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Influence of stocking density on blood parameters during the transport of short distance in commercial broiler chicken

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Abstract
A study was carried out to evaluate the effect of stocking density on blood parameters when the broilers are transported for a short distance of 150 km. The broiler birds were transported to 150 km with a stocking density of 480 and 350 sq.cm. The broilers were slaughtered with rest for four hours and without rest, blood samples were collected for the analysis of serum uric acid and malonaldehyde. The broilers transported with stocking density of 480 sq. cm with feed withdrawn and slaughtered without rest had significant (p<0.05) increase in the level of uric acid when compared with the broilers slaughtered with rest. The broilers transported after feed withdrawn under stocking density of 350 sq. cm and slaughtered after rest had a significantly (p<0.05) increased level of uric acid when compared control group. The broilers transported with stocking density of 480 sq. cm and slaughtered without rest had a significantly reduced level of MDA when compared with the broilers slaughtered with rest. The broilers with stocking density of 350 sq.cm with feed withdrawn, slaughtered with rest and with feed not withdrawn, slaughtered without rest had a significantly (p<0.05) decreased level of MDA.

Keywords: Stocking density, blood parameters during, broiler chicken

1. Introduction
Poultry industry in India has made a remarkable growth ever since its inception and is presently emerging as a sunrise sector with a growth rate of 8.51 and 7.52 percent in egg and broiler chicken meat production, respectively (BAHS, 2019) [2], as against 2.90 percent for agricultural crops (Economic Survey, 2019–2020) [5]. Estimates from the All India Poultry Breeders Association indicates that poultry contributes for 17.31 billion USD of total India's gross value and satisfies the hungers of 50 million people through direct and indirect employment. Within the poultry sector, broiler and layer segment constitutes about 65.30 and 34.70 percent, respectively with monthly turnover of 400 million chicks and 8,400 million eggs, respectively (ICRA, 2020) [8].
Broiler chicken rearing is mostly being carried out in the form of an intensive system in different geographical areas to be transported by road over a long distance to urban areas or centralized processing plants. Transportation is an essential component of the poultry industry, but leads to enormous stress on birds because they have little space for behavioural thermoregulation. The proportion of broiler chicken dead on arrival (DOA) has been reported to vary from 0.15 to 0.67 percent (Mitchell, 2006) [9]. Transportation of broiler resulted in average mortality of 0.30 to 0.40 percent and mortality rate increased with the length of journey (Petracci *et al.*, 2006) [11]. Transportation stress not only affects the chicken welfare but also decrease the quality of chicken and meat.

2. Materials and Methods
The selected broilers were feed withdrawn for 4 hours before the transport and without feed withdrawal, the birds were shifted manually and loaded in to the crates (Dimension: 88cm x 52cm). The crates were weighed after filling with the nine broilers per crate with the stocking density 480 sq cm (Indian standard 5238: 2001 Transport of poultry and Code of Practice) in four crates and 13 broilers per crate with the stocking density of 350 sq cm (routine practice) in four crates. The transport trial was conducted during the late evening time starting from seven o clock. The time taken for travelling 150 km was 3 hour. After the transport crates along with the birds were weighed for measuring the weight loss. The birds were slaughtered immediately. The blood samples were collected after transport without rest and by giving rest

for 4 hours before slaughter for the analysis of uric acid and malonaldehyde.

3. Results and Discussion

The results (Mean ± SE) of serum uric acid (mg/dl) in broiler chicken slaughtered without rest and with rest after transport are presented in the Table 1. The serum uric acid of the broilers transported for 150 km with stocking density of 480 sq. cm after feed withdrawn and slaughtered without rest and with rest for 4 hours were 5.28 ± 0.62 and 2.27 ± 0.53, respectively and for the broilers transported under stocking density of 350 sq. cm were 3.18 ± 1.17 and 3.66 ± 0.83, respectively. The broilers transported for 150 km with stocking density of 480 sq. cm without feed withdrawal and slaughtered without rest and with rest for 4 hours were 4.26 ± 0.55 and 3.07 ± 0.97, respectively and for the broilers transported under stocking density of 350 sq. cm were 2.93 ± 0.68 and 2.38 ± 0.89, respectively and for the control group the serum uric acid were 0.91 ± 0.26, respectively. There was a significant increase (p<0.05) of serum uric acid in the broilers slaughtered without rest and rest for 4 hours after transport when compared with the control. The broilers transported with stocking density of 480 sq. cm with feed withdrawn and slaughtered without rest had significant (p<0.05) increase in the level of uric acid when compared with the broilers slaughtered with rest. The broilers transported after feed withdrawn under stocking density of 350 sq. cm and slaughtered after rest had a significantly (p<0.05) increased level of uric acid when compared control group.

The resuls of the current study concur with the findigs of Delezie *et al.* (2007) [4] who found that plasma uric acid level significant increased for broilers transported 1.5 h under high stocking density when compared with low stocking density. Hussnain *et al.* (2020) [7] found that uric acid levels were is significantly higher in birds transported for 240 km compared to 80 and 160 km transport. He *et al.* (2022) [6] found that serum uric acid level for the broilers transported for 3 h was 133µmol/ L, which increased significantly when compared with control group (121 ng mL).

On the contrary to the findings Sarkar *et al.* (2013) [12] found that plasma uric acid levels for the broilers that were transported by paddle van for a period of 2.5 h showed no significant variation when compared with the control. Al-Abdullatif *et al.* (2021) [1] observed that uric acid level of the broilers transported for 4 h was 1.9 mg/dl. There was no significant effect on uric acid level due to transport.

The results (Mean ± SE) of serum malonaldehyde (µg/dl) in broiler chicken slaughtered without rest and with rest after transport are presented in the Table 1. The serum MDA of the broilers transported for 150 km with stocking density of 480 sq. cm after feed withdrawn and slaughtered without rest and with rest for 4 hours were 0.27 ± 0.01 and 0.67 ± 0.04, respectively and for the broilers transported under stocking density of 350 sq. cm were 0.63 ± 0.05 and 0.40 ± 0.08, respectively. The broilers transported for 150 km with stocking density of 480 sq. cm without feed withdrawal and slaughtered without rest and with rest for 4 hours were 0.29 ± 0.01 and 0.47 ± 0.10, respectively and for the broilers transported under stocking density of 350 sq. cm were 0.48 ± 0.03 and 0.62 ± 0.04, respectively and for the control the serum MDA were 0.27 ± 0.04, respectively. There was a significant increase (p<0.05) of serum MDA in the broilers slaughtered without rest and rest for 4 hours after transport when compared with control. The broilers transported with stocking density of 480 sq. cm and slaughtered without rest had a significantly (p<0.05) reduced level of MDA when compared with the broilers slaughtered with rest. The broilers transported with stocking density of 350 sq.cm with feed withdrawn, slaughtered with rest and feed not withdrawn, slaughtered without rest had a significantly (p<0.05) decreased level of MDA.

The study results agreed with the findings of Perai *et al.* (2014) [10] reported that plasma malonaldehyde concentration increased significantly in broilers after 3 h transport when compared with before transport. He *et al.* (2022)[6] also found that serum malonaldehyde level for the broilers transported for 3 h were 10.64 nmol/mL, which increased significantly when compared with control group (7.95 nmol/mL), respectively. But, Delezie *et al.* (2007) [4] and Castellinia *et al.* (2016) [3] observed that there was no significant difference on MDA level after transport of broiler.

Table 1: Mean (± S.E.) serum uric acid (mg/dl) and malonaldehyde (µg/dl) in broiler chicken slaughtered without rest and with rest after transport for 150 km

Treatment		Parameters	
Rest before slaughter	**Feed**	**Uric acid (mg/dl)**	**Malonaldehyde (µg/dl)**
Control (without transport)		0.91^{a}±0.26	0.27^{a}±0.04
Stocking density 480 sq. cm			
Without rest	Withdrawn	5.28^{c}±0.62	0.27^{a}±0.01
4 hour rest		2.27^{ab}±0.53	0.67^{d}±0.04
Without rest	Not withdrawn	4.26^{bc}±0.55	0.30^{a}±0.01
4 hour rest		3.07^{abc}±0.97	0.47^{bc}±0.10
Stocking density 350 sq. cm			
Without rest	Withdrawn	3.18^{abc}±1.17	0.63^{cd}±0.05
4 hour rest		3.66^{bc}±0.83	0.40^{ab}±0.08
Without rest	Not withdrawn	2.93^{abc}±0.68	0.47^{bc}±0.03
4 hour rest		2.38^{ab}±0.89	0.62^{cd}±0.04

^{abc}Means with different superscripts in a column differ significantly (p<0.05) (n=6)

3. Conclusion

The overall mean serum uric acid and MDA level in broilers transported for 150 km in both the stocking density incresed significantly when compared with control. The 4 hour rest after tansport reduced the level of uric acid in the broilers tansported with stocking density of 480 sq. cm with feed withdrawn. Whereas the level of MDA did not decrerase significantly with rest of 4 hours.

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