.333, 4098.667, 4081.333 ve 4123.667 g, yemden yararlanma oranı 2.154, 2.248, 2.338 and 2.248 olarak kaydedilmiştir. Ölüm oranı ise A, B, C ve D gruplarında sırasıyla %6.6 10.0 3.3 ve 0.0 olarak belirlenmiştir. Canlı ağırlık kazancı, yem tüketimi, yemden yararlanma oranı ve ölüm oranı bakımından yerleşim sıklığının istatistik açıdan önemli bir etkisi olmamıştır. Ancak, yoğun yerleşim sıklığı ölüm oranında görünür bir artışa yol açmıştır.

Anahtar Kelimeler: Etlik piliç**,** Verim performansı, Yerleşim sıklığı, Sıcak iklim

INTRODUCTION

In broiler production housing and managemental conditions are critical factors in the maintenance of good production and control of diseases. Stocking density plays an important role in broiler production. Poultry industry always opts for higher density stocking because increasing space allowances in production systems can have a major negative economic impact for industry as revenue per unit of space increases linearly with density (7). Provision of floor space may be one of these critical factors. In less floor space situation, air flow at the level of the bird is often reduced, resulting in reduced dissipation of body heat to the air. The overall effect on broiler chickens of reducing floor space can be reduced growth rate, feed efficiency, livability, and, in some cases, carcass quality (8).

Stocking densities vary considerably with various countries and husbandry systems as it is considered top priority in animal welfare and affects birds' performance (1). Although there is a clear positive correlation between stocking density and economic return (1,7); Petek et al. (7), but studies have shown that higher stocking densities compromise the welfare of animals involved. With the increase in stocking density, the metabolic waste and heat production is produced more when there is a rise in housing temperature above 30°C (6). In Pakistan without considering the season, usually one square foot floor space per bird is provided when broilers are kept on litter. This much space is provided to avoid over dampness of the litter, which can be detrimental to the growing broilers. Assuming no change in performance, higher stocking

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density results in higher profitability per kilogram of chicken produced (3) but more mortality and reduction in broiler growth performance due to high ambient temperature has been well documented especially at later growth period. Higher stocking density reduces the fixed cost of production and produces more kg of broiler per unit area. Thus up to a critical point, profitability increases with increased stocking density (5).

Broilers can perform well only if balanced ration is provided in excellent managemental conditions. Stocking density is one of the managemental conditions which play a vital role in the productive performance of broilers. If proper floor space is not available to the birds, it may cause stress (2). As stocking density will affect the physiology of the bird which may ultimately influence the performance of the bird so an optimum stocking density will maximize profitability. Therefore, this study was planned to investigate the effect of different stocking densities on the production performance of Hubbard broilers under high temperature environmental conditions of Pakistan in open sided naturally ventilated house.

MATERIALS AND METHODS

Birds' Husbandry:

The experiment was conducted during April-May, in duration of six weeks at the Poultry Research Centre (PRC), University of Agriculture, Faisalabad, Pakistan. Experiment house was cleaned and whitewashed with lime ($CaO + H_2O$). Saw dust of 2-3cm depth was used as bedding for the chicks. One hundred and eighty day-old male Hubbard broiler chicks were purchased from a local commercial hatchery and reared in a group for one week as adaptation period to get the birds of same growth rate and live weight. At 8^{th} day, 120 birds of medium weight were selected and divided into 12 experimental units or replicates having 10 chicks in each. These replicates were further allotted to four groups A, B, C and D so that each group has three replicates. Each replicate (consisting of 10 birds) of A, B, C and D was provided with 10 birds/m², 12 birds/m², 9 birds/m² and 8 birds/m² stocking density, respectively.

The birds were fed *ad libitum* with commercial broiler starter ration for first four weeks of age and then were fed *ad libitum* with commercial broiler finisher ration up to 6 week of age. The feed was provided in mash form. The composition of starter and finisher rations is given in Table 1. Vaccination schedule was followed for Newcastle Disease (ND) and Infectious Bursal Disease (IBD). For prevention of Coccidiosis, Coxidar liquid (Barrett Hodgson Pakistan, Pvt., Ltd.), was given to the chicks @ 3ml/liter of drinking water. To reduce the stress on the birds, vitamins (A, D, E and K) were also given to the birds through the drinking water. The ambient temperature during the experiment remained between 35°C and 45°C. The experimental house was ventilated with the extraction fans to maintain the house temperature and ventilation. It was open sided house. Minimum ventilation requirement was followed throughout the entire experiment. The house temperature was set at 32°C on placement and then was set to be dropped by 0.30°C on daily basis according to production guide for Hubbard broilers. The house temperature ranged from 28ºC to 34ºC during the experiment due to high ambient temperature. Due to high ambient temperature the actual house temperature remained about 10-15ºC higher than the set point house temperature clearly showing hot conditions of the experiment house. The observations were made from day 8 to 6 week of age on the live performance parameters; weight gain, feed consumption, feed conversion ratio and mortality.

Statistical Analysis

The data collected in the research trial was analyzed by the analysis of variance (ANOVA) technique in Completely Randomized Design. The difference in the means was compared by the Least Significant Difference where the results were significant. Data for mortality was analyzed statistically by Chi-Square Test for being not in normal distribution.

RESULTS AND DISCUSSION

Production Performance

Weight Gain: The data regarding weight gain was calculated at the end of the experiment (6 weeks of age). Total weight gain per bird (2-6 weeks) of groups A, B, C and D was recorded as 1851.337, 1823.556, 1745.777 and 1834.663g, respectively (Table 2, Figure 1). The highest weight gain per bird was in group A. The lowest weight gain was recorded for the group C. When the data was subjected to analysis of variance (ANOVA) under Completely Randomized Design, non-significant difference was observed between the four groups of stocking density. The results were in agreement with the results of Tong et al. (2012) who observed non-significant effect of stocking density on the weight gain but they reported that there was a tendency of reduced growth at higher stocking density. In the present study, increase or decrease in weight gain for the birds kept at four different stocking densities was not in a regular pattern. The weight gains for the birds of groups A, B and D were almost identical, it means that treatments of stocking densities were not affected by high environmental temperature because of high ventilation rate used and air movement at the level of birds (3).

Feed Consumption: The average feed consumption per bird (2-6 weeks) was 3987.333, 4098.667, 4081.333 and 4123.667g for the groups A, B, C and D, respectively (Table 2, Figure 1). When the data for feed consumption was subjected to the statistical analysis, the results were non-significant. In the present study, the feed consumption was almost identical for the groups B and C whereas group D consumed more feed than the birds of group B. In group D, some birds may have to travel farther to access a feeder and therefore they have used more feed to maintain themselves and for production as well. Feed consumption may be negatively affected by increased stocking density (3). Feed intake was not decreased in a linear method as birds' stocking density was increased from 8 birds/m² to 12birds/m² in this study.

Mortality: The average mortality percentage (2-6 week) for the groups A, B, C and D was 6.667, 10.00, 3.333 and 0.000 %, respectively (Table 2, Figure 1). The data for mortality obtained during the experiment showed no significant difference between all the four groups when subjected to statistical analysis. The mortality percentage was highest for the group B and lowest for the group D. In this study, the birds died during the experimental period were diagnosed for the cause of mortality. They showed the signs of heat stroke, ascites and salt poisoning. The results showed non-significant difference in the mortality

were in line with Sekeroglu et al. (9), Buijs et al. (1) and Feddes et al. (3) who reported that stocking density had no effect on mortality. However, the results were much similar to the findings of Imaeda (4) who reported that the mortality was increased during the summer season. He explained that it seems that the higher incidence of Sudden Death Syndrome (SDS) contributes to a significant increase in the total mortality in summer, as number of SDS deaths expressed as a percentage of total number of deaths increased by 10%. Heat stress mortality showed an increasing trend with increasing density and the same case could be in this study as birds were found dead due to heat stroke and it could be due to low air flow at the birds' level at high stocking density (3).

Table 1. Composition of starter and finisher rations of the experiment

Ingredients (%)	Starter Ration (0-21d)	Finisher Ration (22-42d)
Maize	33.00	37.00
Rice broken	16.00	15.00
Rice bran	6.00	6.00
Fish meal	5.00	5.20
Soybean meal	15.00	14.00
Rapeseed meal	3.50	3.00
Corn gluten 30%	5.00	5.00
Corn gluten 60%	9.00	6.00
$CaCO_3$	0.8	0.95
DCP	0.65	0.75
Premix	0.50	0.50
Vegetable Oil	2.95	4.00
Molasses	2.60	2.60
Total	100	100
	Calculated Nutrients Content	
Metabolizable Energy (Kcal/kg)	3150	3300
Crude Protein (%)	22.5	20.0
Crude fiber (%)	4.50	4.30
Calcium (%)	1.00	0.95
Available phosphorus (%)	0.45	0.50
Linoleic acid (%)	4.00	5.50
Methionine (%)	0.50	0.50
Lysine (%)	1.10	1.10

Table 2. Effect of stocking density on weight gain, feed consumption, FCR and mortality

Description	Stocking Density Groups				SEM	P-Value
	A	B	C	D		
Weight gain (g)	1851.337	1823.556	1745.778	1834.663	23.3926	0.4333
Feed consumption (g)	3987.333	4098.667	4081.333	4123.667	29.7685	0.3226
FCR	2.154	2.248	2.338	2.248	0.0375	0.0943
Mortality (%)	6.667	10.000	3.333	0.000	2.1517	0.3871

Group A= 10 Birds/m^2, Group B= 12 Birds/m^2, Group C= 9 Birds/m^2, Group D= 8 Birds/m^2

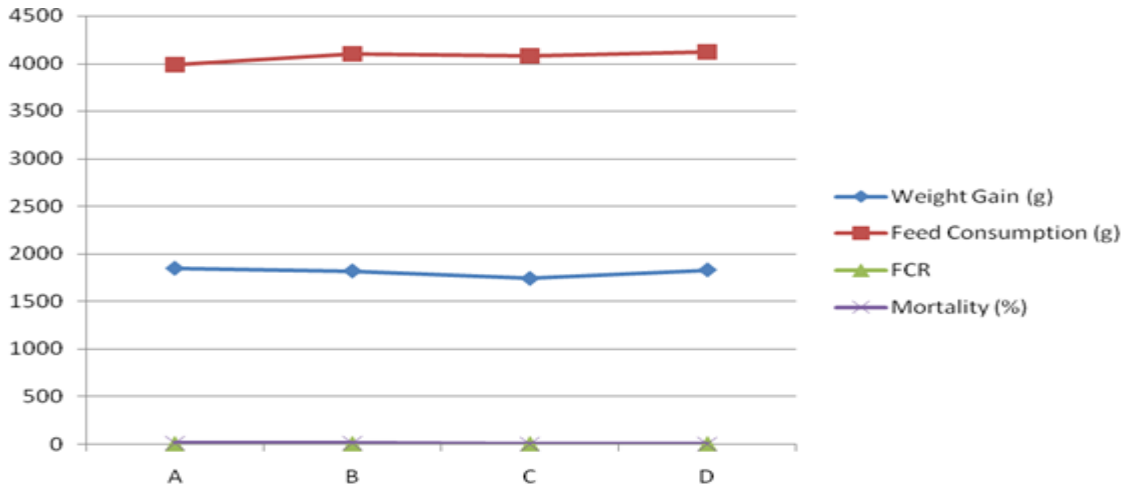

Figure 1. Graphical representation of effect of stocking density on weight gain, feed consumption, FCR and mortality under high environmental temperature

Feed Conversion Ratio (FCR): Feed conversion ratio (FCR) per the bird (2-6 weeks) was 2.154, 2.248, 2.338 and 2.248 for the group A, B, C and D, respectively (Table 2, Figure 1). When the data for feed conversion ratio was subjected to the statistical analysis, the results were found to be non-significant. The results were in line with Feddes et al. (3) who reported non-significant results for feed conversion ratio for the broiler chicks under different stocking densities. In this study, the poorest feed conversion ratio (FCR) was for the group C but not affected significantly by the stocking density treatments. In the control group A, the average feed conversion ratio (FCR) was 2.15, which was the best in the four treatments of floor space. The FCR for both of the groups B and D was same (2.25). However, the effect of floor space on FCR was found to be non-significant.

CONCLUSION

The present study showed non-significant difference between the four treatments of stocking density or floor space provisions i.e. weight gain, feed consumption, FCR and mortality were found to be having non-significant difference between the four treatments of stocking densities under hot climate. Hence it can be concluded that if there is no effect of stocking density on the live performance of broiler chicks then they can be stocked at maximum density (12 birds/m²) without any detrimental effect on the live production performance keeping the weather conditions in mind of a certain region in general and specifically of Pakistan where the weather temperature is increased up to 45ºC and this high environmental temperature may cause high mortality when the birds would be highly stocked. The above study demonstrates that reducing stocking density on broiler farms will significantly improve broiler welfare. However, because stocking density is so critical in maintaining economic viability, further research should be conducted to find an optimal stocking density at which suitable levels of broiler welfare and economic return are achieved.

CONFLICT OF INTEREST

The authors for this manuscript solemnly declare that there is no any kind of conflict of interest.

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