

## CROSSBRED CALF MORTALITY AND MANAGERIAL PRACTICES IN OPERATIONAL AREA OF DAIRY VIGYAN KENDRA

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### ABSTRACT

*The study objective is to know the prevailing crossbred calf mortality & managerial practices in the operational area of Dairy Vigyan Kendra (DVK), Vejalpur, Gujarat, India. A total of 300 crossbred cattle owners from 30 villages of 10 talukas were selected using the simple random sampling method for the study from August to December 2022. The data were collected based on the pre-tested structured interview schedule. Overall crossbred calf mortality was observed 33.70 per cent in the study area. There was a higher mortality rate in male calves (56.78%) than in female crossbred calves (16.98%) due to limited attention towards the male calf. The mortality rate was recorded higher during the first three months of age (70.78%) and during the monsoon (39.72%). The primary reason for calf mortality was malnutrition/ male calf negligence. Farmers urgently need extension services on scientific calf rearing practices such as providing concentrate feed, cutting navel cord with the sterilized object, providing milk as per body weight, on-time colostrum feeding, provision of milk replacer, calf starter, salt, mineral mixture, deworming, and vaccinations against diseases.*

**Keywords:** calf, crossbred cattle, dairy vigyan kendra, mortality

### INTRODUCTION

Calf rearing is a crucial component and the future progeny of the dairy farm, which the farmers commonly neglect. Calf morbidity and mortality are a constant problem for milk producers worldwide (Radostits *et al.*, 2007), especially in the tropics, where high temperatures and humidity promote the multiplication and transmission of infectious agents (Moran, 2011). In India, calf mortality ranges from 12.50 to 30 per cent (Singh *et al.*, 2009), even if it may be as high as 81 per cent (Tiwari *et al.*, 2007). Due to the high mortality of calves in India because of mismanagement, calf rearing should be taken on scientific lines with economically sound footing (Banerjee, 1998). Different management and environmental factors were reported to significantly affect calf morbidity and mortality; these include colostrum feeding, housing, calving assistance, production system, herd size, season and hygiene of micro- environment (Shiferaw *et al.*, 2002). There is a vast scope for increased productivity through improved management practices, including calf rearing to get maximum profits (Singh *et al.*, 2012). The present study was conducted to investigate the crossbred calf mortality & managerial practices in the operation area of Dairy Vigyan Kendra (DVK), Vejalpur, Gujarat.

### METHODOLOGY

The study was conducted among the crossbred cattle owners in the operational area of Dairy Vigyan Kendra (DVK), Vejalpur, from August to December 2022. Eleven talukas are under the operational jurisdiction of DVK. Out of that, seven talukas (Godhra, Shehera, Morva (Hadaf), Jambughoda, Ghoghamba, Halol and Kalol) are under the Panchmahals district, and four talukas (Santrampur, Khanpur, Kadana and Lunawada) are under Mahisagar district. The government of Gujarat established the first Dairy Vigyan Kendra in India in the 2012-13 financial year at Vejalpur to cater training needs of dairy farmers, boost clean milk production and increase animal productivity. Panchmahals district lies between 22.45 Northern latitudes and 73.36 Eastern longitudes. Mahisagar district geographically lies between 23.13 Northern latitudes and 73.62 Eastern longitudes. Dairy is the second-largest economic activity after agriculture in both districts. The total cattle and buffalo populations are 5,44,346 and 7,58,156, respectively, in the operational area of Dairy Vigyan Kendra (DVK), Vejalpur (20<sup>th</sup> Livestock Census). The total number of productive crossbred cows is 1,01,400 in the study area. The average milk yield per day per crossbred cow is 4.38 kg in the operational area of Dairy Vigyan Kendra (DVK), Vejalpur, which is lower than the Gujarat state average (6.50 kg) as per the 36<sup>th</sup> survey report, Government of Gujarat.

A total of ten talukas of the operational area of DVK were randomly selected for the study. Three villages were selected randomly from each taluka. Ten crossbred cattle owners out of all the owners whose crossbred cattle calved within the twelve months were randomly selected from each village. A sample of 300 crossbred cattle owners from 30 villages was selected for the investigation by adopting the Ex-Post-Facto research design. A standardized, well-structured pre-tested interview schedule was prepared in line with the objectives in consultation with the experts of Livestock Production Management. The crossbred calf mortality data were categorized according to age and gender. Herd size meant the number of dairy animals owned by the family of respondents at the time of inquiry. These dairy animals were converted into Standard Animal Units (S.A.U.) as per the methodology suggested by Patel *et al.* (1983). During the study, the months were categorized into three seasons, viz. winter (November to February), summer (March to June), and monsoon (July to October). The data were collected and analyzed with suitable statistical techniques. The mortality rate is the ratio of the number of deaths in the year to the average total population of the year.

$$\text{Mortality rate} = \frac{\text{Number of died animals in the study area}}{\text{Total animal population in the study area}} \times 100$$

## OBJECTIVE

To know crossbred calf mortality and managerial practices in operational area of dairy vigyan kendra, vejalpur

## RESULTS AND DISCUSSION

The majority of crossbred cattle owners belonged to the middle-aged group (55.33%) having secondary to higher secondary level of education (58.34%) with marginal (76.00%) landholding and small ( $\leq 8$  SAU) herd size (51.00%) with low ( $\leq 1$  lakh) annual income (77.67%). A similar result by Chinchmalatpure, 2022 reported that the vast majority of dairy farmers (99.00%) had earned up to one lakh rupees annually, and 74 per cent of them possessed 5-10 milch animals. Less than one-third (23.33%) of them had received training related to animal husbandry from any of the animal husbandry departments of the state and centre. Most of the calving in crossbred cattle was in the monsoon season (45.23%), followed by winter (33.39%) and summer (21.38%). A similar result by Hassan *et al.*, 2007 stated that the calving frequency of crossbred cattle was highest (45.7%) in July to October (monsoon), followed by (November to February) winter (36.2%). Less than half of the respondents (42.00%) were aware of sex-sorted semen, and almost all (41.66%) who were aware of it they willing to use sex-sorted semen for less than ₹ 200 (Table 1).

**Table 1: Profile of crossbred cattle owners**

(n = 300)

Sr. No.	Profile of crossbred cattle owners	Frequency	Per cent
<b>1</b>	<b>Age</b> ( $\bar{x} = 44.39$ , S.D.= 16.56)		
i	Young ( $\leq 35$ years)	62	20.67
ii	Middle-aged (36–50 Years)	166	55.33
iii	Old ( $> 50$ Years)	72	24.00
<b>2</b>	<b>Education</b>		
i	Illiterate	19	06.33
ii	Primary education (up to 8th standard)	70	23.33
iii	Secondary education (9th to 10th standard)	99	33.00
iv	Higher secondary education (11th to 12th std.)	76	25.34
v	Graduate and above	36	12.00
<b>3</b>	<b>Landholding</b> ( $\bar{x} = 1.26$ , S.D.= 0.50)		
i	Landless farmers	01	0.33
ii	Marginal farmer (Up to 1.00 ha)	228	76.00
iii	Small farmer (1.01 to 2.00 ha)	64	21.34
iv	Medium farmer (2.01 to 4.00 ha)	04	01.33
v	Large farmer (Above 4.00 ha)	03	01.00
<b>4</b>	<b>Training in Animal Husbandry</b>		
i	Training received	70	23.33
ii	Training not received	230	76.67
<b>5</b>	<b>Herd size (in Standard Animal Unit)</b> ( $\bar{x} = 8.57$ , S.D.= 4.16)		
i	Small ( $\leq 8$ SAU)	153	51.00

Sr. No.	Profile of crossbred cattle owners	Frequency	Per cent
ii	Medium (8.01 to 16 SAU)	126	42.00
iii	Large (> 16 SAU)	21	07.00
<b>6</b>	<b>Annual Income (<math>\bar{x}</math> = 91433.33, S.D.= 36816.62)</b>		
i	Low income ( $\leq$ ₹ 1 lakh)	233	77.67
ii	Medium income ( ₹ 1.01 to 2 lakhs)	62	20.67
iii	High income (> ₹ 2 lakhs)	05	01.66
<b>7</b>	<b>Calving of crossbred cattle as per season wise (n=650)</b>		
i	Winter (November to February)	217	33.39
iii	Summer (March to June)	139	21.38
iii	Monsoon (July to October)	294	45.23
<b>8</b>	<b>Awareness about sex sorted semen</b>		
<b>9</b>	<b>Willingness to use sex sorted semen in animals for breeding</b>		
<b>10</b>	<b>At which price they wanted female sex sorted semen (n=125)</b>		
i	$\leq$ ₹ 200	111	88.80
iii	₹ 201 to 400	09	07.20
iii	> ₹ 400 Rs	05	04.00

A perusal of the data shown in Table 2 indicated that most crossbred cattle owners had cleaned the calf immediately after birth (94.00%) and had not used disinfectant after cutting the navel cord (71.00%). The present finding was similar to Mahla *et al.* (2015); Godara *et al.* (2017) reported that most farmers cleaned the calf immediately after birth. It was observed that only 64.00 per cent of owners had cut the navel cord of crossbred calves, and only 8.00 per cent of them used a sterilized object to cut the navel cord. The present finding was in close conformity with the reports of Mahla *et al.* (2015); Sabapara *et al.* (2015); Sreedhar and Sreenivas, (2015); Godara *et al.* (2017) reported that very few farmers had followed disinfection of the naval cord. Such a result is due to a lack of awareness and monetary issues of dairy farmers. There is a need to motivate dairy farmers to cut the navel cord with a sterilized object. The majority of crossbred cattle owners had provided milk (97.33%), colostrum (99.33%), and concentrate feed (84.67%) to their calf. The major issue was that only 18.00 per cent of crossbred cattle owners provided colostrum to the calf within one hour of birth, and only 6.33 per cent of them provided milk to the calf as per body weight which reflected the lack of awareness about scientific calf rearing practices among the crossbred cattle owners. A similar result of very few farmers feeding colostrum to the calves within one hour immediately after birth was reported by Mahla *et al.* (2015); Sreedhar and Sreenivas, (2015). This showed the very low awareness among the crossbred cattle owners about the importance of first colostrum feeding and its timing. It is a well-established fact that delays in the feeding of colostrum lead to the lower

effectiveness of colostrum in providing immunity to calves (Sharma and Mishra, 1987). Crossbred cattle owners had provided calf starter (56.33%), mineral mixture (50.00%), milk replacer (43.67 per cent) and salt (23.00 per cent) to their calves. A similar result by Yadav *et al.* (2016) reported that more than half of the dairy farmers (57.60%) provided calf starter to their calves. However, Sabapara *et al.* (2015) stated that only 2.67 per cent of the dairy farmers provided calf starter in the Surat district of Gujarat. Most dairy farmers were unaware of the calf starter and milk replacer reported by Kumar *et al.* (2021). The majority of crossbred cattle owners had used deworming agents at 21 days of age of calf (84.33%), but only 44.33 per cent of them provided deworming every month up to the six months of age of calf. The present study observations were more encouraging than the findings of Sreedhar and Sreenivas, (2015); they reported that only 16.67 per cent of farmers had dewormed their calves at regular intervals. Regular deworming can reduce calf mortality which was supported by Pal *et al.* (2016) reported that 79-85 percent reduction in calf mortality under field conditions when deworming was practiced from 1-2 weeks after birth. There were 66.00 and 63.67 per cent of crossbred cattle owners who had given vaccination for *Hemorrhagic Septicemia* (HS) and Foot and Mouth Disease (FMD) vaccine to their calves, respectively. Vaccination of Brucellosis (13.33%) and Theileriosis (14.67%) were observed in the study area. A study by Pata *et al.* (2019) stated that 68.67 per cent of buffalo owners practiced vaccination against FMD disease, followed by 16 per cent of owners against HS in Junagadh and Porbandar districts of Gujarat.

**Table 2: Prevailing crossbred calf rearing practice**

(n= 300)

Sr. No.	Prevailing practices	Frequency	Per cent
1	Clean the calf immediately after birth	282	94.00
2	Cut the navel cord of calf	192	64.00
3	Cut navel cord with a sterilized sharp object	24	8.00
4	Which disinfectant is used after cutting of navel cord?		
	A. No disinfectant use	213	71.00
	B. Povidone iodine	87	29.00
5	Feeding of colostrum to the calf	298	99.33
6	Time of first colostrum feeding		
	A. After dropping of placenta	56	18.67
	B. One to four hours of birth	190	63.33
	C. Within one hour of birth	54	18.00
7	Provide milk to the calf	292	97.33
8	Quantity of milk provides to calf		
	A. Only up to let down of milk	91	30.33
	B. One quarter	182	60.67
	C. As per body weight	19	6.33
9	Milk feeding up to age		
	A. One month	56	18.67
	B. Two months	62	20.67
	C. Three months	74	24.67
	D. More than three months	100	33.33
10	Providing milk replacer to calf	131	43.67
11	Providing calf starter to calf	169	56.33
12	Providing concentrate feed to calf	254	84.67
13	Providing mineral mixture to calf	150	50.00
14	Providing salt to calf	69	23.00
15	A. Bedding facility	169	56.33
16	Deworming at 21 days age of the calf	253	84.33
17	Deworming at every month up to 6 months of calf	133	44.33
18	Deworming at every six months of calf	277	92.33
19	HS vaccination to calf	198	66.00
20	FMD vaccination to calf	191	63.67
21	Brucellosis vaccination to calf	40	13.33
22	Theileriosis vaccination to calf	44	14.67
23	Type of treatment		
	A. Never called a veterinarian	0	0.00
	B. Used indigenous medicines, then a vet. was called	85	28.33
	C. Called a vet. or para-vets immediately when calf fell sick	215	71.67

Data in Table 3 indicated an overall 33.70 per cent mortality rate was observed in the crossbred calves in the study area. The crossbred calf mortality rate was 56.78 per cent and 16.98 per cent in male and female crossbred

calves, respectively, in the operational area of DVK, Gujarat. There was a higher mortality rate in male calves due to negligence by the owners. There is no economic utility of male calves. Similar results were obtained by Selvan *et al.*

(2019) reported that overall crossbred calf mortality was 27.7 per cent, and mortality rate was higher in male (29.03%) as compared to female (26.37%) in crossbred (Holstein Friesian

× Tharparkar) calves (spread over 16 years; 1999–2014) maintained at Livestock Research Centre, National Dairy Research Institute, Karnal.

**Table 3: Crossbred calf mortality rate (year 2021-22)**

Sr. No.	Sex	No. calf born in the last year	No. calf died in the last year	Mortality rate (Per cent)
i	Male	273	155	56.78
ii	Female	377	64	16.98
<b>Total</b>		<b>650</b>	<b>219</b>	<b>33.70</b>

Mortality in crossbred calves (70.78%) was higher during the first three months of age (Table 4). Selvan *et al.* (2019) indicated that the majority of crossbred calves (82.30%) died within three months of age. In the present study, only 18.00 per cent of crossbred cattle owners had provided colostrum within one hour to their calves, so overall immunity development may be less, resulting in higher mortality in the age group upto 3 months. The mortality was higher in the monsoon season (39.72%), followed by the winter (35.62%) and summer (24.66%) seasons (Table 4). A similar result was obtained by Kharkar *et al.* (2017), who reported that the overall mortality was found to be highest in monsoon (48.44%), followed by winter (42.18%) and summer (9.38%). Monsoon was the most susceptible season to calf disease and mortality. Moist and humid conditions, along with rainfall may be suitable for the growth and proliferation of disease causal agents. The majority of crossbred calves died during the first three months of age due to lack of management, especially in the feeding of colostrum within one hour of their calves’ birth, which is reflected in their

overall immunity. Hordofa *et al.* (2021) reported that delayed colostrum intake, calving difficulty, and calving season were the three major factors identified that significantly affect calf mortality. According to Moran, (2011), the likelihood of a calf getting sick increases by 10 percent for every hour of delay in colostrum feeding in the first 12 hours of the birth. Since the concentration of IgG in colostrum and its absorption from the small intestine decrease over time, it is advisable to give a sufficient amount of colostrum immediately after birth (within 1–2 hours and before 6 hours) to ensure the transfer of passive immunity (Arnold, 2014). Malnutrition /Male calf negligence (36.99%) was the major reason for crossbred calves’ mortality, followed by diarrhoea (31.05%), parasitic infestation (11.41%) and lumpy skin disease (10.50%) (Table 5). A similar result was reported by Kharkar *et al.* (2017); Hordofa *et al.* (2021) stated that diarrhoea or gastroenteritis was the leading cause of calf mortality, and Fentie *et al.* (2020) reported that malnutrition was one of the problems of calf mortality which might be due to less attention regarding feeding to male calves.

**Table 4: Mortality pattern of crossbred calves in different age groups and seasons**

Sr. No.	Age	No. of calves died			Per cent of total calves died		
		Male	Female	Total	Male	Female	Total
1	Birth to 3 months	111	44	155	71.61	68.75	70.78
2	3.01 to 6 months	37	11	48	23.87	17.19	21.92
3	More than 6 months	07	09	16	04.52	14.06	07.30
<b>Total</b>		<b>155</b>	<b>64</b>	<b>219</b>	<b>100</b>	<b>100</b>	<b>100.00</b>
1	Winter	55	23	78	35.48	35.94	35.62
2	Summer	36	18	54	23.23	28.13	24.66
3	Monsoon	64	23	87	41.29	35.93	39.72
<b>Total</b>		<b>155</b>	<b>64</b>	<b>219</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

**Table 5: Reasons of crossbred cattle owners for crossbred calves’ death**

(n=106)

Sr. No.	Reasons	Frequency	Per cent
1	Pneumonia	01	00.46
2	Diarrhoea/ dysentery	68	31.05
3	Malnutrition /Male calf negligence	81	36.99
4	Bloat	08	03.65

Sr. No.	Reasons	Frequency	Per cent
6	Navel ill/ Joint ill	13	05.94
7	Parasitic infestation	25	11.41
8	Lumpy Skin Disease	23	10.50
	<b>Total</b>	<b>219</b>	<b>100.00</b>

Table 6 revealed that the correlation between concentrate feeding to calf with female crossbred calves' mortality was found negative and significant at 5 per cent of level of confidence, which means providing concentrate feed to calf reduces female calf mortality. Concentrates that

are supposed to be the most effective feed for early rumen development need to be offered to calves as early as possible (Noci, 2010). The remaining practices did not find any significant effect on female calf mortality in field conditions, which may be due to the homozygous group of respondents.

**Table 6: Relationship between common management practices and female calf mortality**

(n= 300)

Sr. No.	Practices	Correlation coefficient ('r' value)
X <sub>1</sub>	Clean the calf immediately after birth	-0.005 <sup>NS</sup>
X <sub>2</sub>	Cut the navel cord of calf	0.025 <sup>NS</sup>
X <sub>3</sub>	Disinfectant used after cutting of navel cord	0.111 <sup>NS</sup>
X <sub>4</sub>	Feeding of colostrum	0.041 <sup>NS</sup>
X <sub>5</sub>	Time of first colostrum feeding	0.057 <sup>NS</sup>
X <sub>6</sub>	Provide milk to the calf	0.034 <sup>NS</sup>
X <sub>7</sub>	Quantity of milk provides	-0.031 <sup>NS</sup>
X <sub>8</sub>	Milk feeding up to age	-0.048 <sup>NS</sup>
X <sub>9</sub>	Providing milk replacer to calf	0.080 <sup>NS</sup>
X <sub>10</sub>	Providing calf starter	0.047 <sup>NS</sup>
X <sub>11</sub>	Providing concentrate feed to calf	-0.134 <sup>*</sup>
X <sub>12</sub>	Providing mineral mixture	-0.016 <sup>NS</sup>
X <sub>13</sub>	Providing salt	0.024 <sup>NS</sup>
X <sub>14</sub>	Bedding facility	0.047 <sup>NS</sup>
X <sub>15</sub>	Deworming	-0.068 <sup>NS</sup>
X <sub>16</sub>	Vaccination	0.039 <sup>NS</sup>

\* Significant at 0.05 per cent level of probability, <sup>NS</sup> Non-significant

## CONCLUSION

The mortality rate of male crossbred calves (56.78%) was very high than female calves (16.98%), and the overall crossbred calf mortality rate was 33.70 per cent in the operational area of DVK. The majority of crossbred calves died during the first three months of age in the monsoon season, and the major causes of calf mortality were malnutrition/ male calf negligence and diarrhoea. There is an urgent need to educate and motivate dairy farmers about scientific calf rearing practices by conducting training programmes special in the field of providing concentrate feed, milk to calf as per their body weight, first colostrum feeding within one hour of birth, milk replacer, calf starter, salt, mineral mixture, deworming agent at every month up to six months, and vaccinations. There is an urgent need to make a state-level concrete policy to prevent heavy male

crossbred calf mortality, along with the introduction of sex-sorted semen in bovine with a nominal price.

## CONFLICT OF INTEREST

This is to declare that there is "No conflict of interest" among researcher.

## REFERENCES

- 20<sup>th</sup> Livestock Census (2019). All India Report. Ministry of Agriculture, Department of Animal Husbandry, Dairying & Fisheries, Krishi Bhawan, New Delhi, India.
- 36<sup>th</sup> Survey Report (2018-19). Major Livestock Products for the Year 2018-2019 on Estimates of Gujarat State. Directorate of Animal Husbandry Krishi Bhavan,

- Sector 10-A Gandhinagar - 382 010, Gujarat State, India.
- Arnold, M. (2014). Colostrum management for dairy calves. The University of Kentucky, College of Agriculture. [https://afs.ca.uky.edu/files/colostrum\\_management\\_for\\_dairy\\_calves.pdf](https://afs.ca.uky.edu/files/colostrum_management_for_dairy_calves.pdf)
- Banerjee, G. C. (1998). A textbook of animal husbandry (8<sup>th</sup> Eds.), Oxford & IBH Publishing Company Private Limited. New Delhi, India.
- Chinchmalatpure, U. R. (2022). Socio-economic status of dairy farmers and their constraints in adoption of improved dairy management practices. *Guj. J. Ext. Edu.*, Special Issue: 22-25. <https://doi.org/10.56572/gjoeec.2022.si.0006>
- Fentie, T., Guta, S., Mekonen, G., Temesgen, W., Melaku, A., Asefa, G., Tesfaye, S., Niguse, A., Abera, B., Kflewahd, F. Z., Hailu, B., Begna, F. and Worku, Z. (2020). Assessment of Major Causes of Calf Mortality in Urban and Periurban Dairy Production System of Ethiopia. *Vet. Med. Int.*, Article ID: 3075429. <https://doi.org/10.1155/2020/3075429>
- Godara, V., Singh, N., Kumar, S. and Robin. (2017). Calf rearing management practices followed in rural areas of Western Haryana, India. *Int. J. Curr. Microbiol. Appl. Sci.*, 6(12): 2996-3000.
- Hassan, F., Khan, M. S., Rehman, M.S., Sarwar, M. and Bhatti, S. A. (2007). Seasonality of calving in Nili-Ravi buffaloes, purebred Sahiwal and crossbred cattle in Pakistan. *Italian J. Anim. Sci.*, 6(2): 1298-1301.
- Hordofa, D., Abunna, F., Megersa, B. and Abebe, R. (2021). Incidence of morbidity and mortality in calves from birth to six months of age and associated risk factors on dairy farms in Hawassa city, southern Ethiopia. *Heliyon*, 7: e08546.
- Kharkar, K. P., Raghuvanshi, D. S., Lende, S. and Khati, B. M. (2017). Mortality Pattern in Crossbred Calves of Dairy Cattle. *J Krishi Vigyan*, 5(2): 116-121. <https://doi.org/10.5958/2349-4433.2017.00026.5>
- Kumar, S., Dahiya, S. P., Kumar, M. and Kumar, N. (2021). Appraisal of calf rearing practices followed by farmers in Hisar district of Haryana. *Haryana Vet.*, 60(2): 179-182.
- Mahla, V., Choudhary, V. K., Saharan, J. S., Yadav, M. L., Kumar, S. and Choudhary, S. (2015). Study about socio-economic status and calf rearing management practices adopted by cattle keepers of Western Rajasthan, India. *Indian J. Agri. Res.*, 49(2): 189-192.
- Moran, J. B. (2011). Factors affecting high mortality rates of dairy replacement calves and heifers in the tropics and strategies for their reduction. *Asian-australas. J. Anim. Sci.*, 24(9): 1318-1328.
- Noci, B. (2010). Effects of different rations on growth and rumen development of calves. Dissertation, Free University Berlin; Berlin, Germany.
- Pal, S. S., Sharma, I. and Fareeda. (2016). Clinical importance of scheduled deworming in buffalo calves. *Intas Polivet*, 17(1): 85-87.
- Pata, B. A., Odedra, M. D., Savsani, H. H., Ahlawat, A. R., Patbandha, T. K. and Odedara, A. B. (2019). Breeding, calf and health management practices opted by buffalo owners in Junagadh and Porbandar districts of Gujarat: A Comparative Study. *Int. J. Curr. Microbiol. Appl. Sci.*, 8(3): 2426-2435.
- Patel, R.K., Kumbhare, S.L. and Sharma, K. N. S. (1983). Standardization of Bovine Units. *Indian J. Anim. Hlth.*, 93(2): 457-550.
- Radostits, O. M., Gay, C. C., Hinchcliff, K. W. and Constable, P. D. (2007). A textbook of the diseases of cattle, horses, sheep, pigs and goats. Veterinary Medicine, 10, 2045-2050.
- Sabapara, G. P., Fulsoundar, A.B. and Kharadi, V. B. (2015). Survey of calf rearing practices followed at rural dairy farms in Surat district. *J Anim Res.*, 5(2): 257-261.
- Selvan, A. S., Tantia, M. S., Kumar, D. R., Karuthadurai, T., Upadhyay, A., Lathwal S. S. and Kumaresan, A. (2019). Factors influencing calf mortality in zebu and crossbred cattle reared under subtropical agroclimatic conditions. *Indian J. Ani. Sci.*, 89(3): 304-309. <https://doi.org/10.56093/ijans.v89i3.88088>
- Sharma, M. C. and Mishra, R. R. (1987). Livestock health and management. Khanna Publishers, New Delhi, India.
- Shiferaw, Y., Yohannes, A., Yilma, Y., Gebrewold, A. and Gojjam, Y. (2002). Dairy husbandry and health management at Holleta. Proceeding of the 16th Conference of the Ethiopian Veterinary Association.

- Addis Ababa, Ethiopia. (pp.103–119).
- Singh, D. D., Kumar, M., Choudhary, P. K. and Singh, H. N. (2009). Neonatal calf mortality - An overview. *Intas Polivet*, 10(2): 165-169.
- Singh, S. K., Agarwal, S.B. and Chandel, B. S. (2012). Resource use efficiency in buffalo milk production in Varanasi district of Uttar Pradesh, India. *J. dairy. foods home sci.*, 31(4): 259-263.
- Sreedhar, S., and Sreenivas, D. (2015). A study on calf mortality and managerial practices in commercial dairy farms. *Livest. Res. Int.*, 3(4): 94-98.
- Tiwari, R., Sharma, M. C. and Singh, S. P. (2007). Buffalo calf health care in commercial dairy farms: a field study in Uttar Pradesh (India). *Livest. Res. Rural. Dev.*, 19(3): <http://www.lrrd.org/lrrd19/3/tiwa19038.htm>
- Yadav, S. P., Paswan, V. K., Sawant, P. and Bhinchhar, B. K. (2016). Breeding and calf rearing management practices followed in Varanasi district of Uttar Pradesh, India. *Indian J. Ani. Res.*, 50(5): 799-803.

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Received : March 2023 : Accepted : May 2023