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Housing management practices followed by Jaffarabadi buffalo owners in rural areas of Junagadh district of Gujarat, India

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Abstract
A field study was conducted in Junagadh district of Gujarat to ascertain the housing management practices followed by Jaffarabadi buffalo owners and data were collected from randomly selected 320 respondents through personal interview with the help of structured interview schedule. The present study revealed that majority (63.43%) of respondents provided conventional type of houses for their buffaloes. About 66.25% of buffalo sheds were near to the dwelling of the respondents and 69.06% of the sheds were oriented in east-west direction. Majority (93.44%) of respondents adopted single line tying method of animal. About 92.50, 87.81 and 98.12% of the respondents had adequate floor space, light and ventilation respectively, in their buffalo sheds. Majority (76.25%) of respondents had earthen floors in their buffalo sheds; 23.75% had slope in floors towards backside of the animal sheds; 89.38% of respondents used cemented type pillars. About 80.63% sheds had single slope type of roof; 65% had *Pucca* type of manger and 16.56% of sheds had provision of drainage facility for slurry. Majority (36.44%) of respondents kept their animals inside the house during day as well as night. All the respondents adopted some kind of measures to protect the animals from extreme weather conditions. About 96.25% respondents store the manure by means of heap and 80% respondents store manure at distance location from buffalo sheds.

Keywords: Housing, Jaffarabadi buffalo, management, practices, rural areas

Introduction
Livestock husbandry is major agro economic activity since antiquity and backbone of rural economy in India. In the poor under privileged farming community livestock provides the employment, income, nutrition and manure. Different dairy co operative societies and different dairy farming development schemes accelerated the number of milch animals especially the buffalo and are considered more remunerative and productive as compared to cows (Khan and Parashari, 2019) [8]. According to 20th livestock census, India has about 536.76 million total livestock population. The buffalo population in India is 109.85 million showing increased 1.1 percent over previous livestock census. India holds first position in buffalo population in the world. About 20.5 percent of the total livestock is contributed by buffaloes (Anonymous, 2020) [2]. India ranks 1st in total milk production with 198.44 million tones which was increase 5.69 percent over the previous year. Buffalo contributes 48.34 percent to the total milk production of India and the per capita availability of milk is 406 grams per day/per person (Anonymous, 2021b) [4]. Gujarat contributed 7.71% (15.29 million tonnes) of milk to the total milk production in India and per capita availability of milk was 615 g/day during 2019-20 (Anonymous, 2021b) [4]. In Gujarat estimated milk yield per day per buffalo is 5.47 kg. Estimated milk production of the buffalo of Gujarat state during 2019-20 has 7507.52 thousand tones. Gujarat holds 3rd position with contributing 9.60 percent of the total buffalo population in India (Anonymous, 2021a) [3]. Understanding the buffalo husbandry practices followed by farmers in a region plays a vital role in the improvement of productivity of buffaloes and economy of milk producers. It is also useful to identify the strengths and weakness of the rearing system and helpful to formulating suitable intervention policies (Sivaji *et al.*, 2018) [18]. Each component of management practices interacts either independently or in combination to affect the productivity of the livestock. Production potential of livestock depends mostly on the management practices under which they are reared and these practices vary significantly across various agro-ecological regions.

Provision of proper housing facilities to the animals not only reduces the energy wastage in thermoregulation but also provides good hygienic condition, reduces the incidence of diseases, protects them from predators and provides better working condition to the dairy farmers. Therefore, it is necessary to collect information regarding housing management practices followed by Jaffarabadi buffalo owners in Junagadh district of Gujarat.

Materials and Methods

A field survey was conducted in Junagadh district of Gujarat during January, 2022 to April, 2022. Junagadh district possess nine talukas namely Bhesan, Junagadh, Keshod, Manavadar, Mangrol, Maliya hatina, Vanthali, Mendarda and Visavadar (Anonymous, 2021c) [5]. This district is spread over an 8,831.0 sq. km with 4.50% of the total geographical area of Gujarat State. The district Junagadh forms a part of Kathiawar peninsula and is sub divided into four sub-micro regions namely, Junagadh coastal plain, Bhadar, Ojat and Hiran river plain, Girnar hills and Junagadh Gir forested region on the basis of topography, climate, geology soils and natural vegetation. Out of nine talukas in the district, four talukas were randomly selected. From each selected taluka, eight villages were selected at random. Ten Jaffarabadi buffalo owners from each village were randomly selected using a multi stage random sampling technique with the help of veterinary officer /village dairy cooperatives which constituted a total of 320 respondents. While selecting respondents due care was taken to ensure that they were evenly distributed in the village and truly represented buffalo management practices prevailing in the area. The selected respondents were single interviewed and the desired information was collected regarding housing management practices with the help of structure interview schedule. Data were tabulated and analyzed as per standard statistical tools to draw meaningful inferences (Snedecor and Cochran, 1994) [19].

Results and Discussion

Housing type provided by Jaffarabadi buffalo owners

Distribution of Jaffarabadi buffalo owners according to housing type are presented in Table 1 and revealed that majority (63.44%) of the buffalo owners provided conventional type of houses followed by shed + under tree (35.62%) and loose (0.94) type of houses for their animals. Highly significance (p<0.01) difference was found between the talukas and type of housing. The findings are in similar with findings of Vranda *et al.* (2017) [22]. Present findings are contrary to the findings of Sreedhar *et al.* (2017) [20] found that majority (82.08%) of respondents provided loose type houses to their dairy animals. Majority (66.25%) of buffalo sheds were nearby to the dwelling followed by 24.69 and 9.06% of buffalo sheds were attached to dwelling and at the field of farmers, respectively. Highly significance (p<0.01) difference was found between the talukas. Similar findings are also reported by Patel *et al.* (2018) [14]. However, present findings are contrary to the findings of Kumar *et al.* (2020) [10] found that majority (80.6%) of respondents kept their animals inside their dwelling. It might be due to the fact that farmers preferred to have animal houses near to their houses for better management of the dairy animals. Majority (69.06%) of the animal houses were oriented in east-west direction, while 30.94% of the animal houses were oriented in north-south direction. Present findings are in accordance with the findings of Patel *et al.* (2018) [14] and Rathwa and Soarathiya (2020) [16]. Most (93.44%) of the buffalo owners had single row system of animal housing followed by 4.06 and 2.50% of the respondents had tail to tail and head to head type of housing system, respectively. These findings are supported with the findings of Ahirwar *et al.* (2010) [1], Vranda *et al.* (2017) [22] and Patel *et al.* (2018) [14]. However, present findings are contrary to the findings of Pilaniya *et al.* (2018) [15] found that 49.34% of the respondents had head to head system of housing to their animals. Adequate floor space was available in 92.50% of the animal houses, while inadequate floor space in 7.50% of the animal houses. Present results are encouraging than the findings of Kishore *et al.* (2013) [9] and Panchbhai and Gubbawar (2021) [12] who found that more than 80% of respondents had adequate floor space in their animal houses. Most (87.81%) of the buffalo owners had adequate provision of light in the animal houses, while it was inadequate in the houses of 12.19% of the respondents. Supported findings were reported by Patel *et al.* (2018) [14]. However, present findings are lower than the finding of Viswkarma *et al.* (2018) [21] found that all the farmers provided adequate light in animal sheds. About 98.12% of buffalo owners had adequate provision of ventilation to their buffalo sheds followed by 1.88% had inadequate provision of ventilation to their buffalo shed. Out of total buffalo owners, 22.00% had provision of artificial ventilation. Present findings are in accordance to the findings of Kumar *et al.* (2020) [10] and Panchbhai and Gubbawar (2021) [12].

Data in the Table 1 indicated that 76.25% of the respondents had earthen floors in their buffalo houses, followed by 18.44, 3.44 and 1.87% of the respondents had *pucca*, brick paved and stone paved floors, respectively. The earthen floors are to be less hygienic and more worm problems occur as compared to *pucca* floors. This might be due to fact that lack of awareness to take the advantages of *pucca* floor in animal shed. These findings are in accordance with the results of Sabapara *et al.* (2010) [17] and Kumar *et al.* (2020) [10]. However, the present results are contrary to the results of Patel *et al.* (2018) [14] found that 77.08% of the respondents had *pucca* floor to their animal sheds in Valsad district of Gujarat. Majority (73.13%) of the buffalo owners had no slope in floors of buffalo sheds followed by slope towards back (23.75%) and slope towards front (3.12%) in the buffalo shed. This might be due to lack of knowledge to keeping the slope in floor to maintain good hygienic conditions of animal houses. Highly significant difference (p<0.01) in slope of floor was found between the talukas. The present findings are in accordance with Pata *et al.* (2018) [13]. However, Patel *et al.* (2018) [14] contrary observed that 76.70% of the animal sheds had slope towards back in floor of animal shed in Valsad district of Gujarat.

Type of housing materials used by Jaffarabadi buffalo owners

Distribution of Jaffarabadi buffalo owners according to type of housing materials used was presented in Table 2 indicated that most (89.38%) of the buffalo owners used cemented type poles, followed by wooden poles (6.87%) and iron poles (3.75%) to support the roof of buffalo sheds. Present findings are similar with the findings of Patel *et al.* (2018) [14]. However, present findings are contrary to the findings of Sabapara *et al.* (2010) [17] observed that 85.50% of the respondents was used wooden type poles for support the roof of sheds in tribal area of South Gujarat. About 88.43% of the

buffalo owners had full walls in their buffalo sheds, while 10.00 and 1.57% of the buffalo owners had half and no walls in their buffalo sheds, respectively. It might be due to the fact that full wall provided better protection from extreme weather. Significant (p<0.05) different was found between the talukas and wall of house. The results are contrary to Rathwa and Soarathiya (2020) [16] found that 72.50% of the respondents had half walls in their animal sheds in Navsari district of Gujarat. Majority (52.19%) of the buffalo owners used cemented sheets as roofing material for their buffalo sheds, followed by galvanized iron sheets (21.25%), thatch roof (20%) and tiles (6.56%) as roofing material for their buffalo sheds. Prevailing climatic condition and economic status of the farmers might have played a significant role in the selection of roofing materials. Highly significant (p<0.01) difference in type of roof was found between the talukas. The present results are in similar with the findings of Patel *et al.* (2018) [14]. The present results are contrary to the earlier results of Vranda *et al.* (2017) [22] observed that 72.22% of the respondents used galvanized iron sheet as roofing for their dairy animal sheds. It was found that 80.63% of the buffalo owners had single slope type of roof, while 15.94 and 3.43% of the buffalo owners had double slope and flat type roof in their buffalo sheds, respectively. This might be due to that most of the sheds were lean type, hence might have single slope type of roof. Present results were supported by findings of Pata *et al.* (2018) [13] and Patel *et al.* (2018) [14].

Data in Table 2 revealed that all the buffalo owners provided manger to their buffaloes in which majority (65%) % of the buffalo owners had *pucca* manger, while 30.00 and 5.00% of the respondents had *Kutcha* and wooden assisted temporary type Manger for their buffaloes. This might be due to fact that *Pucca* feed manger is more hygienic, easy to clean and durable. Type of manger was found highly significant (p<0.01) difference between the talukas. Present findings are similar with the results of Pilaniya *et al.* (2018) [15]. However, the present results are contrary to the findings of Sabapara *et al.* (2010) [17] observed that 86.11% of respondents provided wooden assisted type of manger in animal sheds. This might be due to the lack of knowledge of dairy farmers in their study areas of Navsari district of south Gujarat. About 65.94% of the buffalo owners had adequate depth of manger for feeding of animals, while 34.06% of the respondents had inadequate depth of manger for feeding of animals. In respect to depth of manger highly significant (p<0.01) difference was observed between the talukas. These findings are similar to the findings of Mishra *et al.* (2018) [11]. Data in Table 2 indicated that 83.44% of buffalo sheds had no provision of drainage facility for urine, while 16.56% had provision of drainage facility for urine in their buffalo sheds. With respect to provision of drainage system significant (p<0.05) difference was observed between the four talukas. The present findings are supported by the findings of Sreedhar *et al.* (2017) [20] and Pata *et al.* (2018) [13]. In contrast to present finding, Godara *et al.* (2018) [6] reported that majority (74.50%) of the respondents had drainage facility for urine in their buffalo shed.

Table 1: Distribution of Jaffarabadi buffalo owners according to housing type

Sr. No.	Practices	Maliya Hatina (N= 80)		Vanthali (N= 80)		Bhesan (N= 80)		Visavadar (N= 80)		Overall (N= 320)	
		N	%	N	%	N	%	N	%	N	%
1	Type of Housing										
	Loose	00	00	00	00	01	1.25	02	2.50	03	0.94
	Shed+under tree	48	60.00	26	32.50	23	28.75	17	21.25	114	35.63
	Conventional	32	40.00	54	67.50	56	70.00	61	76.25	203	63.43
	X^2	32.67**									
2	Location of shed										
	Attached to human dwelling	13	16.25	15	18.75	19	23.75	32	40.00	79	24.69
	Nearby their dwelling	59	73.75	53	66.25	57	71.25	43	53.75	212	66.25
	At the field of farmer	08	10.00	12	15.00	04	5.00	05	6.25	29	9.06
	X^2	19.28**									
3	Direction of shed										
	East-West	59	73.75	53	66.25	57	71.25	52	65.00	221	69.06
	North-South	21	26.25	27	33.75	23	28.75	28	35.00	99	30.94
	X^2	1.91									
4	Method of tying										
	Single line	78	97.50	75	93.75	74	92.50	72	90.00	299	93.44
	Head to head	00	00	01	1.25	02	2.50	05	6.25	08	2.50
	Tail to tail	02	2.50	04	5.00	04	5.00	03	3.75	13	4.06
	X^2	8.09									
5	Floor space										
	Adequate	72	90.00	75	93.75	71	88.75	78	97.50	296	92.50
	Inadequate	08	10.00	05	6.25	09	11.25	02	2.50	24	7.50
	X^2	5.40									
6	Light										
	Adequate	64	80.00	71	88.75	72	90.00	74	92.50	281	87.81
	Inadequate	16	20.00	09	11.25	08	10.00	06	7.50	39	12.19
	X^2	6.62									
7	Ventilation										
	Adequate	78	97.50	80	100.0	78	97.50	78	97.50	314	98.12
	In adequate	02	2.50	00	00	02	2.50	02	2.50	06	1.88
	X^2	2.03									
8	Type of floor										
	Puccafloor	09	11.25	17	21.25	14	17.50	19	23.75	59	18.44
	Earthen floor	65	81.25	59	73.75	62	77.50	58	72.50	244	76.25

	Brick paved	00	00	03	3.75	01	1.25	02	2.50	06	1.87
	Stone paved	06	7.50	01	1.25	03	3.75	01	1.25	11	3.44
	X^2	13.76									
9	Slope of floor										
	Towards front	07	8.75	03	3.75	00	00	00	00	10	3.12
	Towards back	23	28.75	13	16.25	27	33.75	13	16.25	76	23.75
	No slope	50	62.50	64	80.00	53	66.25	67	83.75	234	73.13
	X^2	24.70**									

n- Frequency, NS- Non-significant, * Significant at 5 per cent level ($p \leq 0.05$), ** Significant at 1 per cent level ($p \leq 0.01$)

Table 2: Distribution of Jaffarabadi buffalo owners according to type of housing materials used

Sr. No.	Practices	Maliya Hatina (N= 80)		Vanthali (N= 80)		Bhesan (N= 80)		Visavadar (N= 80)		Overall (N= 320)	
		N	%	N	%	N	%	N	%	N	%
1	Type of pillar/pole										
	Wooden	07	8.75	04	5.00	06	7.50	05	6.25	22	6.87
	Iron	04	5.00	03	3.75	00	00	05	6.25	12	3.75
	Cemented/brick	69	86.25	73	91.25	74	92.50	70	87.50	286	89.38
	X^2	5.81									
2	Wall of house										
	Full	64	80.00	72	90.00	69	86.25	78	97.50	283	88.43
	Half	14	17.50	07	8.75	09	11.25	02	2.50	32	10
	No wall	02	2.50	01	1.25	02	2.50	00	00	05	1.57
	X^2	12.92*									
3	Type of roof										
	Cemented sheets roof	31	38.75	49	61.25	41	51.25	46	57.50	167	52.19
	Galvanized iron sheet roof	13	16.25	16	20.00	20	25.00	19	23.75	68	21.25
	Thatched roof	11	13.75	03	3.75	05	6.25	02	2.50	21	6.56
	Tiles roof	25	31.25	12	15.00	14	17.50	13	16.25	64	20.00
	X^2	22.39**									
4	Features of roof of shed										
	Flat	03	3.75	02	2.50	05	6.25	01	1.25	11	3.43
	Single slope	69	86.25	63	78.75	65	81.25	61	76.25	258	80.63
	Double slope	08	10.00	15	18.75	10	12.50	18	22.50	51	15.94
	X^2	8.64									
5	Provision of type manger										
	Kutcha	42	52.50	22	27.50	20	25.00	12	15.00	96	30.00
	Pucca	27	33.75	57	71.25	58	72.50	66	82.50	208	65.00
	Wooden assisted temporary	11	13.75	01	1.25	02	2.50	02	2.50	16	5.00
	X^2	53.79**									
6	Depth of manger										
	Adequate	32	40.00	57	71.25	56	70.00	66	82.50	211	65.94
	Inadequate	48	60.00	23	28.75	24	30.00	14	17.50	109	34.06
	X^2	35.32**									
7	Provision of drainage system										
	Yes	06	7.50	13	16.25	19	23.75	15	18.75	53	16.56
	No	74	92.50	67	83.75	61	76.25	65	81.25	267	83.44
	X^2	8.02*									

n- Frequency, NS- Non-significant, * Significant at 5 per cent level ($p \leq 0.05$), ** Significant at 1 per cent level ($p \leq 0.01$)

Housing practices adopted by Jaffarabadi buffalo owners

It was observed from the Table 3 that majority (63.44%) of the buffalo owners kept their animals inside the house during day and night, followed by only during night (36.56%). Highly significance ($p<0.01$) difference was found between the talukas. The present findings are in accordance with the findings of Patel *et al.* (2018) [14]. Contrary to present findings, Jatolia *et al.* (2017) [7] found that 66.33% of the respondents kept their buffaloes inside the shed during night time. Majority (63.12%) of the buffalo owners provided bedding material on floor to their buffaloes during winter season, while 29.69% buffalo owners closed their animals shed with curtains during winter to protect their buffaloes in cold weather condition. It was also found that 7.19% of the buffalo owners used rubber mat. Highly significant ($p<0.01$) difference was observed with respect to winter management between the four talukas. Present finding are similar with the findings of Sreedhar *et al.* (2017) [20]. In contrast to the present findings, Viswkarma *et al.* (2018) [21] reported that only 18.33% of the respondents followed the winter managemet practices. About 65.00% buffalo owners sprinkled water on their buffaloes, while 16.57, 15.31 and 3.12% buffalo owners sprinkled water on buffaloes + fan, sprinkled water on buffaloes + spreading of grass on the top of roof and provided wallowing tank to protect the buffalo from heat stress during summer season, respectively. It might be due to knowledge of the buffalo owners regarding effects of the extreme weather conditions on health and production performance of the buffaloes. Highly significant ($p<0.01$) difference was observed with respect to summer management between the talukas. Present finding are in accordance with the findings of Pata *et al.* (2018) [13] who reported that 78.00% splashed the water on buffalo. Viswkarma *et al.* (2018) [21] reported that 93.34% of the respondents adopted summer

management measures for their buffaloes during summer season. Most (96.25%) of the buffalo owners stored the manure by means of heaps, while 3.75% of the buffalo owners stored the manure in pits. In contrast to the present finding, Kumar *et al.* (2020) [10] and Panchbhai and Gubbawar (2021) [12] found that 86.7 and 88.88 respondents disposed the manure from animal shed to manure pit. Majority (80%) of the respondents kept storage of manure at distance to their buffalo sheds, while 20.00% of the respondents kept storage of manure adjacent to their buffalo shed. Patel *et al.* (2018) [14] reported that 54.60% of the respondents had manure pit away from their animal sheds, while 45.40% of the respondents had manure pits adjacent to their animal sheds.

Table 3: Distribution of Jaffarabadi buffalo owners according to housing practices followed

Sr. No.	Practices	Maliya Hatina (N= 80)		Vanthali (N= 80)		Bhesan (N= 80)		Visavadar (N= 80)		Overall (N= 320)	
		N	%	N	%	N	%	N	%	N	%
1	Placement of animals										
	During only night	48	60.00	26	32.50	24	30.00	19	23.75	117	36.56
	Both day & night	32	40.00	54	67.50	56	70.00	61	76.25	203	63.44
	X^2	26.66**									
2	Winter management										
	Providing bedding material	61	76.25	46	57.50	56	70.00	39	48.75	202	63.12
	Closing the shed with curtains	17	21.25	23	28.75	21	26.25	34	42.50	95	29.69
	Rubber mat	02	2.50	11	13.75	03	3.75	07	8.75	23	7.19
	X^2	21.31**									
3	Summer management										
	Sprinkling of water on buffalo	52	65.00	43	53.75	59	73.75	54	67.50	208	65.00
	Sprinkling of water on buffalo + spreading of grass on top of roof	21	26.25	11	13.75	09	11.25	08	10.00	49	15.31
	Sprinkling of water on buffalo + fan	07	8.75	16	20.00	12	15.00	18	22.50	53	16.57
	Wallowing tank	00	00	10	12.50	00	00	00	00	10	3.12
	X^2	46.63**									
4	Storage of manure										
	Manure pit	06	7.50	03	3.75	02	2.50	01	1.25	12	3.75
	Manure heap	74	92.50	77	96.25	78	97.50	79	98.75	308	96.25
	X^2	4.84									
5	Location of manure										
	Adjacent	19	23.75	14	17.50	13	16.25	18	22.50	64	20.00
	Distant	61	76.25	66	82.50	67	83.75	62	77.50	256	80.00
	X^2	2.03									

n- Frequency, NS- Non-significant, * Significant at 5 per cent level ($p \leq 0.05$), ** Significant at 1 per cent level ($p \leq 0.01$)

Conclusion

It can be concluded that few of the Jaffarabadi buffalo owners in survey area followed scientific aspects of housing management practices properly but most of the Jaffarabadi buffalo owners need to be improved housing management practices in study areas by organizing awareness camps, exposure visits and training programmes regarding scientific buffalo housing management practices will be helpful for improving Socio-economic condition of the buffalo owners in future.

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