

Research Paper

Effect of Stocking Density on Behavioral Trait and Mortality of Broiler Chicken Under Intensive Poultry Production System

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ABSTRACT

Present investigation was conducted on broilers aged 6 weeks at poultry unit of Livestock farm complex, College of Veterinary and Animal Science, Navania, Udaipur (Rajasthan University of Veterinary and Animal Sciences) India. There was highly significant ($P \leq 0.01$) impact of stocking density on drinking frequency from 2nd to 6th week among all treatment groups. The mean percentage for weekly drinking frequency was highest in D3 (21.25) followed by control group D2 (20.12) and D3 (19.77) respectively. Similarly locomotion (movement of birds) showed ($P \leq 0.05$) significant effect on stocking density from 2nd to 6th week among all the three densities. The mean percentage for weekly locomotion was highest in D1 (58.30) followed by control group D2 (55.05) and D3 (52.05) respectively. However, non-significant effect of cannibalism was observed in all the three stocking densities during the whole experimental period. In the current study stocking density had no effect on leg deformity in broiler chickens. There was no mortality in all the treatment groups over the whole research period.

Keywords: Behavioural trait, Broiler, Intensive system, Stocking density

Poultry all over the world serve as a good source of an animal protein to most people throughout the world. Poultry is the second most widely eaten meat in the world, accounting for about 30% of meat production worldwide, after pork at 38% (FAO, 2019). As per the 20th Livestock census (2019) total Poultry population in India is 851.81 million that has been increased by 16.81% than previous census. Over 45.78% increase in backyard Poultry and total backyard Poultry is 317.07 million in 2019. The total commercial Poultry is 534.74 million which has increased by 4.5%. Among the livestock sector Poultry industry contributes about 1% of national

GDP and about 14% of the livestock GDP (Mishra, 2020). Stocking density is considered to be one of the highest important environmental factors due to established effects on growth rate of broiler chickens. Inadequate stocking density and heat stress caused by climate change can lower blood homeostasis and negatively impact the behavioral traits of animals (Mortari *et al.* 2002; Park *et al.* 2018).

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MATERIALS AND METHODS

The experiment was conducted at Poultry Farm of Livestock Farm Complex, College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur (Rajasthan University of Veterinary and Animal Sciences, Bikaner). One hundred and twenty (120) day old broiler chicks from a commercial hatchery in Ajmer, Rajasthan, were used for the study. In the brooding process, heat and light were provided by electrical hover brooders. The period of brooding lasted for 2 weeks. A total of 120 birds were randomly assigned to three stocking densities up to six weeks of age. Stocking densities were considered experimental design treatments. Four replications were assigned to each treatment and every replication was allocated to eight chicks D1 (8 birds/m²), D2 (10 birds/m²) which served as control, D3 (12 birds/m²). Both sexes were reared together on deep litter floor. The experimental pens, drinkers, and feeding troughs were cleaned, disinfected, and sprayed against external parasites before the commencement of experiment. During the entire experimental period, all experimental chicks were handled identically and strict hygienic measures were taken as per standard practice. On the 4th and 14th days, broiler chicks were vaccinated against Ranikhet disease (F1 strain) and Infectious Bursal Disease.

The observation was conducted according to Martin and Bateson's (2015) instructions, which involved scanning with the naked eye continuously from first to six weeks of age. Birds were observed twice daily, morning (9 a.m. to 10 a.m.) and evening (4 p.m. to 5 p.m.) respectively. All birds were scanned for 5 minutes before commencing a new 5 minutes scan of all behavior till the session completed. Drinking, mobility (bird movement), and cannibalism were among the documented behavioral tendencies. Based on the total number of birds observed, the percentage of birds showing categorized behavior was calculated (Reiter and Bessei, 2009).

Data on behavioral traits were entered into M.S. Excel and analyzed with SPSS software Version 22.0 (SPSS, 2015). A statistical technique of one-way ANOVA was used to compare means and if the probability value was less than 0.05, the difference was pronounced statistically significant. Duncan's Multiple Range Test was used to distinguish significant ($P < 0.05$) differences across variables

(Steel *et al.* 1997).

RESULTS AND DISCUSSION

Behavioural traits

The observed effect of behavioural traits on different stocking densities at different age groups was presented in Table 1-3. These findings revealed that bird drinking frequency and locomotion were significantly influenced by stocking density, while as cannibalism and leg deformation was unaffected by stocking density.

Weekly drinking frequency

The mean for the weekly drinking frequency for the 1st week were 3.47, 3.67 and 3.55 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly drinking frequency for the 2nd week were 7.77, 8.02 and 8.45 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly drinking frequency for the 3rd week were 11.30, 12.17 and 12.72 for treatment group D1, D2 (control) and D3, respectively.

The mean for the weekly drinking frequency for the 4th week were 16.10, 16.80 and 17.20 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly drinking frequency for the 5th week were 17.35, 18.12 and 18.57 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly drinking frequency for the 6th week were 19.77, 20.12 and 21.25 for treatment group D1, D2 (control) and D3, respectively.

The weekly drinking frequency was significantly ($P < 0.05$) affected by stocking density in the present research. Similar results were reported (Skrbic *et al.* 2009; Simitzis *et al.* 2012; Yanai *et al.* 2018 and Casanova *et al.* 2019) who found significant impact of stocking density on drinking. On the other hand, non-significant difference on drinking was reported by Leone and Estevez, 2008.

Weekly movement of birds (locomotion)

The mean for the weekly movement of birds for the 1st week were 16.42, 17.55 and 18.0 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly movement of birds for the 2nd week were 23.02, 23.52 and 23.77 for treatment group D1, D2 (control) and D3, respectively. The

**Table 1:** Proportion (%) of birds' weekly drinking frequency reared indifferent stocking densities

Weeks	Groups	N	Drinking frequency					
			1	2	3	4	5	6
D1		30	3.47	7.77 ^{ab}	11.30 ^a	16.10 ^a	17.35 ^a	19.77 ^a
D2		42	3.67	8.02 ^{ab}	12.17 ^b	16.80 ^b	18.12 ^b	20.12 ^a
D3		48	3.55	8.45 ^b	12.72 ^c	17.2 ^b	18.57 ^b	21.25 ^b
SEM		—	0.08	0.11	0.19	0.15	0.17	0.22
P-value		—	NS	*	**	*	*	*

* -Significant ($P < 0.05$), ** - Significant ($P < 0.01$), NS-Non -significant, a, b, c, Meanswith different superscript within the columns differ significantly with each other.

Table 2: Proportion (%) of birds weekly locomotion reared indifferent stocking densities

Weeks	Groups	N	Locomotion (movement of birds)					
			1	2	3	4	5	6
D1		32	16.42	23.02 ^a	35.50 ^b	42.20 ^b	48.25 ^b	58.30 ^c
D2		40	17.55	23.52 ^b	34.90 ^b	41.95 ^b	47.82 ^{ab}	55.05 ^b
D3		48	18.0	23.77 ^b	32.97 ^a	38.70 ^a	46.87 ^a	52.05 ^a
SEM			0.89	0.10	0.34	0.50	0.27	0.78
P-value			NS	*	*	*	*	**

* -Significant ($P < 0.05$), ** - Significant ($P < 0.01$), NS-Non -significant, a, b, c, Meanswith different superscript within the columns differ significantly with each other.

Table 3: Proportion (%) of birds weekly Cannibalism reared in different stocking densities

Weeks	Groups	N	Cannibalism					
			1	2	3	4	5	6
D1		32	2.47	3.57	7.57	14.90	21.67	28.45
D2		40	2.05	3.40	6.77	14.17	21.40	27.87
D3		48	1.70	3.22	6.90	14.47	21.25	27.92
SEM			0.45	0.15	0.42	0.44	0.18	0.53
P-value			NS	NS	NS	NS	NS	NS

* -Significant ($P < 0.05$), ** - Significant ($P < 0.01$), NS-Non -significant, a, b, c, Meanswith different superscript within the columns differ significantly with each other.

mean for the weekly movement of birds for the 3rd week were 35.50, 34.90, and 32.97 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly movement of birds for the 4th week were 42.20, 41.95, 38.70 and for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly movement of birds for the 5th week were 48.25, 47.82 and 49.87 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly movement of birds for the 6th week were 58.30, 55.05 and 52.0 for treatment group D1, D2 (control) and D3, respectively.

The weekly movement of birds was highly and significantly ($P < 0.01$) affected by stocking density in

the present research. Similar results were reported by (Skrbic *et al.* 2009, Simitzis *et al.* 2012 and Casanova *et al.* 2019) who found significant impact of stocking density on locomotion. On the other hand non-significant difference on locomotion was reported by Leone and Estevez, 2008.

Weekly Cannibalism

The mean for the weekly cannibalism of birds for the 1st week were 2.47, 2.05 and 1.70 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly cannibalism of birds for the 2nd week were 3.57, 3.40 and 3.22 for treatment group D1, D2 (control) and D3, respectively. The

mean for the weekly cannibalism of birds for the 3rd week were 7.57, 6.77 and 6.90 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly cannibalism of birds for the 4th week were 14.90, 14.17 and 14.47 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly cannibalism of birds for the 5th week were 21.67, 21.40 and 21.25 for treatment group D1, D2 (control) and D3, respectively. The mean for the weekly cannibalism of birds for the 6th week were 28.45, 27.87 and 27.92 for treatment group D1, D2 (control) and D3, respectively. The weekly cannibalism of birds was unaffected by stocking density in the present research. Similar results were reported by Febrer *et al.* 2006 and Huo *et al.* 2016.

Leg Deformity

It was observed that leg deformity was unaffected by stocking density during the entire research period. The weekly leg deformity of birds was unaffected by stocking density in the present research. Similar results were reported by Sorensen *et al.* 2000; Dawkins *et al.* 2004 and Huo *et al.* 2016.

The present findings on Behavioural aspects of broiler chickens from 0 to 6 weeks of age revealed that increased stocking density had a greater influence on drinking and locomotion, although cannibalism had no effect on broiler chickens among all the three stocking densities. Leg deformity was also unaffected by increasing or decreasing stocking density in the present study.

Percent mortality

There was no mortality in all the treatment groups over the whole experimental period. Similar results were obtained by Tinoco *et al.* 2007; Beg *et al.* 2011 and Tong *et al.* 2012 found that the stocking density had no effect on mortality among different stocking densities. The findings in the present study are attributed to management practices and other environmental conditions available to the experimental birds in poultry house.

CONCLUSION

The present findings on behavioral aspects of broiler chickens revealed that increased stocking density decreases behavioral activity in terms of drinking and locomotion, although cannibalism had no effect

on broiler chickens among all the three stocking densities. Leg deformity was also unaffected by increasing or decreasing stocking density in the present study. Hence, it was concluded that lower stocking density is advantageous to birds since the birds are less stressed and can express themselves freely.

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