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Research Article

EFFECT OF STOCKING DENSITY ON BLOOD BIOCHEMICAL PROFILE, CARCASS CHARACTERISTICS AND DEVELOPMENT OF DIGESTIVE ORGANS OF TURKEY POULTS IN WINTER

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ABSTRACT

One week old, Beltsville Small White variety turkey poults (n=144) were divided into three treatments T-1: Standard stocking density (2.5 sq ft/ bird), T-2: High stocking density (1.25 sq ft/ bird) and T-3: Low stocking density (5.0 sq ft/ bird) and reared till 12 weeks of age. There was no significant difference in blood biochemical parameters among the treatment groups except serum cholesterol which was significantly higher ($P<0.05$) in the low stocking density group compared to the control group. Further, there was no significant difference in the carcass characteristics among the different treatment groups. Length of the small intestine and large intestine was significantly higher ($P<0.01$) in T-3 compared to the other two treatment groups. Proventriculus weight, small intestine weight and average caecal length was significantly lower ($P<0.05$) in T-2. Thus, it may be concluded that turkey poults can be reared under high stocking density without any adverse effect on the blood biochemical attributes and carcass quality characteristics during winter season.

Keywords: Blood biochemical, Carcass character, Stocking density, Turkey

Poultry occupies a unique position in livestock economy. The world's total production of poultry meat comprises of 85.6 % chicken, 6.8 % turkey, 4.6 % duck and 2.6 % goose and guinea fowl meat. India is the third largest egg and fourth largest poultry meat producer in the world. The poultry meat contributes nearly 46 % of total meat production of India. Turkeys are gradually gaining popularity in the world poultry market as a part of diversified poultry farming. Stocking density is one of the important aspects of housing management (Glatz and Rodda, 2013). Various authors have described the economic importance of stocking density as a factor for carcass quality and as a factor for poultry welfare. Increased stocking density can influence the skeletal development of broilers negatively and can increase the leg abnormalities leading to concerns in animal welfare. Animal welfare issues are considered controversial because it is generally assumed that any improvement in the area of animal welfare will have a negative impact on farm profitability (Marchewka *et al.*, 2013). Welfare considerations associated with turkey production are becoming increasingly important. The stocking densities under which chicken are usually kept vary greatly between breed, countries and husbandry system. Due to lack of stocking density standards, which balance the welfare issues and economic productivity for turkey in Indian conditions, farmers have to rely on personal experience in determining space allowances and hence the work was undertaken to study the effect of three different stocking densities on blood biochemical profile, carcass characteristics and development of digestive organs of turkey poults in winter season.

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MATERIALS AND METHODS

The study was conducted at the poultry farm of the Pt. Deen Dayal Upadhyaya Pashu Chikitsha Vigyan Vishwavidhyalaya Evam Go-Anusandhan Sansthan (DUVASU), Mathura, U.P. The approval of Institutional Animal Ethics Committee of College of Veterinary Science and Animal Husbandry, DUVASU, Mathura was obtained.

Experiment Design: Day old turkey poults of Beltsville small white variety procured during the winter months (average mean temperature 25.92 ºC and average mean Temperature Humidity Index 73.06) were wing banded and reared under standard managemental conditions for a week. Thereafter, one hundred and forty four poults were weighed individually and distributed randomly on uniform body weight basis in 3 treatment groups and 3 replicates in each treatment. The treatment groups were - 1: The birds were subjected to standard stocking density as described by CPDO, Bengaluru (2.5 ft^2 per bird)/(0.232 m^2 per bird)/ (4.305 birds per m^2)/ (0.4 birds per ft^2); 2: The birds were subjected to high stocking density (1.25 ft^2 per bird)/ (0.116 m^2 per bird)/ (8.625 birds per m^2)/ (0.8 birds per ft^2) and 3: The birds were subjected to low stocking density (5 ft^2 per bird)/ (0.464 m^2 per bird)/ (2.152 birds per m^2)/ (0.2 birds per ft^2). During the experimental period, the poults were provided turkey starter ration till 8 weeks of age (NRC, 1994) and turkey grower ration thereafter till 12 weeks of age (NRC, 1994). The birds were reared on deep litter system and continuous light (24L: 0D) as natural light was provided during the day time and after that artificial light with incandescent bulbs was given maintaining at

least 40 lux light in every corner of the house.

Blood biochemical parameters: At the end of 12 weeks of age, blood was collected into sterile tubes from six birds in each treatment group and serum was harvested and stored at -20 ºC until analyzed. The total protein, uric acid, creatinine, ALT (alanine aminotransferase), AST (aspartate aminotransferase), ALP (alkaline phosphatase) and total cholesterol were estimated in serum by standard techniques through kits procured commercially.

Carcass characteristics and development of digestive organs: At the end of the experiment, four birds per treatment were randomly selected. Birds were kept off feed for 12 h prior to their sacrifice but drinking water was supplied to them. Immediately after recording the live weights, the birds were sacrificed and allowed to bleed completely following 'halal' method. The birds were then eviscerated by removing the crop, trachea and viscera. The lungs were scrapped off and heart, liver and gizzard constituting giblets were separated, cleaned and weighed. The eviscerated carcass was allowed to chill in ice water for one hour and then weight of carcass was recorded. Individual cut-up parts as percent of live weight viz. thigh, drumstick, breast, back, neck and wings were estimated. The length and weight of different digestive organs (proventriculus, small intestine, large intestine and caecum) were measured.

Statistical Analysis: Data pertaining to various parameters were analyzed statistically as per the standard procedure and difference between the treatment means was obtained by using Duncan multiple range test.

RESULTS AND DISCUSSION

Blood biochemical parameters: Cholesterol level in low stocking density (SD) was significantly higher ($p<0.05$) than standard SD (Table 1). However, its level in high SD did not differ significantly with other two treatments. Further, no significant difference was observed between treatments for the other biochemical parameters *viz*. total protein, uric acid, serum creatinine, ALT, AST and ALP during winter season. In this study, the values of different serum biochemical parameters were in range of the values reported by Priya and Gomathy (2008).

Contradictory findings have been reported pertaining to blood protein and cholesterol. Thaxton *et al.* (2006) found that stocking density did not result in recognizable trend in cholesterol concentrations. Ozbey and Esen (2007) found that stocking density of rock partridges significantly affect the levels of blood total protein, total cholesterol, urea and alkaline phosphatase. Sekeroglu *et al.* (2011) exposed broilers to 3 stocking densities 9, 13 and 17 birds per m^2 and found that plasma protein levels were different significantly among the density groups. Tong *et al.* (2012) found that different stocking density in male suquin yellow chicken significantly affected the levels of blood total protein. Houshmand *et al.* (2012) in their study did not find significant difference between the normal and high stocking density with blood cholesterol. The higher level of cholesterol in low SD compared to the standard SD in our study may be due to the cold stress experienced by the birds during winter.

Carcass characteristics: Average percent liver weight was found to be significantly higher ($p<0.05$) in standard SD treatment than other two SD treatments (Table 2). However, no significant difference was observed between high and low SD. Average percent gizzard weight was significantly higher ($p<0.05$) in low SD than high SD. No significant difference was found among the treatments for other carcass traits *viz.* percent processing shrinkage, percent dressing yield, percent eviscerated weight, percent ready to cook yield and percent heart weight. Further, no significant difference was found among the treatment groups for individual cut-up parts as percent of live weight *viz.* thigh, drumstick, breast, back, neck and wings (Table 3).

Nicol *et al.* (2006) compared three stocking densities 7 birds/m^2, 9 birds/m^2 and 12 birds/m^2 and found that birds housed at 7 and 9 birds/m^2 had lower percent

Table 1

Effect of stocking density on the serum biochemical of growing turkey poults in winter

Treatment	Cholesterol (mg/dl)	Creatinine (mg/dl)	Total protein (g/dl)	Uric acid (mg/dl)	ALP (IU/L)	SGOT (IU/L)	SGPT (IU/L)
1	138.41[b]	0.29	3.06	3.15	1366.17	114.04	37.35
2	178.03[ab]	0.38	3.12	3.53	1243.79	114.26	5.75
3	202.50[a]	0.33	2.99	3.05	1408.88	113.82	11.05
SEM	10.78	0.03	0.09	0.41	40.26	8.65	9.55
Sig Level	P<0.05	NS	NS	NS	NS	NS	NS

Means bearing different superscript within a column differ significantly
NS: Non significant ($p>0.05$); SEM: Pooled Standard Error of Means

Table 2

Effect of stocking density on the carcass quality characteristics (% live weight) of turkey poults at 12 weeks of age in winter

Treatment	Processing Shrinkage (%)	Dressing (%)	Eviscerated wt (%)/ Ready to cook yield (%)	Heart weight (%)	Liver weight (%)	Gizzard weight (%)
1	4.71	75.01	65.84	0.51	2.02[a]	3.38[ab]
2	4.40	74.62	66.87	0.47	1.63[b]	2.47[b]
3	4.60	75.32	65.96	0.48	1.62[b]	3.99[a]
SEM	0.21	0.25	0.47	0.01	0.08	0.24
Sig level	NS	NS	NS	NS	P<0.05	P<0.05

Means bearing different superscript within a column differ significantly
NS: Non significant (p>0.05); SEM: Pooled Standard Error of Means

Table 3

Effect of stocking density on the cut up-parts as per cent of live weight of turkey poults at 12 weeks of age in winter

Treatment	Thigh (%)	Drumstick (%)	Breast (%)	Back (%)	Neck (%)	Wings (%)
1	15.20	14.76	29.80	21.82	5.90	12.52
2	14.61	14.03	31.44	22.21	5.22	12.48
3	15.41	14.64	30.59	20.93	5.77	12.67
SEM	0.20	0.19	0.36	0.31	0.25	0.11
Sig level	NS	NS	NS	NS	NS	NS

NS: Non significant (p>0.05); SEM: Pooled Standard Error of Means

Table 4

Effect of stocking density on the development of digestive organs of turkey poults at 12 weeks of age in winter

Treatment	Proventriculus weight (g)	Small Intestine length (cm)	Small Intestine weight (g)	Large Intestine length (g)	Large Intestine weight (g)	Average caecal length (cm)	Average Caecal weight (g)
1	0.37[a]	6.88[b]	2.41[a]	0.51[b]	0.24	1.23[a]	0.65
2	0.31[b]	6.43[b]	1.93[b]	0.46[b]	0.23	0.96[b]	0.54
3	0.37[a]	8.20[a]	2.42[a]	0.60[a]	0.26	1.24[a]	0.64
SEM	0.01	0.27	0.09	0.02	0.01	0.05	0.04
Sig level	P<0.05	P<0.01	P<0.05	P<0.01	NS	P<0.01	NS

Means bearing different superscript within a column differ significantly
NS: Non significant (p>0.05); SEM: Pooled Standard Error of Means

liver weight, than most of the 12 bird/m^2 treatments. Jayalakshmi *et al.* (2009) observed no significant effect for giblet, back, breast, thigh, wings and drum stick of commercial broiler reared in different floor densities. But observed significantly higher dressed weight, eviscerated weight, ready to cook yield and percent meat yield in 750 cm^2 per bird density group. Nahashon *et al.* (2009) found no significant difference in mean weights of breast, thigh, drumsticks, wings and gizzard of French guinea broilers reared on different floor densities. However, the liver weight of birds reared at low floor density was found 14% lesser and heart weight higher than that of birds reared at other floor densities. Whereas, Sekeroglu *et al.* (2011) found no significant effect on carcass yield and internal organ weights in broilers reared in three different densities. Dozier *et al.* (2006) found that carcass weight was depressed by increasing stocking density but carcass yields were not affected. Increasing stocking density was found to decrease breast fillet weight and its relative yield and breast tender weight, but not breast tender yield. Tong *et al.* (2012) in their study on effect of stocking density on performance of chicken in cage system found no significant difference in the organ to BW ratios, carcass and eviscerated carcass yields as density increased.

Development of digestive organs: Average proventriculus weight and average small intestine weight were found to be significantly higher ($p<0.05$) in standard and low SD treatments than high SD treatment (Table 4). Average small intestine length and average large intestine length were significantly higher ($p<0.01$) in low SD than other two SD treatments. Average cecal length was found to be significantly higher ($p<0.01$) in standard and low SD treatments than high SD treatment. There was no significant difference observed for average large intestine weight and average caecal weight among different stocking density treatments. The lower small intestine length, large intestine length, small intestine weight, large intestine weight and caecal weight in the high stocking density group birds may be due to poorer access to feed due to competition between the birds resulting in lesser development of the digestive organs compared to the other two treatment groups.

From this study, it can be concluded that turkey poults up to the age of 12 weeks can be reared under high stocking density in intensive farming system during the winter season without having any adverse effect on the blood biochemical attributes and carcass quality characteristics.

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