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Effect of farm location on dairy farm housing welfare scores in Karnataka

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Abstract
This study was undertaken to compare the influence of farm location on dairy farm housing welfare scores in Karnataka, India. A total of 401 adult crossbred cattle in 60 dairy cattle farms, 30 from the peri-urban region of Bengaluru Rural district and 30 from rural region of Kolar district of Karnataka were considered for the present study. The mean scores of the welfare indicator 'Housing type and space availability', 'Type & height of roof' and 'Type of floor' in peri-urban and rural regions out of total score of 10, 3 and 2, was 5.17 ± 0.308 & 6.18 ± 0.394, 1.63 ± 0.102 & 1.68 ± 0.106 and 0.67 ± 0.073 & 0.73 ± 0.104, respectively. The mean scores of the welfare indicator 'Microclimate protection measures', 'Feeding and watering space availability' and 'Milking system' in peri-urban and rural regions, out of total score of 5, was 2.00 ± 0.166 & 1.47 ± 0.208, 3.77 ± 0.092 & 4.00 ± 0.048 and 2.40 ± 0.091 and 2.47 ± 0.093, respectively. The mean welfare score in peri-urban and rural regions, out of total score of 30, was 15.63 ± 0.398 and 16.53 ± 0.577, respectively. No significant difference in welfare score of housing and other facilities was observed in the dairy farms located in different regions.

Keywords: Dairy cattle welfare, rural, peri-urban, Karnataka

Introduction
Animal husbandry is the backbone of many farmers and has played an active role in strengthening of India's rural economy. It is an integral component of Indian agriculture, supporting livelihood for more than two-third of the Indian rural population (Biradar and Kumar, 2013) [2]. Dairying is considered as a profitable enterprise that gives multiple benefits in the form of supplementary income throughout the year, gainful employment, and nutritional security for the families (Sreedhar and Ranganadham, 2010) [6]. As per the DAHDF, 2019 [4]. India has the highest dairy cattle population in the world, including 193.46 million cattle, which accounts for 36.04 per cent of total farm animals in the country, and 109.85 million buffaloes. The livestock sector has contributed nearly 4.11% to India's Gross Domestic Product (GDP), which is about 21.58% of agricultural GDP. Karnataka ranks eleventh in overall milk production in India with annual milk production of about 11 million metric tonnes (BAHS, 2019) [1]. Moreover, the livestock sector is considered to be an emerging growth driver in the agricultural sector.

Materials and Methods
In India, Karnataka state stands sixth among the largest states in terms of geographical area. It lies on the western part of the Deccan plateau. Karnataka is one of the country's leading agricultural states, with a relatively high density of livestock population and livestock rearing is regarded as an important part of the rural economy. Bengaluru Rural and Kolar districts were purposively selected to represent peri-urban and rural regions of Karnataka, respectively. Both districts Bengaluru Rural (3,24,583) and Kolar (2,09,642) have a large population of crossbred cattle and are the leading milk producers in the state. Bengaluru Rural and Kolar are in the eastern dry agro-climatic zone in South Karnataka. The purposive random sampling method was used for the selection of livestock farms households.

The resource/environment-based indicators of animal welfare were assessed at 60 dairy farms, 30 from the peri-urban region of Bengaluru Rural district and 30 from rural region of Kolar district were considered for the present study, comprising 401 adult crossbred dairy cows in which the animal-based indicators were evaluated. Relevant variables to study the management practices related to the welfare status of dairy cattle and attitude of farmers to dairy cattle welfare formed the basis for developing the schedule of enquiry, and to assess the dairy cattle welfare. Assessment of the welfare status of dairy cattle was done by using the basic components of the welfare scale were developed by Calamari and Bertoni (2009) [3] based on Integrated Diagnostic System Welfare (IDSW), and the Dairy Cattle Welfare Scale developed by Kumar (2016) [5], with suitable modifications keeping in view the farming practices and local conditions of the study area.

Results and Discussion

The overall mean scores of the welfare indicator 'Housing and other facilities' in dairy farms of peri-urban and rural regions are presented in Table 1, with detailed breakup in Table 2. Out of total score of 30, the welfare score of peri-urban and rural regions was found to be 15.63 ± 0.398 and 16.53 ± 0.577, respectively. No significant difference in welfare score was observed in the dairy farms located in different regions.

Comparable figures were reported for small and medium farms in peri-urban (14.50 ± 0.64 and 15.50 ± 0.58) and rural (16.20 ± 0.92 and 15.80 ± 0.76) farms by Kumar (2016) [5], respectively. There were no significant differences in the scores among farms of different regions, possibly due to better microclimate protection measures in peri-urban dairy farms being compensated by better housing type, space availability and feeding/watering space availability in rural dairy farms. Similar findings regarding non-significant differences among peri-urban and rural farms were reported by Kumar (2016) [5].

Housing type and space availability: The mean welfare score of 'housing type and space availability' in peri-urban and rural regions, out of total score of 10, was 5.17 ± 0.308 and 6.18 ± 0.394, respectively, with rural dairy farms having significantly higher (P<0.05) scores.

Significantly lower welfare score obtained in peri-urban areas as compared to rural areas was primarily due to the high cost of land and associated space constraints leading to very low availability of covered and open area. Ventilation and light were also better in rural areas. Most of the dairy farmers in peri-urban dairy farms practiced zero grazing without provision of open area. Similar findings were reported by Kumar (2016) [5].

Type and height of roof: The mean scores of the welfare indicator 'type and height of roof' in dairy farms of peri-urban and rural regions, out of total score of 3, was 1.63 ± 0.102 and 1.68 ± 0.106, respectively. Both regions had similar usage of roof materials and comparable ridge heights, and differences were not significant. Similar findings were reported by Kumar (2016) [5].

Type of floor: The mean scores of the welfare indicator 'type of floor 'in dairy farms of peri-urban and rural regions, out of total score of 2, was 0.67 ± 0.073 and 0.73 ± 0.104, respectively. There were no significant differences among regions as the better bedding material in peri-urban farms was compensated by better flooring type in rural dairy farms. Similar findings were reported by Kumar (2016) [5].

Microclimate protection measures: The mean scores of the welfare indicator 'microclimate protection measures' in dairy farms of peri-urban and rural regions, out of total score of 5, was 2.00 ± 0.166 and 1.47 ± 0.208, respectively. The mean welfare score of the peri-urban area dairy farms was significantly (P<0.05) higher, primarily due to adoption of fans and bathing in the day time. In contrast, no significant differences among farms of different regions was reported by Kumar (2016) [5].

Feeding and watering space availability: The mean scores of the welfare indicator 'feeding and watering space availability' in dairy farms of peri-urban and rural regions, out of total score of 5, was 3.77 ± 0.092 and 4.00 ± 0.048, respectively. The mean welfare score of the rural dairy farms was significantly (P<0.05) higher than that of peri-urban dairy farms, primarily due to better feeder space and feeding area hygiene. In contrast, no significant differences among farms of different regions was reported by Kumar (2016) [5].

Milking system: The mean scores of the welfare indicator 'milking system 'in dairy farms of peri-urban and rural regions, out of total score of 5, was 2.40 ± 0.091 and 2.47 ± 0.093, respectively. There were no significant differences among milking system welfare scores of different regions due to better awareness about the importance of scientific milking techniques in the area. Similar findings were reported by Kumar (2016) [5].

Table 1: Mean welfare score of 'housing and other facilities' component in peri-urban and rural dairy farms

Welfare indicator	Max Score	Region		Overall	P-value
		Peri-urban	Rural		
Housing type & space availability	10	$5.17^a \pm 0.308$	$6.18^b \pm 0.394$	**5.68 ± 0.257**	0.047
Type and height of roof	3	1.63 ± 0.102	1.68 ± 0.106	**1.66 ± 0.073**	0.734
Type of floor	2	0.67 ± 0.073	0.73 ± 0.104	**0.70 ± 0.063**	0.602
Microclimate protection measures	5	$2.00^a \pm 0.166$	$1.47^b \pm 0.208$	**1.73 ± 0.136**	0.049
Feeding & watering space availability	5	$3.77^a \pm 0.092$	$4.00^b \pm 0.048$	**3.88 ± 0.054**	0.028
Milking system	5	2.40 ± 0.091	2.47 ± 0.093	**2.43 ± 0.065**	0.610
Total score	30	15.63 ± 0.398	16.53 ± 0.577	16.08 ± 0.352	0.204

Note: Means within a row bearing different superscripts differ significantly (P<0.05).

Table 2: Mean welfare score of sub-components of 'housing and other facilities' in dairy farms of different regions

Sl. No.	Welfare indicator	Max Score	Region		Overall
			Peri-urban	Rural	
1	Housing types & their space availability	10	5.17 ± 0.308	6.18 ± 0.394	5.68 ± 0.257
	Type of housing	3	2.13 ± 0.063	2.33 ± 0.088	2.23 ± 0.055
	Covered area	3	0.77 ± 0.207	1.27 ± 0.179	1.02 ± 0.140
	Open area	2	0.57 ± 0.124	0.73 ± 0.143	0.65 ± 0.095
	Ventilation	1	0.87 ± 0.041	0.93 ± 0.032	0.90 ± 0.026
	Light	1	0.83 ± 0.055	0.92 ± 0.035	0.88 ± 0.033
2	Type and height of roof	3	1.63 ± 0.102	1.68 ± 0.106	1.66 ± 0.073
	Roof material	2	1.30 ± 0.085	1.37 ± 0.089	1.33 ± 0.061
	Roof ridge height	1	0.33 ± 0.055	0.32 ± 0.045	0.33 ± 0.035
3	Type of floors	2	0.67 ± 0.073	0.73 ± 0.104	0.70 ± 0.063
	Flooring type	1	0 ± 0	0.13 ± 0.063	0.07 ± 0.032
	Bedding material	0.5	0.27 ± 0.046	0.20 ± 0.045	0.23 ± 0.032
	Floor surface	0.5	0.40 ± 0.037	0.40 ± 0.037	0.40 ± 0.026
4	Microclimate protection measures	5	2.00 ± 0.166	1.47 ± 0.208	1.73 ± 0.136
	Evaporative cooling system	1	0 ± 0	0 ± 0	0 ± 0
	Fans	1	0.40 ± 0.091	0.13 ± 0.063	0.27 ± 0.058
	Bathing in the day time	1	0.87 ± 0.063	0.57 ± 0.092	0.72 ± 0.059
	Keeping cows in open area during day time	1	0.37 ± 0.089	0.43 ± 0.092	0.40 ± 0.064
	Shady trees in an open area	1	0.37 ± 0.089	0.33 ± 0.088	0.35 ± 0.062
5	Feeding & watering space availability	5	3.77 ± 0.092	4.00 ± 0.048	3.88 ± 0.054
	Feeder space	1	0.90 ± 0.056	1.00 ± 0.000	0.95 ± 0.028
	Feeding area hygiene	1	0.87 ± 0.063	0.97 ± 0.033	0.92 ± 0.036
	Waterer space	1	1.00 ± 0.000	1.00 ± 0.000	1.00 ± 0.000
	Watering system	1	0 ± 0	0.03 ± 0.033	0.02 ± 0.017
	Watering area hygiene	1	1.00 ± 0.000	1.00 ± 0.000	1.00 ± 0.000
6	Efficient milking system	5	2.40 ± 0.091	2.47 ± 0.093	2.43 ± 0.065
	Separate milking parlour	1	0.03 ± 0.033	0 ± 0	0.02 ± 0.017
	Milking technique	1	0.37 ± 0.089	0.47 ± 0.093	0.42 ± 0.064
	Fresh water for washing udder and cleaning	1	1.00 ± 0.000	1.00 ± 0.000	1.00 ± 0.000
	Teat disinfection	1	0 ± 0	0.03 ± 0.033	0.02 ± 0.017
	Milking equipment hygiene and sanitation	1	1.00 ± 0.000	0.97 ± 0.033	0.98 ± 0.017
	Total score	30	15.63 ± 0.398	16.53 ± 0.577	16.08 ± 0.352

Conclusion

The study found no significant overall difference in housing welfare scores between peri-urban and rural dairy farms in Karnataka, though rural farms scored slightly higher. Rural farms had significantly better housing type, space availability, and feeding/watering areas due to more land and better hygiene. In contrast, peri-urban farms showed significantly better microclimate protection through fans and bathing practices. Other factors like roof type, flooring, and milking systems showed no significant variation. The results suggest that while space limitations affect peri-urban farms, they compensate with better climate control, whereas rural farms benefit from better infrastructure and space, balancing overall welfare outcomes.

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