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WELFARE STATUS OF DAIRY CATTLE UNDER EXTENSIVE AND INTENSIVE FARMING SYSTEM IN HAMBANTOTA DISTRICT, SRI LANKA

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ABSTRACT

The dairy sector is one of the emerging industries in Sri Lanka, where animal welfare is poorly addressed by the scientific community. The well-being of dairy cattle housed under two different management practices (intensive and extensive farming) in the Hambantota district, Sri Lanka was compared for five freedom (5F) concept and behavioral assessment using semi-structured and pre-tested questionnaires. Altogether 50 dairy cattle were observed in the extensive and intensive management practices for 30 days continuously. Collected data were analyzed by SPSS using descriptive studies and student's T-test at p=0.05. The average of five freedom (5F) factors for the extensive management system was 37.07% which reflects "Good" and for the intensive was 44.86%, and welfare status is "Normal". The welfare status of both management systems was significantly different ($p<0.05$). Cattle exhibit a diverse range of behaviors in both management systems with significant differences ($p<0.05$), except resting, licking, rumination and execration; the rest of the behaviors were in the highest mean rank in the intensive management system. There is no significant difference ($p>0.05$) between intensive and extensive management systems based on climatological parameters (Temperature, Relative humidity and Thermal heat index). Based on the 5F concept extensive management system is better than the intensive management systems in the dairy industry in the Hambantota district of Sri Lanka.

Keywords: *Welfare status, behaviours, five freedom assessment, farming System, dairy Cattle*

1. Introduction

The intricate interplay between animal welfare, agricultural practices, and socio-economic dynamics has become an increasingly pertinent subject of research and concern in modern agricultural landscapes (De Rosa et al., 2009). Among the livestock species contributing significantly to both food security and livelihoods, dairy cattle play a pivotal role by providing essential protein sources, draught power, and byproducts (Madzingira, 2018). As the demand for dairy products escalates alongside population growth, diversifying agricultural systems to accommodate both extensive and intensive production methods has become imperative (Kaurivi et al., 2019). However, the implications of these divergent systems on the welfare of dairy cattle remain a subject of substantial debate and exploration. Sri Lanka, endowed with a rich agricultural heritage and characterized by a substantial agricultural land area, has witnessed the coexistence of traditional extensive farming practices and modern intensive approaches. The Hambantota District, situated in the southern region of the country, stands as a microcosm of this agricultural diversity, where both extensive and intensive dairy farming systems operate (Hitihamu et al., 2021). Against this backdrop, understanding and evaluating the welfare status of dairy cattle under these distinct systems becomes pivotal for informed decision-making and policy formulation. Dairy animal welfare varies significantly across different farming systems and regions, influencing both ethical standards and productivity. Intensive systems, common in North America and parts of

Europe, offer high milk yields and controlled environments but often restrict natural behaviours and show higher rates of lameness and stress-related conditions. In contrast, pasture-based systems like those in New Zealand, Australia, and Ireland provide better opportunities for natural behaviours and lower disease incidence, though they face challenges such as weather exposure and nutritional variability. Organic and low-input systems, more prevalent in Europe, emphasize preventive healthcare and outdoor access, generally resulting in improved welfare indicators despite lower yields. Regional contexts also play a role—while smallholder systems in South Asia may lack modern infrastructure, they often allow for freer grazing and closer human-animal bonds. Literature suggests that policies grounded in animal welfare science can help optimize farming practices by promoting systems that balance productivity with ethical care. Incorporating welfare assessment frameworks, region-specific guidelines, and incentive programs can drive improvements, while transparent labelling and public engagement can support market-based rewards for welfare-friendly practices, ultimately contributing to more sustainable and socially acceptable dairy production. This research article delves into a comprehensive study of the welfare status of dairy cattle within the Hambantota District. By meticulously analysing a range of factors encompassing health, behaviour, physiological indicators, and environmental conditions, this study aims to contribute to the broader discourse on animal welfare and sustainable agricultural practices. Furthermore, it provides valuable insights into optimizing dairy farming practices, thereby promoting efficiency while upholding the comprehensive welfare of the animals involved Welfare status of the dairy cattle was referred based on the established 5F welfare concept developed by the UK Farm Animal Welfare Council (2012).

2. Materials and methods

2.1 Description of the study area

The Hambantota District, situated in the southern region of the country, stands as a microcosm of agricultural diversity, where both extensive and intensive dairy farming systems operate under dry, semi-arid climate zone. The study area receives only 1070 mm of rainfall annually. There are 12 veterinary ranges in Hambantota. Ridiyagama NLDB farm was selected as an intensive farming system.

2.2 Sample and data collection

The semi-structured and pre-tested questionnaire was prepared including farm's information, climatological parameters of the location, behavioural assessment and assessment questions for 5F concept. By the observation of the animal (without restrain and confined of the animal); data were collected under ethical consent. For the study 50 dairy cattle were observed in each management practices for 30 days continuously from May to June, 2022. In this study, a comparative assessment of dairy animal welfare across different farming systems and regions was conducted using a structured methodology grounded in the Five Freedoms (5F) framework. The Five Freedoms—freedom from hunger and thirst; discomfort; pain, injury or disease; fear and distress; and the freedom to express normal behaviour—served as the foundational criteria for data collection and analysis. Field data were gathered through a combination of on-farm observations, farmer interviews, and review of veterinary and management records. Indicators such as feed and water availability, housing and bedding quality, health status, handling methods, and access to grazing or social interaction were recorded and categorized under the relevant freedoms. This standardized approach enabled consistent cross-system and cross-regional comparisons, ensuring that welfare

assessments were both objective and comprehensive. The use of the 5F framework also provided a practical basis for identifying welfare deficiencies and strengths within each farming context, thereby supporting policy recommendations aimed at optimizing dairy farming practices globally. The reviewers will be seriously looking into this section to ascertain whether the methodologies or experiments presented are repeatable and whether the methods are appropriate

2.3 Data analysis

Gathered data from the filled questionnaires were checked thoroughly and entered into a Microsoft Excel (2016) and encoded. Descriptive and inferential analysis were performed by SPSS version 25.0. Depicted temperature, humidity level and heat index of both management systems were considered under descriptive analysis. The data were analysed using Student's t-test, and differences between group means were determined using the Least Significant Difference (LSD) method at a 0.05 level of significance. The climatological parameters of both the management systems, behaviour assessment and 5F concept were analysed under inferential analysis.

3. Results and Discussion

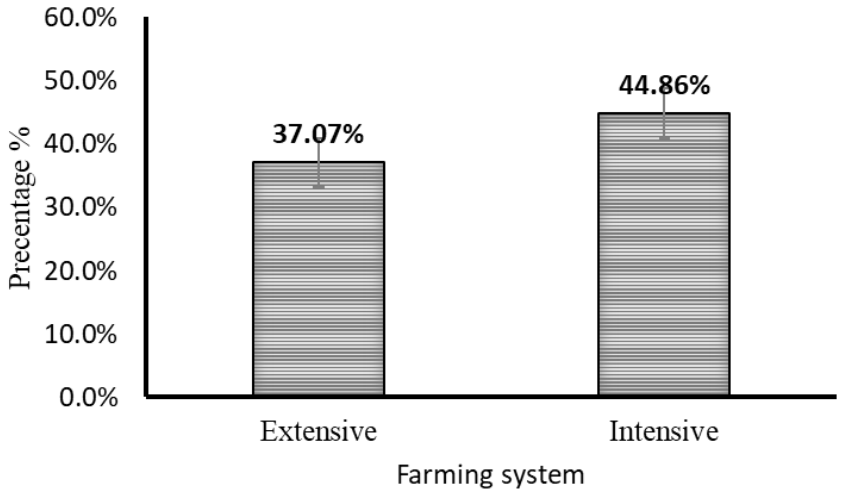
3.1. Five freedom assessment

Where F1 (freedom from hunger, thirst, and malnutrition) in extensive and intensive management system was 32.36% and 31.53%, respectively (Table 1). According to the 5F welfare concept, both systems were in great status. F2 (freedom from pain, disease, and injury) in extensive and intensive management system was 9.56% and 11.27%, respectively. Both systems were in "Very Good" welfare status. In F3 (freedom from fear and distress) 32.42% reported in the extensive and 47.00% reported in the intensive systems where, welfare status was "Good" and "Normal", respectively. Welfare status for F4 (freedom to display most normal patterns of behaviour) were "Normal" in extensive system and "Very Poor" in intensive farming system where it recorded 44.26% and 95.00%, respectively. The F5 (freedom from discomfort) was 65.14% ("Poor") in the extensive farming system and 50.00% ("Normal") in the intensive farming system. According to the Fig 1, the overall average 5F of the extensive system was 37.07%, welfare status is "Good" and in intensive it was 44.86% and welfare status is "Normal". Welfare status of both the management systems were significantly different ($p<0.05$).

Table 1. Comparisons of extensive and intensive management system based on 5F concept

Five freedom factors	Farming System	Mean	SD	T value	P Value
1F	Intensive	31.53%	2.30	-2.22	0.00
	Extensive	32.36%	6.72	-2.22	
2F	Intensive	11.27%	12.73	1.89	0.00
	Extensive	9.56%	11.56	1.89	
3F	Intensive	47.05%	2.46	21.06	0.00
	Extensive	34.40%	11.11	21.06	
4F	Intensive	95.00%	0.00	24.72	0.00
	Extensive	44.26%	38.93	24.72	
5F	Intensive	50.00%	0.00	-24.91	0.00
	Extensive	65.13%	0.60%	-24.91	

Fig 1. Overall Five Freedom Factors in two management system 100 cattle



3.2 Behaviours assessment

Based on animal ethogram; key behaviours of the cattle (Foraging, Resting, Grooming, Licking, Rumination, Tail Wagging, Moving, Sucking, Interaction, Excretion and Vocalization) are listed in Table 2. According to the results all the behaviours were significantly ($p<0.05$) differ between extensive and intensive management system. Except resting, licking, rumination and execration; rest of the behaviours were in highest mean rank in intensive management system.

Table 2. Behavioural comparisons between extensive and intensive management system

Behaviors	Farming system	Mean Rank	T value	P value
Foraging	Extensive	33.80	-8.43	0.00
	Intensive	87.20		
Resting	Extensive	85.60	-7.93	0.00
	Intensive	35.40		
Grooming	Extensive	51.43	-2.93	0.00
	Intensive	69.57		
Licking	Extensive	77.20	-5.48	0.00
	Intensive	43.80		
Rumination	Extensive	80.20	-6.21	0.00
	Intensive	40.80		
Tail Wagging	Extensive	30.50	-10.11	0.00
	Intensive	90.50		
Moving	Extensive	30.50	-9.48	0.00
	Intensive	90.50		
Sucking	Extensive	52.90	-3.61	0.00
	Intensive	68.10		
Interaction	Extensive	54.33	-2.00	0.04
	Intensive	66.68		
Excretion	Extensive	72.23	-3.79	0.00
	Intensive	48.77		
Vocalization	Extensive	57.00	-2.71	0.00
	Intensive	64.00		

3.3 Climate conditions

In 30 days of study duration, maximum temperature, humidity and heat index were recorded as 32 °C, 94% and 40.6 °C respectively, in extensive management system. In intensive system, maximum of temperature, humidity and heat index were recorded as 31 °C, 94% and 101 °F respectively. Based on Table 3, there is no significant difference ($p>0.05$) between intensive and extensive farming system in climatological parameters, because both the faming systems were located in the same agro-ecological zone. The effects of the climate conditions of both the farms still remain the same.

Table 3. Comparisons of Climate condition between extensive and intensive farming system

Variables	Farming System	Mean Rank	T value	*p* value
Temperature	Extensive (N=30)	31	0.233	0.816
	Intensive (N=30)	30		
Relative Humidity	Extensive (N=30)	27.22	-1.461	0.144
	Intensive N=30)	33.78		
Thermal Heat Index	Extensive N=30)	29.68	-0.366	0.715
	Intensive (N=30)	31.32		

N= number of days observed

3.4 Discussion

The majority of cattle in Sri Lanka exhibit hybrid characteristics, resulting from crossbreeding between *Bos indicus* (Zebu) and improved Zebu breeds from the Indian subcontinent, or through interbreeding between Zebu and *Bos taurus* (European/American) dairy breeds. The prominent improved Zebu breeds utilized within Sri Lanka's dairy industry include Sindhi and Sahiwal, while European breeds such as Holstein/Friesian and Jersey are commonly observed in the country (Hitihamu et al., 2021). In this study Jersey, cattle breed was observed in both management systems. The well-being of dairy cattle encompasses a myriad of factors, including physical health, behavioural expression, and the provision of a conducive environment (Licitra et al., 2021). Animal welfare is a multidimensional quality (Rushen & Passillé, 1992). On the contrary, it has been argued that disease, injury, and starvation have the potential to negatively impact on animal welfare (Roche et al., 2009). Reportedly, management practices and housing systems impact animals' welfare, as well as farm productivity (Licitra *et al.*, 2021). Welfare status of the livestock assess by "Five Freedom" concept (Farm Animal Welfare Council, 1993). This greater Freedoms paradigm was not meant to reflect ideal or unreachable states, nor was it meant to be an absolute criterion for compliance with accepted principles of animal welfare (Webster, 1994); rather, it was meant to be a checklist for assessing the strengths and weaknesses of husbandry systems (Webster, 2008). In this study, all the five freedoms were significantly ($p<0.05$) differed between intensive and extensive management systems. While both systems provided enough access to food, water, and healthcare of cattle, well-being occurred in 1F; because both management systems of the farms were located near abundant and accessible pastureland, fodder grass and water catchment areas. Well management practices of the dairy cow in both the management systems; lead to "very good" level on welfare status free from pain, disease, and injury. Notably, the intensive management system exhibited difficulties in allowing cattle to display natural behaviours, resulting in a depressing "Very Poor" welfare rating. Because in intensive management system, cow produces significant amounts of milk and its calf is removed

shortly after delivery, the modern dairy cow may not be a "natural" animal. It could also be argued that the modern dairy cow is not managed in a natural manner. Instead of grazing, it might be housed and fed with produced rations (Capdeville & Veissier, 2001). Few studies have compared the behaviour of dairy cows in continuously housed versus pasture-based production methods (Marley et al., 2010; Caja et al., 2016; Lovarelli et al., 2020; Pugliese et al., 2021). According to number of studies (Regula et al., 2004; Berckmans, 2014; Madzingira, 2018; Kaurivi et al., 2019), the frequency of mastitis and uterine illness was typically lower in extensive farming systems, which is assumed to be a result of enhanced cow hygiene and less exposure to environmental infections (Mattachini et al., 2013).

According to behaviour assessment, cattle spend more time for sleeping and ruminating at night than grazing, which occurs mostly during the day. Which is justified by Fisher & Mellor (2008), on his findings, the majority of grazing occurred during the day, while cattle spent more time resting and ruminating at night. In addition, there was a diurnal rhythm of behaviour, with grazing activity maxima occurring at sunrise and sunset. Both extensive and intensive dairy farming systems have distinct implications for animal welfare. While extensive systems may provide more natural grazing opportunities, intensive systems can offer controlled environments that mitigate disease risks. Striking a balance between these systems, along with the incorporation of best management practices, is imperative for optimizing animal welfare in diverse dairy farming contexts (Shivonen, 2015). While climatological factors did not differ considerably across the two systems, showing that the two systems share the same climatic circumstances, it is obvious that management techniques play a significant impact on cattle welfare and behaviour rather than heat index.

4. Conclusion

In this study, intensive and extensive dairy cattle management systems were compared in the Hambantota District of Sri Lanka. In terms of welfare outcomes, extensive management system outperformed intensive management system. These benefits can be ascribed to the provision of comfortable and sanitary living circumstances, such as soft surfaces and plenty of possibilities for activities such as grazing and strolling. The intensive management system succeeded in preventing hunger and discomfort through controlled feeding and climate management, the extensive system surpassed in encouraging freedom from pain, disease, distress, and the expression of natural activities. Overall, the welfare of the dairy cattle was better under the extensive management system than under the intensive management system.

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