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Effect of floor space allowances on physiological and haematological parameters in *Vizi*anagaram Lambs

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Abstract
This study evaluated how different floor space allowances influence physiological and haematological responses in *Vizi*anagaram lambs under intensive conditions. Twenty-four post-weaned lambs were divided into three groups and maintained for 90 days with space allowances of 0.4, 0.8 and 1.2 m² per animal. Rectal temperature and pulse rate were slightly higher in lambs kept under restricted space, indicating mild stress, while respiration rate showed no significant change.
Haematological analysis revealed improved haemoglobin, packed cell volume and erythrocyte count in lambs provided with more space, whereas leucocyte count was higher under restricted conditions. FAMACHA score and faecal egg count remained unaffected. The results suggest that adequate space helps maintain better physiological stability in lambs.

Keywords: Floor space allowance, *Vizi*anagaram lambs, physiological and haematological parameters

Introduction
Sheep farming plays an important role in rural livelihoods, especially in countries like India where it supports income generation and food security. Indigenous breeds are generally preferred because they are well adapted to local climatic conditions and can perform reasonably well even under limited feeding and management resources.
*Vizi*anagaram sheep is one such meat-type breed found in the northern coastal region of Andhra Pradesh. These animals are known for their adaptability and consistent growth under both field and farm conditions. In recent years, there has been a gradual shift from traditional grazing systems to more intensive forms of rearing. Because of this, proper housing management has become increasingly important. Among different housing factors, floor space allowance is a key aspect. When animals are provided with sufficient space, they are able to move freely, rest comfortably, and access feed without much competition. On the other hand, restricted space may lead to stress and reduced performance.
Physiological parameters such as rectal temperature, respiration rate, and pulse rate are useful indicators of how animals respond to their environment. Similarly, haematological parameters give an idea about the health status and overall condition of the animals.
However, only limited information is available on how floor space affects these parameters in *Vizi*anagaram lambs. So, the present study was taken up to evaluate the effect of different space allowances under intensive rearing conditions.

Materials and Methods
The experiment was conducted at the Sheep Unit of the Livestock Research Station (LRS), Garividi, in *Vizi*anagaram district of Andhra Pradesh, under an intensive system of management for a period of 90 days. Twenty-four healthy post-weaned *Vizi*anagaram lambs were selected from the station flock for the study. All animals were examined prior to the experiment and only clinically healthy animals were included in the study. Prior to the commencement of the trial, the lambs were maintained under uniform conditions for 15 days to allow acclimatization and to adapt to the housing environment, feeding schedule, and routine management practices. During this adaptation period, the animals were dewormed with fenbendazole at a dose rate of 7.5 mg/kg body weight as a preventive measure, and the treatment was repeated once during the middle of the experimental period to control internal parasitic infections.

After the acclimatization period, the lambs were randomly allocated into three treatment groups based on their body weight, with eight animals in each group to ensure uniform distribution. Throughout the study, the animals were housed in clean, well-ventilated pens and maintained under proper hygienic conditions. Each group was allotted a different floor space allowance as per the experimental design.

Treatment	Floor space allowance
T_1	0.4 m² per lamb
T_2	0.8 m² per lamb
T_3	1.2 m² per lamb

Physiological parameters: Physiological parameters like rectal temperature, respiration rate, and pulse rate were recorded at regular intervals using standard methods. These observations were taken carefully to understand how the animals responded under different space conditions.

Faecal egg count: Faecal samples were collected at monthly intervals and analysed using the McMaster technique to estimate egg count.

Haematological parameters

Haematological parameters *viz*., haemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leucocyte count (TLC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were estimated at 30-day intervals up to 90 days during the experimental period.

Parameter	Description
Haemoglobin (Hb) g/dL	Oxygen-carrying capacity
Packed cell volume (PCV) %	RBC volume percentage
Total erythrocyte count (TEC) $\times 10^6/\mu L$	RBC count
Total leucocyte count (TLC) $\times 10^3/\mu L$	WBC count
Mean corpuscular volume MCV (fL)	RBC size
Mean corpuscular haemoglobin MCH (pg)	Hb per RBC
Mean corpuscular haemoglobin concentration (MCHC) g/dl	Hb concentration in RBC

FAMACHA

FAMACHA scoring of lambs was carried out at 0, 45 and 90 days during the experimental period to assess anaemia status. The scoring was based on the colour of the conjunctival mucous membrane using the standard FAMACHA chart. These observations were recorded to monitor the health condition of lambs under different floor space allowances.

Famacha Score	Mucous Membrane Colour	Anaemia Status
1	Dark red	Normal
2	Red-pink	Mild
3	Pink	Moderate
4	Light pink	Severe
5	Pale/white	Very severe

Statistical Analysis

The data were analysed using (ANOVA) as per Snedecor and Cochran (1994) to assess the effect of different floor space allowances on the studied parameters.

Results

Effect of Floor Space Allowances on Physiological parameters in Lambs

Rectal temperature showed noticeable variation among the treatment groups. Lambs maintained under lower space allowance recorded slightly higher values compared to those provided with more space. As the experiment progressed, a gradual decline in temperature was seen in all groups.

Respiration rate did not show much difference among the groups at any stage of the study. The values remained almost similar throughout, indicating that space allowance had little effect on this parameter.

Pulse rate, however, showed a different pattern. Higher values were observed in lambs kept under restricted space. Over time, the pulse rate decreased gradually in all groups, suggesting that the animals were adapting to the conditions.

It was clearly observed that while some parameters responded to space variation, others remained stable across treatments.

Table 1: Effect of Treatments on Physiological Parameters (Mean ± SE)

Parameter	Time	T1 (Mean ± SE)	T2 (Mean ± SE)	T3 (Mean ± SE)	P-value	Significance
Rectal Temperature (°F)	0 Day	102.48 ± 1.08^{a}	102.37 ± 0.73^{ab}	102.18 ± 1.12^{b}	0.041	*
	45 Day	102.58 ± 0.97^{a}	102.27 ± 0.72^{b}	102.27 ± 0.72^{b}	0.038	*
	90 Day	102.32 ± 0.70^{a}	102.15 ± 0.56^{ab}	101.98 ± 1.06^{b}	0.045	*
Respiratory Rate (breaths/min)	0 Day	27.50 ± 0.76^{a}	26.75 ± 0.70^{a}	27.25 ± 0.82^{a}	0.612	NS
	45 Day	26.87 ± 0.71^{a}	26.12 ± 0.62^{a}	26.50 ± 0.74^{a}	0.584	NS
	90 Day	24.75 ± 0.67^{a}	24.12 ± 0.54^{a}	24.50 ± 0.61^{a}	0.603	NS
Pulse Rate (beats/min)	0 Day	83.50 ± 1.15^{a}	82.75 ± 1.05^{b}	83.12 ± 1.09^{ab}	0.029	*
	45 Day	82.25 ± 1.01^{a}	81.50 ± 0.93^{b}	81.87 ± 0.96^{ab}	0.033	*
	90 Day	80.75 ± 0.90^{a}	80.12 ± 0.82^{b}	80.50 ± 0.85^{ab}	0.037	*

Means bearing different superscripts (a, b, c) within a row differ significantly ($p < 0.05$).
* Significant ($p < 0.05$); NS = Non-significant

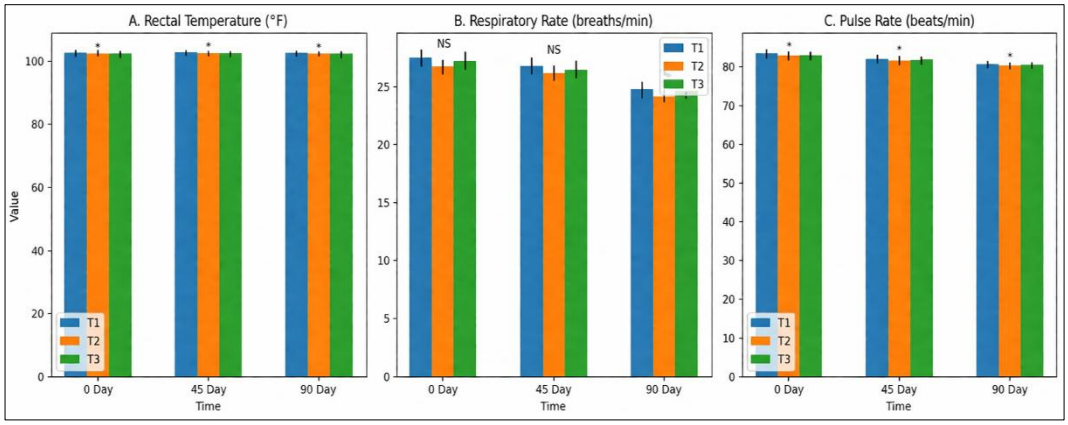

Fig 1: Effect of different treatments on physiological parameters of animals. (A) Rectal temperature, (B) Respiratory rate, and (C) Pulse rate expressed as Mean ± SE. Bars bearing * indicate significant difference ($P < 0.05$), while NS indicates non-significant difference

Famacha Score

Famacha scores recorded during the study did not vary much among the groups. The values remained almost similar at all-time intervals, suggesting that floor space did not have any major influence on anaemia status.

Table 2: Effect of treatments on famacha score (Mean ± SE)

Time	T1 (Mean ± SE)	T2 (Mean ± SE)	T3 (Mean ± SE)	Significance
0 Day	2.00 ± 0.19[a]	1.75 ± 0.25[a]	1.75 ± 0.25[a]	NS
45 Day	2.00 ± 0.27[a]	1.63 ± 0.18[a]	1.75 ± 0.25[a]	NS
90 Day	2.00 ± 0.19[a]	2.00 ± 0.19[a]	1.88 ± 0.23[a]	NS

Values are Mean ± SE. Means with same superscript do not differ significantly (P>0.05).

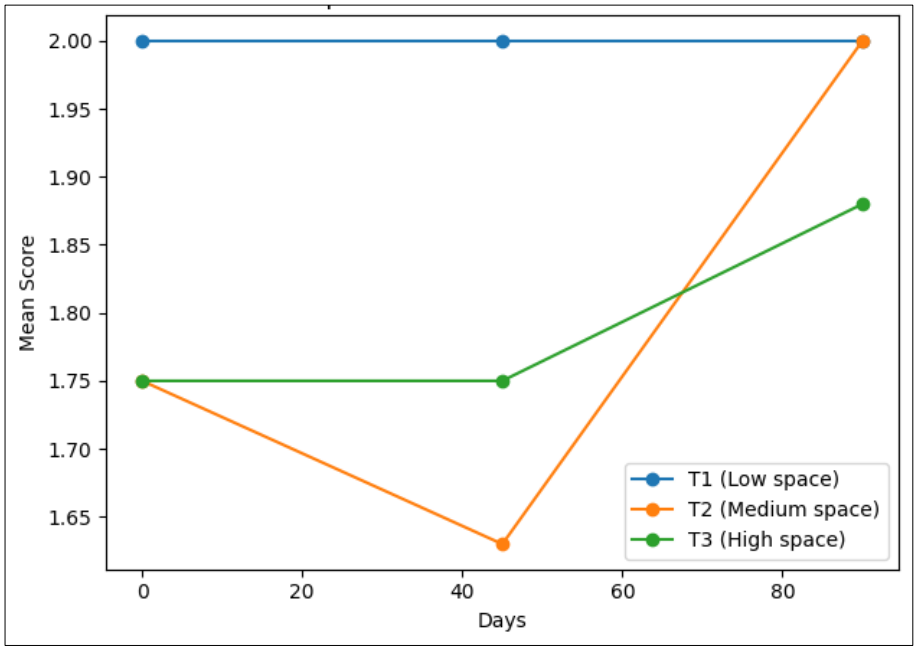

Fig 2: Effect of different floor space allowances on score of lambs

Faecal egg count

Faecal egg count increased gradually from the beginning to the end of the study in all groups. Although slightly higher values were noticed in some cases, the differences were not statistically significant. This indicates that parasite load was not directly affected by the space provided under the given conditions.

Table 3: Effect of treatments on Egg per Gram (EPG) values (Mean ± SE)

Time	**T1 (Mean ± SE)**	**T2 (Mean ± SE)**	**T3 (Mean ± SE)**	**Significance**
0 Day	149.25 ± 11.59[a]	148.13 ± 12.35[a]	162.00 ± 14.15[a]	NS
45 Day	168.00 ± 13.35[a]	165.63 ± 14.42[a]	180.75 ± 16.67[a]	NS
90 Day	180.50 ± 14.90[a]	178.13 ± 15.96[a]	195.75 ± 18.52[a]	NS

Values are expressed as Mean ± SE. Means bearing same superscript (a) do not differ significantly (P > 0.05). NS = Non-significant.

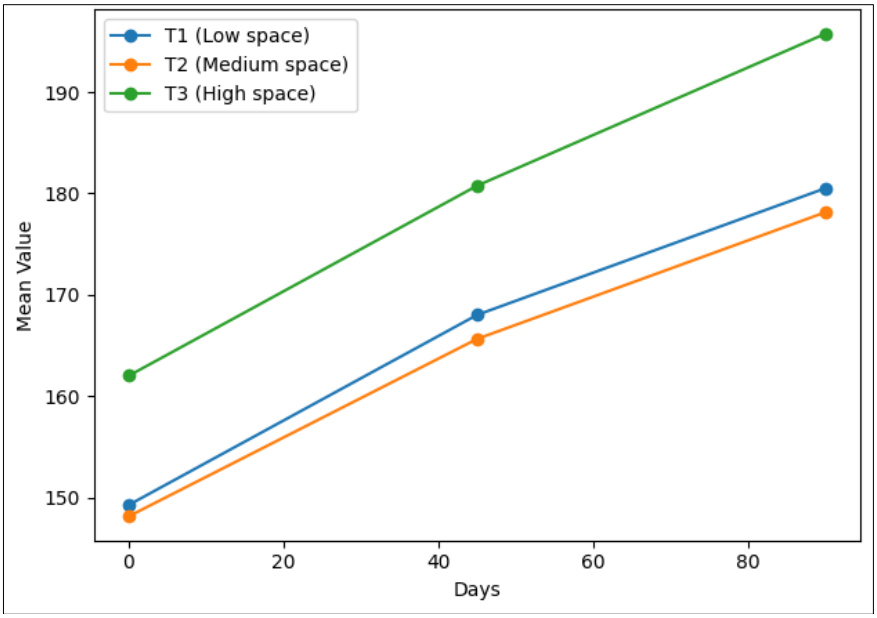

Fig 3: Effect of different floor space allowances on parameter of lambs over time

Effect of Floor Space Allowances on Hematological Parameters in Lambs

Haematological parameters showed some clear differences among the groups. Lambs provided with more space had better haemoglobin levels, packed cell volume, and total erythrocyte count. This suggests an improved physiological condition in these animals.

On the other hand, total leucocyte count was higher in lambs kept under restricted space. This may be linked to mild stress conditions. However, parameters like MCV, MCH, and MCHC remained almost unchanged across all groups.

Overall, it appears that increased space had a positive effect on important blood parameters, while some indices remained unaffected.

Table 4: Effect of Treatments on Hematological Parameters (Mean ± SE)

Parameter	T1 (Mean ± SE)	T2 (Mean ± SE)	T3 (Mean ± SE)	Significance
Hb (g/dL)	10.46±0.24^{a}	10.92±0.23^{b}	11.65±0.31^{c}	0.032*
PCV (%)	31.8±0.3^{a}	33.2±0.3^{b}	35.0±0.4^{c}	0.048*
TEC (×10^{6}/µL)	10.8±0.3^{a}	11.4±0.3^{b}	12.3±0.4^{c}	0.021*
TLC (×10^{3}/µL)	10.1±0.3^{a}	9.5±0.3^{b}	8.6±0.3^{c}	0.045*
MCV (fL)	29.1±0.15	28.9±0.13	28.7±0.10	NS
MCH (pg)	9.43±0.14	9.56±0.05	9.57±0.04	NS
MCHC (g/dL)	33.0±0.2	33.1±0.2	33.3±0.2	NS

Means bearing different superscripts (a, b, c) within a row differ significantly ($p < 0.05$).
* Significant ($p < 0.05$); NS = Non-significant

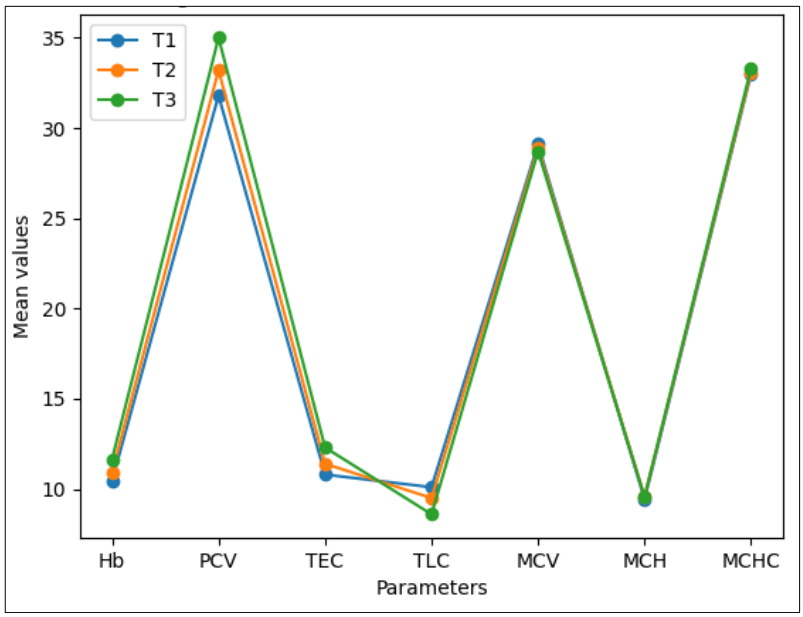

Fig 4: Haematological parameters of lambs under different floor space allowances (Mean ± SE)

Discussion

The findings of the present study suggest that floor space allowance has a clear influence on certain physiological and haematological responses in *Vizianagaram* lambs. Lambs kept under restricted space showed slightly higher rectal temperature and pulse rate, which may be due to mild stress caused by limited movement and increased competition. It was also noticed that similar trends have been reported earlier, where higher stocking density affected physiological stress indicators in sheep (Akin *et al.*, 2018; Chaumont *et al.*, 2020) [1, 4].

Respiration rate, however, did not differ significantly among treatments. This suggests that the level of space provided in the present study was sufficient to maintain normal respiratory function. Comparable findings were reported in sheep where respiration rate remained relatively stable despite variation in stocking density (Averós *et al., 2014*) [2].

FAMACHA score and faecal egg count did not show significant differences among treatment groups, indicating that floor space allowance had no direct influence on anaemia status or parasite load under the present management conditions. Earlier studies also suggest that parasitic load is more closely related to environmental and management factors rather than housing space alone.

Haematological parameters showed a clearer response to variation in floor space. Lambs maintained under higher space allowance exhibited improved haemoglobin levels, packed cell volume, and total erythrocyte count, indicating better physiological status and oxygen-carrying capacity. In contrast, total leucocyte count was higher in lambs under restricted space, which may reflect a stress-related response. These findings are in agreement with earlier reports where stress conditions influenced haematological parameters in sheep.

Interestingly, erythrocyte indices such as MCV, MCH, and MCHC remained unchanged across treatments. This suggests that while overall blood profile responds to environmental conditions, red blood cell characteristics remain relatively stable. Similar trends have been reported in sheep reared under different environmental conditions (Seixas *et al.*, 2021) [7].

Overall, the results suggest that although moderate variation in floor space may not influence all parameters, restricted space can induce mild physiological stress and affect key indicators. Providing adequate space appears to support better physiological stability and overall health in lambs under intensive rearing systems. These observations are in line with earlier findings on sheep housing and behaviour (Bøe and Færevik, 2016) [3]. This trend was also clearly noticed during the experimental period.

Summary and Conclusion

From the present study, it can be concluded that floor space allowance has a measurable effect on certain physiological and haematological parameters in *Vizianagaram* lambs. Animals kept under restricted space showed higher rectal temperature and pulse rate, indicating possible stress. In contrast, lambs provided with more space showed better blood parameters, suggesting improved physiological condition. However, parameters like respiration rate, FAMACHA score, and faecal egg were not significantly affected. This indicates that while moderate variation in space may not influence all parameters, providing adequate space is still important for maintaining overall health and well-being of the animals.

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