

Contribution Title

Comparing sheep production systems in India, through:

Comparative Evaluations of Abnormal Behavior, Panting, Lamb Mortality and Fleece Cleanliness in Kenguri Sheep under Intensive and Extensive Rearing Systems in Yadgir District of Karnataka, India

Author: **Kanakaraja MG¹**

¹PhD scholar under the division of Livestock Production Management, ICAR – National Dairy Research Institute, Karnal, Haryana, India; contact email: drkmgulagi96@gmail.com

Keywords: Abnormal behavior, Animal welfare indicators, fleece cleanliness, lamb mortality, panting.

1. First Section

1.1 Abstract:

The important welfare issues of Kenguri sheep faced during group welfare assessment were analyzed during the study. Total of 20 each intensive and extensive Kenguri sheep farms having the herd size ranging from 35 to 300 and 25 to 1480, respectively were cited for group welfare assessment in Yadgir (i.e., Northern Eastern dry agro-climatic zone) district of Karnataka state, India. Krishi Vigyan Kendra, Kawadimatti, Yadgir, UAS, Raichur. Here each selected herd raised up in both intensive and extensive rearing systems was assessed for 20 minutes, during the months of January and February of the year 2022. The group level welfare indicators such as abnormal behavior (stereotypy), panting, lamb mortality and fleece cleanliness were evaluated as per Animal Welfare Indicators assessment protocol for sheep. The overall first group level welfare assessment was significant in between the intensive and extensive rearing systems. The comparative welfare study among total of 40 sheep farms revealed that, the stereotypy observed was 4.88 and 1.24%, panting was 1.71 and 3.66%, mild heat stress was 2.18 and 6.49%, lamb mortality was 30.06 and 26.47% in lambs born alive and 0.89 and 2.03%, in lambs born dead. Losses upto weaning was 3.40 and 4.45% and minimum ewes mated was 45.73 and 42.48%. Minimum lambs reared was 30.48 and 26.52%; Fleece cleanliness was very wet that is 2.19 and 3.47%, and filthiness is 0.14 and 1.11% of animals in both intensive and extensive rearing systems, respectively. This study may boost the quality of animal assessment for getting better value-added products under the frame work of welfare status in farming community in the future.

1.2 Introduction

Animal welfare has recently gained importance, not only in developed nations but also in developing nations like India, where land and labour are easily available to produce agricultural products affordably. Along with improved health and production, better animal welfare practices have also increased the trading market opportunities. India ranked third in the sheep population in the world, with 74.26 million sheep (20th Livestock census, 2019). The total percentage of sheep has increased during 2019 census compared to last livestock census 2012 (19th Livestock census, 2012) by 14.13% (BAHS, 2023).

In southern India in the state of Karnataka, the total population of Kenguri sheep is 6.7 lakhs, according to recent report (Gowane *et al.*, 2020). The nutritional value of mutton has increased due to globalization and it is now necessary to improve the sheep's mutton quality in order to meet the growing demand (Kulkarni *et al.*, 2008). Since consumers desire high quality livestock products obtained from good welfare accustomed production systems and they are willing to pay fairly for those products. Therefore, evaluating the welfare of animals is a key area for improving economic productivity.

Animal welfare includes Animal husbandry, behavior, management techniques, and health. It is evident that the precise and reliable assessment of the key attributes is crucial for all aspects of animal welfare (Scott *et al.*, 2001). Prior to the development of management-based indicators by Mullan *et al.* (2009), on-farm welfare assessments primarily focused on evaluating farm resources (such as housing and feed), also known as resource-based indicators, or those that evaluated farmer policies and management techniques, also known as policy-based indicators (Capdeville and Veissier, 2001; FAWC, 2009).

A "natural life" for sheep is possible with the help of large-scale sheep farming practices. Sheep have a great deal of independence and control over their behaviors, including grazing, exploring, ruminating, social contact and a maternal instinct (Dwyer, 2009). These characteristics of extensive systems are related to those found in the "five freedoms" - freedom to express typical behaviors - which is one of the three conceptual frameworks used to evaluate animal health (Fraser, 2003).

1.3 Material and Methods

1.3.1 Sheep Farm Visits:

Twenty sheep farms both in intensive and extensive rearing systems, having total sample size ranging from 25 to 1480 were selected based on their availability in Yadgir district of Karnataka, the average annual rainfall ranges from 640 to 810 mm (Hallad *et al.*, 2023).

In order to prevent heat stress on the animals, all the sheep were examined at cooler times of the day (either in the morning or in the evening) when the farms were visited. This information was communicated to the sheep farmers via phone prior to the visits. All the data was gathered and entered into the annexure forms according to the Animal Welfare Indicators (AWIN) welfare evaluation of sheep (Dwyer *et al.*, 2015).

1.3.2 Assessment protocol:

Each herd was observed individually by live visit of assessor to the farms and spared about 20 minutes to evaluate each of the four first level group welfare indicators- abnormal behavior (stereotypy), panting, lamb mortality and fleece cleanliness as defined by Dwyer *et al.* (2015). The detailed assessment criteria are presented in the Table 1 below.

Table 1. Assessment of first level group welfare indicators of sheep

Welfare indicators	Assessment criteria
Abnormal behavior (stereotypy)	<ul style="list-style-type: none"> ➤ The flock is watched uninterruptedly for 20 minutes. ➤ The number of animals that exhibit stereotypical behavior, such as repetitive pacing or circling while taking the same path back and forth or around the pen, repeatedly cocking the head back over the shoulders and gazing upward, or repeatedly pulling, biting, or plucking the wool from another ewe's back. ➤ Record the total number of animals showing stereotypy in the observed sub-group.
Panting	<p>Scored on a 3-point scale-</p> <ol style="list-style-type: none"> 1. Normal respiration- The pace of breathing is normal (around 20 inhalations in a minute), and it takes place with the closed mouth. 2. Mild heat stress- The rate of respiration is more than 30 respirations per minute but lower than 40, and breathing is done with the mouth closed. Panting is not tallied for this condition. 3. Panting- The pace of breathing is more than 40 breathing per minute. and it happens while the mouth is open.
Lamb mortality	<ol style="list-style-type: none"> 1. Lambing records available- Record: a) number of lambs born alive, b) number of lambs born dead, and c) losses due to weaning. 2. Minimal records available- Keep track of the following information: <ol style="list-style-type: none"> a) The number of ewes that mated with a breeding ram during the recent breeding season; b) The number of lambs raised (including all lambs produced: those sold for finishing,

	sold as store lambs, sold for breeding and maintained on the farm).
Fleece cleanliness	<p>Scored on a 5-point scale-</p> <ol style="list-style-type: none"> 1. Score 0- Clean and dry. Fleece shows no sign of dirt or contamination. 2. Score 1- Due to the weather at the moment, dry or just a little damp. A little dirt or filth on the body was caused by handling the animals that day or by their pens. 3. Score 2- Very damp or wet. Coat contaminated by mud or dung from field or hill. 4. Score 3- Very wet. Very heavily soiled with mud or dung. 5. Score 4- Animal is filthy, extremely wet, and covered with mud or faeces, which may be on the belly, flanks, legs, back, and face.

(Dwyer *et al.*, 2015)

1.4 Statistical analysis:

The results were derived from the statistical tools such as Mean (average), standard deviation, Chi-square test (P-value) by using IBM SPSS version 16.0 software.

1.5 Results and Discussion

1.5.1 Abnormal Behavior:

The mean percentage occurrence of stereotypic behavior was more in intensive rearing system (4.88 ± 0.69) compared to extensive rearing system (1.24 ± 0.21), as the oral (licking, chewing) and locomotor (butting, weaving, wool biting) behaviors are commonly noticed in intensive system (Table 2). These findings are aligned with the results of Lauber *et al.* (2012).

1.5.2 Panting:

The occurrence of mild heat stress behavior was more in extensive system (6.49 ± 0.77 %) of rearing when compared to intensive system of rearing (2.18 ± 0.55 %). Similarly, the incident of panting was more in extensive rearing system (3.66 ± 0.53 %) than in intensive rearing system (1.71 ± 0.30 %) (Table 2). The testimony on reliability of panting as a heat stress indicator, but the incidence of panting was too low for analysis. Panting can also occur in sheep under psychological stress, when stress-induced hyperthermia can arise, therefore this measure is only specific for heat stress when tested in undisturbed animals, but it can be an indicator of distress in other situations. The similar findings were reported by Pedernera-Romano *et al.* (2011) and Phythian *et al.* (2012).

1.5.3 Lamb Mortality:

The overall lamb survival rate was better in intensive rearing system as percentages of lambs born alive (30.06 ± 1.63), minimum ewes mated (45.73 ± 4.14) and lambs reared (30.48 ± 1.58) were more in intensive rearing system. In contrary lambs born dead (2.03 ± 0.54) and losses due to weaning (4.45 ± 0.09) percentages were more in extensive system of rearing (Table 2). Accurate farm record keeping is required to assess lamb mortality. Many farms fail to keep track of lamb mortality. However, even rudimentary farm records can be used to estimate lamb productivity and they do not distinguish between different causes of mortality, these outcomes are in line with the reports of Stott *et al.* (2012).

1.5.4 Fleece Cleanliness:

The sheep showed more dirtiness, might be due to frequent accessibility to pond water for drinking purposes, leading to more wetness (3.47 ± 0.48 and 2.19 ± 0.35 %) and filthiness (1.11 ± 0.25 and 0.14 ± 0.08 %) reared under extensive and intensive rearing systems, respectively (Table 2). Evaluating the cleanliness of housed sheep's coats and the hygiene of their lying areas, but did not report on the relationships between the two, these results are in agreement with outcomes of Stubbsjøen *et al.* (2011).

Table 2. First level group welfare indicators assessment of Kenguri sheep both in intensive and extensive rearing systems

S No	Particulars	Intensive (n=20)	Extensive (n=20)	(P-value)
Abnormal behavior				
1	Stereotypy (% of animals)	4.88 ± 0.69^a	1.24 ± 0.21^b	0.005
Panting				
1	Mild heat stress (% of animals)	2.18 ± 0.55^a	6.49 ± 0.77^b	0.007
2	Panting (% of animals)	1.71 ± 0.30^a	3.66 ± 0.53^b	0.006
Lamb mortality				
1	Lambs born alive (% of animals)	30.06 ± 1.63^a	26.47 ± 2.27^b	0.025
2	Lambs born dead (% of animals)	0.89 ± 0.15^a	2.03 ± 0.54^b	0.045
3	Losses to weaning (% of animals)	3.40 ± 0.18^a	4.45 ± 0.09^b	0.034
4	Minimum ewes mated (% of animals)	45.73 ± 4.14^a	42.48 ± 4.68^b	0.026
5	Minimum lambs reared (% of animals)	30.48 ± 1.58^a	26.52 ± 2.27^b	0.015
Fleece cleanliness				
1	Very wet (% of animals)	2.19 ± 0.35^a	3.47 ± 0.48^b	0.011
2	Filthy (% of animals)	0.14 ± 0.08^a	1.11 ± 0.25^b	0.000

Mean values with different superscripts (a, b) within the row differ significantly ($P < 0.05$)

1.6 References:

1. 19th Livestock census, Animal Husbandry Statistics. Government of India, Ministry of Fisheries Animal Husbandry and Dairying, Department of Animal Husbandry and Dairying, Krishi Bhawan, New Delhi, 2012. <https://dahd.nic.in/schemes/programmes/animal-husbandry-statistics>
2. 20th Livestock census, Animal Husbandry Statistics. Government of India, Ministry of Fisheries Animal Husbandry and Dairying, Department of Animal Husbandry and Dairying, Krishi Bhawan, New Delhi, 2019. <https://dahd.nic.in/schemes/programmes/animal-husbandry-statistics>
3. Basic Animal Husbandry Statistics, Annual Report. Animal Husbandry Statistics. Government of India, Ministry of Fisheries Animal Husbandry and Dairying, Department of Animal Husbandry and Dairying, Krishi Bhawan, New Delhi, 2023. <https://dahd.nic.in/schemes/programmes/animal-husbandry-statistics>
4. Capdeville J, Veissier I. A Method of Accessing Welfare in Loose House Dairy Cow at Farm Level, Focusing on Animal Observations. *Acta Agric Scand Sect A- Anim Sci* 2001; 51: 62-68. <https://doi.org/10.1080/090647001316923081>
5. Dwyer CM. Welfare of sheep: Providing for welfare in an extensive environment. *Small Rumin Res* 2009; 86: 14-21. <https://doi.org/10.1016/j.smallrumres.2009.09.010>
6. Dwyer CM, Ruiz R, Beltran De Heredia I, Canali E, Barbieri S, Zanella A. AWIN (Animal Welfare Indicators) Welfare assessment protocol for sheep. 2015. https://dx.doi.org/10.13130/AWIN_sheep_2015
7. Farm Animal Welfare Council (FAWC). Farm Animal Welfare in Great Britain: Past, Present and Future. 2009; 44-47. https://www.wellbeingintlstudiesrepository.org/aw_welfare_gen?utm_source=www.wellbeingintlstudiesrepository.org%2Faw_welfare_gen%2F21&utm_medium=PDF&utm_campaign=PDFCoverPages
8. Fraser D. Assessing Animal Welfare at the Farm and Group Level: The Interplay of Science and Values. *Anim Welf* 2003; 12: 433-443. <https://doi.org/10.1017/S0962728600026038>
9. Gowane GR, Akram N, Misra SS, Chopra A, Sharma RC, Kumar A. The breeding structure for the small ruminant resources in India. *Trop Anim Health Prod* 2020; 52(4): 1717-1724. <https://doi.org/10.1007/s11250-019-02188-3>
10. Hallad SC, Reddy GV, Kumbar D. Studies on Variability of Rainfall over North-Eastern Dry Zone of Karnataka: A Statistical Analysis. *Int J Environ Clim* 2023; 13(12): 272-289.
11. Kulkarni MD, Khanvilkar AV, Yadav GB, Khasnis MW, Ambore BN. Sheep Management for Upliftment of Marginal Farmers. *Vet World* 2008; 1: 378-379.
12. Lauber M, Nash, JA, Gatt A, Hemsforth PH. Prevalence and incidence of abnormal behaviors in individually housed sheep. *Animals* 2012; 2(1): 27-37. <https://doi.org/10.3390/ani2010027>
13. Mullan S, Edwards SA, Butterworth A, Whay HR, Main, DCJ. Interdependence of welfare outcome measures and potential confounding factors on finishing pig farms. *Appl Anim Behav Sci* 2009; 121: 25-31. <https://doi.org/10.1016/j.applanim.2009.07.002>

14. Pedernera-Romano C, Ruiz De La Torre JL, Badiella L, Manteca X. Associations between open-field behavior and stress-induced hyperthermia in two breeds of sheep. *Anim Welf* 2011; 20: 339-346. <https://doi.org/10.1017/S0962728600002906>
15. Phythian CJ, Cripps PJ, Michalopoulou E, Jones PH, Grove-White D, Clarkson MJ. Reliability of indicators of sheep welfare assessed by a group observation method. *Vet J* 2012; 193: 257-263. <https://doi.org/10.1016/j.tvjl.2011.12.006>
16. Scott EM, Nolan AM, Fitzpatrick JL. Conceptual and methodological issues related to welfare assessment: a framework for measurement. *Acta Agric Scand Sect A - Anim Sci* 2001; 51: 5-10. <https://doi.org/10.1080/090647001316922983>
17. Stott A, Ahmadi BV, Dwyer CM, Kupiec B, Morgan-Davies C, Milne C. Interactions between profit and welfare on extensive sheep farms. *Anim Welf* 2012; 21: 57-64. <https://doi.org/10.7120/096272812X13345905673683>
18. Stubbsj en SM, Hektoen L, Valle PS, Janczak AM, Zanella A J. Assessment of sheep welfare using on-farm registrations and performance. *Anim Welf* 2011; 20: 239-251. <https://doi.org/10.1017/S0962728600002724>