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Effects of various stocking density on productive performance and some physiological traits of broiler chicks

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Abstract

This experiment was carried out as a survey at the commercial poultry farm of broiler chickens in Duhok region namely Amedy, Akry and Sumail in order to study the effect of stocking density on the chick performance and some physiological traits. Chicks were divided into three stocking densities namely 8.66, 10.41 and 13.36 birds/m². The results obtained are summarized as follows: Live body weights and feed conversion ratio at 7 weeks of age were non significant differences between different stocking densities. Data of feed intake was significantly high in 8.66 while mortality was significant high in stocking density of 13.36. Concerning hematological and blood serum parameters, data revealed insignificant differences among stocking density groups for triglycerides, total plasma protein, albumin, globulin, PCV and RBC count. While there were significant differences in glucose, total cholesterol, HDL, VLDL and Hb between different stocking densities.

Keywords: Broiler, Density, Physiological Traits, Carcass

Introduction

The influence of stocking density (the number of birds calculated on a weight basis per meter square) of different poultry species on growth and productive performance has generated considerable interest in recent years (Abdel-Azeem, 2010). Stocking densities are kept high to maximize financial returns. It is considered as one of the most important environment factors because of the established effect on growth rate of broiler chickens. However, for the purpose of defining optimal stocking density, it is necessary to realize differences in effects depending on the broiler genotype, environment conditions, duration of production cycle (final body weight), season and management conditions (Škrbić et al., 2009).

In the broiler industry, the major concern is the effect of high stocking densities on the welfare of birds, especially during the final weeks of the growing period when body weight per unit area is high (Ravindran et al., 2006). However, abundant studies have shown that increase in stocking density is accompanied with decreases in health and performance. These include reduced growth, body weight, carcass quality and immune status as well as increased breast blisters, ammonia burns and heat stress mortality (Cravener et al., 1992; Heckert et al., 2002; Pettit-Riley et al., 2002; Dozier et al., 2006). The literature has consistently shown that space allowances below a certain point (usually around 14-16 birds/m^2) compromise production and welfare (Estevez, 2007).

This study was undertaken to investigate the effect of various stocking density of broilers on productive performance under the Duhok condition. Also, because optimum stocking density in poultry is still subject to discussion, determination of the effects of stocking density on biochemical blood parameters of broilers was also studied.

Materials and Methods

The experiment was carried out between May and July, 2010 at the poultry unit of Kurdistan region (Duhok governorate farms), Animal Production Department, Agriculture College, University of Duhok, Iraq. A total of 51 day-old broiler (Ross 308 strain) chicks were obtained from a commercial broiler farm and were randomly divided into three stocking density treatment (8.66, 10.41, and 13.36 birds/m^2). Birds were fed standard broiler starter, grower and finisher feed for 49 days.

At the end of experiment, 12 birds from each group were slaughtered to get data on live weight and carcass characteristics. Two ml of blood was collected for

determination of hematological components, including Packed Cell Volume (PCV), Haemoglobin (Hb) concentration and Red Blood Cells (RBC), using standard procedures described by Davice and Lewis (1991). Serum glucose, total cholesterol, triglycerides, HDL, LDL, VLDL, total protein, albumin and globulin were determined by using commercial kits.

Statistical analysis

Data collected were subjected to one-way analysis of variance using SPSS (2007) statistical package. Means were compared using least significant difference (LSD) at probability level of 5% using Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

There was no significant effect of stocking density on live body weight of chickens at the end of the rearing period (Table 1). These results are not inline with studies of Makowski et al. (2004), Feddes et al. (2002) and Reiter and Bessei (2000) who found a significant effect of densities on body weight. However, the results obtained in this study are in agreement with those of Turkyilmaz (2008) who reported that stocking density had no significant effect on live body weight. In general, trend of decrease of the level of growth with the increase of stocking density was established (Lewis et al., 1997, Mortari et al., 2002, Dozier et al., 2005, Škrbić, 2007), as consequence of heat stress (Yadgari et al., *2006*), main factor of growth depression in cases of high stocking densities. Al-Homidan and Robertson (2007) indicated that body weight gain decreased by increasing stocking density of Hybro broiler from 10 to 15 bird/m^2.

The results indicated that broiler kept at 8.66 birds/m^2 consumed ($P \leq 0.05$) more feed as compared with those kept at 10.41birds/m^2 or those kept at 13.36 birds/m^2 during the rearing periods (table 2). Thompson (1972) indicated that feed intake per bird of Cobb broiler chickens decreased as the space per bird decreased. Puron et al. (1995) reported that there is a linear reduction in feed intake of broiler chickens when stocking density increased from 10 to 20 birds/m^2. Also, Feddes et al. (2002) showed that feed consumption decreased in broiler chickens when density increased from 14.3 to 23.8 bird /m^2. Furthermore, Al-Homidan and Robertson (2007) indicated that increasing stocking density of Hybro broiler chicken from 10 to 15 bird/m^2 resulted in reduction of feed consumption. In other study reported by Seker et al. (2009) showed that increasing stocking density of Japanese quails resulted in linear reduction in feed intake.

The analysis of variance indicted that feed conversion ratio was not significantly affected between various densities. The obtained results are in agreement with the results of Al-Homidan and Robertson (2007) who showed that feed conversion ratio of Hybro broiler chickens was not significantly affected by increasing stocking density from 10 to 15 bird/m^2, although feed conversion ratio was better for birds at higher density (1.76 and 1.85). Davidson and Leighton (1984) indicated that high population density caused lower feed efficiency than did a relatively low population density. Erensayin (2001) found that feed conversion ratio was better in quails with increasing group size.

Mortality rate recorded through the rearing period indicated that the birds stocked at 8.66 birds/m^2 showed the lowest percentage of mortality as compared with other groups (Table 1). These results are in harmony with those obtained by Imeada (2000) who indicated that total mortality rate of broiler chickens housed at 18 bird/m^2 was significant higher than those housed at 12 and 15 bird/m^2. Pettit-Riley and Estevez (2001) and AL-Hall (2001) concluded that higher stocking density resulted in significantly higher mortality during rearing period. However these results disagreed with Turkyilmaz (2008), Tinoco et al. (2007), Thomas et al. (2004), Feddes et al. (2002) and Hadorn et al. (2002) who noticed that stocking density had no significant effect on mortality in broilers. The high percentage of mortality in this study may be due to increasing density which caused an increase in stress and litter moisture, which resulted in an impaired immune system against the diseases which caused death of birds (Estevez, 2005). A significant effect of bird density on production index during the last week of age was observed. Chicks stocked at 10.41 birds/m^2 recorded the lowest production index (196.71) as compared with stocking density 8.66 and 13.36 birds/m^2 (214.31 and 210.73) respectively. This may be attributed to the effect of aforementioned parameters in this study.

No significant effect of different stocking density was observed on carcass weight, dressing percentage, thigh, breast, back, wing, neck and adipose tissue weight (Table 2). These results are in disagreement with the results of Dozier et al. (2005) and Dozier et al. (2006) who noticed that carcass weight decreased linearly as stocking density increased. Feddes et al. (2002) observed that birds grown at highest density had lower carcass weight. Whereas, Thomas et al. (2004) indicated that the stocking density had no influence on the carcass characteristic.

The effects of different stocking density on some hematological and biochemical blood parameters of broiler at the end of growing period has been shown in table 3. There were insignificant differences among different density groups of broilers for PCV, RBC, total protein, albumin, globulin and LDL. While there were significant ($P \leq 0.05$) differences in Hb, Glucose, Cholesterol, triglyceride, HDL and VLDL between

Table 1: Effects of different stoking density on live body weight, mortality percentage, feed intake, feed conversion and production index (Mean ± SE)

Parameters	8.66 (birds/m^2)	10.41 (birds/m^2)	13.36 (birds/m^2)
Live body weight (gm)	2618.33±126.6^a	2475.83±113.4^a	2665.00±181.3^a
Feed intake (gm)	6408.50±304.0^a	5535.33±22.4^b	5448.88±0.0^b
Feed conversion ratio	2.49±0.2^a	2.28±0.1^a	2.09±0.1^a
Mortality%	9.00±3.3^c	12.56±4.9^b	16.80±0.0^a
Production index	214.31±14.0^a	196.71±19.6^b	210.73±0.0^a

^{a,b} with different superscript in a row differ significantly (P≤0.05).

Table 2: Effects of different stocking density on Carcass characteristics (Mean ± SE)

Parameters	8.66 (birds/m^2)	10.41 (birds/m^2)	13.36 (birds/m^2)
Carcass weight (g)	1952.08±93.7^a	1746.11±93.4^a	1999.16±151.9^a
Dressing percentage (%)	74.58±0.46^a	70.61±1.85^a	74.79±0.69^a
Thigh weight (%)	28.46±0.58^a	28.44±1.19^a	28.54±0.51^a
Breast weight (%)	32.64±0.80^a	36.46±1.90^a	35.39±1.08^a
Back weight (%)	21.19±0.52^a	21.50±0.80^a	18.49±0.60^b
Wing weight (%)	10.58±0.12^a	11.10±0.50^a	10.90±0.20^a
Neck (%)	7.07±0.21^a	6.57±0.30^a	6.75±0.32^a
Adipose tissue (%)	5.48±0.13^a	6.46±0.30^a	4.90±0.25^b

^{a,b} with different superscript in a row differ significantly (P≤0.05).

Table 3: Effects of different stocking density on haematology and biochemistry (Mean ± SE)

Parameters	8.66 (birds/m^2)	10.41 (birds/m^2)	13.36 (birds/m^2)
Hb (%)	10.16±0.28^b	10.02±0.19^b	11.53±0.87^a
PCV (%)	30.75±0.35^a	30.38±0.72^a	30.83±0.60^a
RBC (million/mm^3)	2.36±0.07^a	2.25±0.01^a	2.22±0.24^a
Glucose (mg/dl)	280.75±10.25^a	251.50±4.86^b	253.0±13.27^b
Total protein (mg/dl)	2.53±0.08^a	2.54±0.2^a	2.66±0.16^a
Albumin (mg/dl)	1.63±0.03^a	1.75±0.16^a	1.57±0.03^a
Cholesterol (mg/dl)	126.7±6.1^a	117.3±3.0^b	121.3±6.1^b
Triglyceride (mg/dl)	100.0±54.1^a	97.9±5.8^a	87.0±25.3^a
HDL (mg/dl)	78.1±4.1^a	67.08±2.8^b	68.5±6.6^b
LDL (mg/dl)	31.2±2.5^a	30.8±2.2^a	30.3±2.3^a
VLDL (mg/dl)	26.16±10.8^a	14.4±1.18^b	17.3±6.0^b

^{a,b} with different superscript in a row differ significantly (P≤0.05).

densities. Our results agree with Škrbić et al. (2009) who indicated that stocking density had no significant affect on biochemical parameters. Glucose concentration was slightly higher than the value stated by Pavkov et al. (1998), whereas it is in accordance with results of Kanački et al. (2008). Placement density did not exert any influence on the haematological characteristics, as very similar values were recorded for the three stocking densities investigated. Serum biochemical parameters were also not density dependent. This is an indication of the body homeostasis of the birds and hence health of the birds was not adversely disturbed as a result of housing the birds up to 14.3 birds/m^2 (Yakubu et al., 2009). Using linear trend analysis, Thaxton et al. (2006) reported that stocking density did not cause physiological adaptive changes indicative of stress. Skomorucha and Muchacka (2007) submitted that the level of biochemical indicators was affected by animal density, although this manifested greatly in birds placed under housing density of 17 birds/ m^2, which is quite higher than the 14.3 birds/m^2 reported in the present study.

Based on established indices it can be concluded that stocking density from 8.66 to 13.36 birds/m^2 in intensive broiler production doesn't have significant effect on sbroiler performance and physiological parameters.

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