



Assessing the Impact of Free-Range and Indoor Rearing Systems on small ruminant physiology, Behavior, and Welfare Indicators in a Sierra Leonean Context

Hassan Benya¹, MPH, Emmanuel Odayeh², MPH, Ibrahim Benya¹, MSc

Affiliations: ¹Celebrity Agricultural company (SL) Limited, Sierra Leone; ²Lithesome Impact Development Initiative, Nigeria

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Background

- Free-range small ruminant production has gained increasing attention due to its potential benefits for animal welfare, behavior, and meat quality.
- Although goats are ranked as the third most productive small ruminants globally, limited research has examined how different rearing systems influence their health, welfare, and muscle characteristics, particularly within the African context.
- In West Africa, and specifically in Sierra Leone, comparative data on long-distance pasture systems (LDPS) versus conventional indoor systems (IS) remain scarce. This knowledge gap hinders evidence-based for sustainable best practices.
- Therefore, this study investigates the impact of a LDPS compared to IS on key parameters including health and welfare indicators, feeding and natural behaviors, and muscle fiber characteristics of small ruminants in Sierra Leone

Objectives

To assess the impact of the Long-Distance Pasture System (LDPS) compared to the Indoor System (IS) on:

- health and welfare indicators,
- feeding and natural behaviors, and
- muscle fiber characteristics

Materials and Methods

- This study was conducted in Port Loko District, Koya Chiefdom, at Celebrity Farm, which operates in two villages. The LDPS was located in Mamusa Village, while the IS was situated in Roborreh Village, approximately two miles apart from each other.
- A total of twenty animals (10 goats and 10 sheep) were randomly assigned to two management systems: the LDPS and the IS. Each system consisted of five goats and five sheep.
- In the LDPS, animals grazed freely within a distance of up to 200 meters on the farm without restriction. In contrast, the IS animals were tethered by the neck and confined to a limited area for regulated feeding.



Figure 1: LDPS sheep grazing in the field

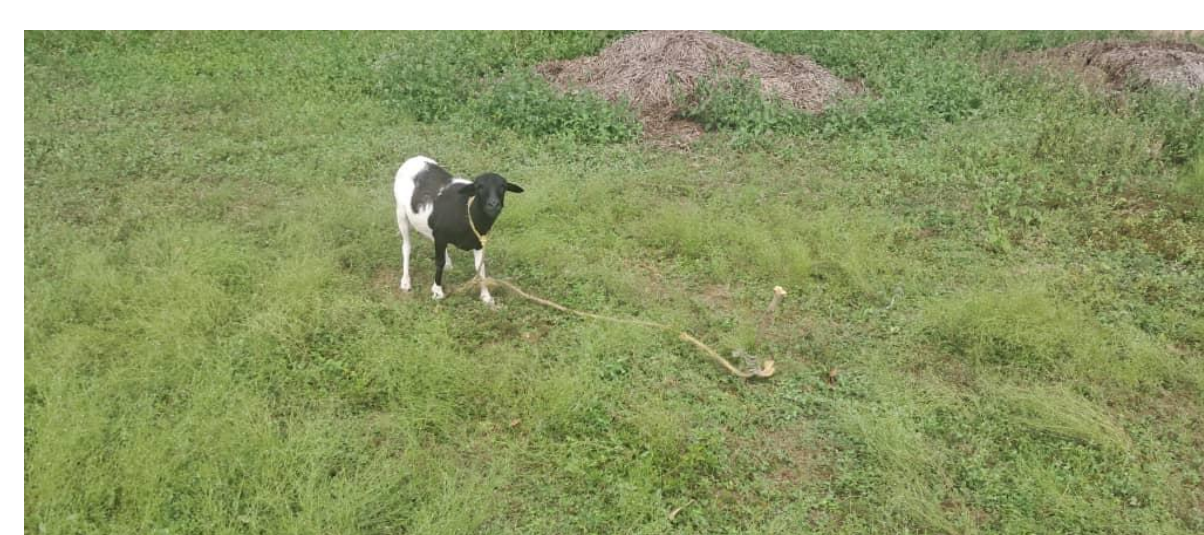


Figure 2: IS sheep grazing in the field

- The study was conducted from May to August 31, 2025. During this period, researchers monitored the animals' health conditions, feeding habits, muscle fiber composition, and welfare indicators—including mobility and behavioral responses—daily from 8:00 a.m. to 6:00 p.m.

Methods

- Data were collected using KoBoToolbox by trained farm staff and later analyzed using Microsoft Excel and SPSS to generate frequencies, proportions, and statistical inferences.
- Body weight was measured using both a standing scale and a tape rule. The tape rule method estimated weight based on the chest girth formula and was validated against the standing scale measurements. The average of the two measurements was used as the confirmed body weight for each animal



Figure 3: Measuring the hearth Girth to estimate weight of the sheep using tape rule



Figure 4: Validating the weight of sheep using standing scale

Results

The study involved 20 small ruminants 10 goats and 10 sheep—equally divided between the LDPS and the IS. Overall, females comprised 70% (14) and males 30% (6) of the sample. The ages ranged from 8 to 40 months, with a mean age of 23.7 months, ensuring balanced representation across species, sex, and age groups;

a). Health & Welfare Indicators: LDPS gained over three times more weight per month compared to those in the IS, and they also demonstrated significantly better health and lower stress levels

Variable	IS	LDPS	P-value
Avg. Monthly Weight Gain	0.82 kg	2.50 kg	p = 0.0005
Health Status	Good	Excellent	-
Stress Indicators	Moderate (bleating, panting)	Minimal (no panting)	-

Table 1: Health, Growth, and Stress Indicators of Small Ruminants Under IS and LDPS Systems

b). Feeding & Natural Behaviors: IS goats and sheep spending more time foraging due to limited movement and stress, whereas LDPS fed with composure with calm behavioral welfare

Variable	IS	LDPS
Foraging Time	8.0 hours	6.6 hours
Normal Feeding Behavior	45%	98%
Resting Time	6.8 hours	7.1 hours

Table 2: Behavioral Indicators (Feeding and Resting Patterns) of Small Ruminants Under IS and LDPS Management System

c). Muscle Fiber Characteristics: Both systems produced firm muscle tone, but LDPS animals showed superior muscle development (92.5%) and fewer injuries (10%). These results suggest that LDPS promotes physical conditioning through movement with lower risk of injury.

Variable	IS	LDPS
Improved Muscle Development	75%	92.5%
Injury Rate	20%	10%

Table 3: Muscle Development and Injury Rate Outcomes Under IS and LDPS Management Systems

Conclusion

- The findings clearly indicate that the Long-Distance Pasture System (LDPS) offers a substantial advantage over the Indoor System (IS) across all key parameters — including productivity, health, welfare, and physical conditioning.
- Goats and sheep reared under LDPS not only exhibited superior growth and muscle development but also showed lower stress levels and more natural feeding behaviors, reflecting enhanced overall welfare and adaptation to their environment

Limitations

- Most of the animals selected were females because the farm operates as a commercial breeding unit. This imbalance may have introduced selection bias and affected the comparability of male and female performance outcomes.
- The pregnancy status of female ruminants was not determined before the recruitment. This may have artificially increased body weight in both LDPS and IS groups, potentially influencing weight gain results.
- During periods of rainfall mainly July and August 2025, animals from both systems were restricted from grazing outdoors, which likely reduced feed intake and contributed to lower weight gain during those times

Recommendations

- Livestock farmers are encouraged to adopt LDPS as the main rearing model for goats and sheep in Sierra Leone, under the guidance of the Ministry of Agriculture and Forestry (MAF) and the Directorate of Livestock given its demonstrated benefits of weight gain and stress free
- The Ministry of Agriculture, in collaboration with veterinary services and agricultural NGOs, should facilitate the provision of mineral and nutritional supplements to enhance animal growth and health in pasture-based systems.
- National Livestock organizations (NLOs) and district livestock officers should organize regular training programs to build farmer capacity in LDPS management, pasture maintenance, and animal welfare monitoring.

Reference

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Contact

Corresponding Author: Hassan Benya, CEO, Celebrity Agricultural Company Limited (SL)

Email: celebrityfarmsl@gmail.com

Phone: +23277558048 / +23275299198

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