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Original Research Article

Mortality Pattern in Deoni and Holdeo (HF X Deoni) Crossbred Cattle under Organised Herd Management Conditions

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A B S T R A C T

Mortality patterns of indigenous Deoni breed and its cross with Holstein Friesian named Holdeo, maintained at Cattle Cross Breeding Project, Marathwada Agriculture University, Parbhani were studied. Thirty five years (1976-77 to 2009-10) data arranged in seven periods (each of Five years) on mortality were analysed for period, season, age, sex and cause effect on mortality rate. The overall mortality was 12.34m%. The mortality in Deoni and Holdeo averaged 4.12 % and 20.44 %, respectively. The mortality rate in two breed under study did not vary significantly between periods, seasons, age categories, sex and causes of disease. However, the trend indicated appreciable difference in mortality rate. The mortality was highest in the period P_2 (1981-85) and P_3 (1986-90) 17.49 % and 17.54 %, respectively and lowest in P_7 (2006-2010) 4.18%. There was very little variation in seasonal mortality rate and mortality rate averaged 4.50 %, 4.05 % and 3.77 % in monsoon (July-October), summer (March- June) and winter (November-February) seasons, respectively. The mortality in the age group of 0- 3 months accounted for a major share (40-50 % or higher) in both groups. Digestive problems followed by anaemia/ debility/ senility and respiratory disorders together accounted for 70-80% of total deaths. The mortality of female (6.85 %) is more than male (5.49 %) animals in both groups.

Keywords

Dairy cattle, Indigenous and crossbred, Organized herd

Introduction

Indian livestock is very important and prospective one. Livestock sector plays an important role in the socio-economic development of the country and is important source of income for the farmers and poor rural. Livestock sector not only provides essential protein and nutrition to human diet but also plays an important role in utilization of non-edible agricultural by-products. The success of livestock industry depends on good health of the livestock that helps to increase the productivity. The knowledge of occurrence of animal disease and pattern of mortality in organized dairy herds serve as a useful indicator for assessing the status of herd health and management programmes and their efficacy (Prasad *et al.*, 2004). A rise in the mortality among a group of cattle can indicate sub-optimal health and welfare.

So, reduction in morbidity and mortality rate are the first and foremost targets of dairy farm management, although there are research findings on the pattern of mortality in herd under tropical Indian conditions. The aim of the present investigation was to document the mortality pattern in herd maintained at the Cattle Cross Breeding

Project, Marathwada Agriculture University, Parbhani, India.

Materials and Methods

The cattle Cross Breeding project (CCBP), Marathwada Krishi Vidyapeeth, Parbhani maintains the pure germplasm of Deoni breed and the unit has introduced a crossbred named as Holdeo by crossing Holstein Friesian (HF) with Deoni. Mortality records of dairy animals over a period of 35 years (1975-2010) were analysed. The data pertained to germplasm of Deoni and its cross with Holstein Friesian (Holdeo) evolved at project. The Cattle Cross Breeding Project maintains an elite herd of dairy animals for research and standardization of management packages for the benefit of researchers, students and dairy farmers. All standard managemental and husbandry practices are followed on the project with weaning system in crossbred animals. The animals are reared in groups of 15-20 per group in case of young calves and 30-40 per paddock in case of older calves and adult animals under loose housing system. All animals are maintained under semi-intensive system of management i.e. let loose for grazing in the morning hours and offering feed and concentrate in evening.

The animals are separated into different categories according to their age and productive status. The paddocks have adequate feeding and watering arrangement for all the animals. A routine herd health programme and vaccination schedule was followed. The causes of death were diagnosed on the basis of clinical history, laboratory investigation and post mortem examination.

The information on yearly mortality pertaining to the 35 years (1975-76 to 2009-10) was collected from the records and divided into seven periods each comprising of five years each to analyse the data appropriately. Each year was divided into three seasons i.e. summer (March - June), Monsoon (July – Oct) and winter (Nov – Feb). This seasonal data was clubbed into seven periods i.e. P_1 (1976-80), P_2 (1981-85), P_3 (1986-90), P_4 (1991-95), P_5 (1996-2000), P_6 (2001-2006) and P_7 (2006-2010). The period from birth to death was divided into six age categories (0 to 3 month, 4-6 month, 7-9 month, 10-12 month, 13 to 36 months and above 36 months) and according to sex in both Deoni and Holdeo crossbred cattle. The causes of mortality based on post-mortem findings were classified into 11 classes Anemia / Debility / Senility (ADS)

Digestive disorders (DD), such as enteritis and its various types and its combination with various systemic disorders (gastritis; gastroenteritis; haemorrhagic gastroenteritis) and various liver disorders, peritonitis, traumatic reticulitis.

Respiratory disorders (RD), such as pneumonia and its various types.

Protozoan diseases (PD)

Gynaecological disorders (GD)

Contagious diseases (CD)

Poisoning deaths (POD) from causes such as nitrate poisoning or snake bites.

Urogenital disorders (UD) namely nephritis, hydronephrosis, nephritis and hepatitis, premature birth and underweight, prepartum and postpartum prolapse (vaginal, uterus, bladder), toxaemia of reproductive origin

Nutritional/metabolic/production disorders (NMD), including bloat/ tympany, acidosis

in a cow with macerated foetus, downer cow syndrome, suspected copper deficiency, toxaemia of mammary origin.

Musculoskeletal disorders (MSD), including joint ill, dislocation of hip joint, paralysis (facial), posterior paralysis of hind limb

Miscellaneous disorders (MD), including cases with toxaemia caused by wounds, tumours in the mandible, asphyxia, foot wounds, brain tumour, exhaustion and debility, internal haemorrhage, heat stroke, low body weight, hypothermia, septic wounds, tail gangrene, hypo sarcoma, jaundice, etc. A few cases in which the cause could not be ascertained were also included in this category.

The number of animals that died were analysed in respect to population available so as to know the percentage mortality pattern of Deoni and crossbred animals at project in different period, seasons, age group and sex. The association of breed, year and season of death, age and causes of death with mortality rate was tested by the chi-square test (Snedecor *et al.*, 1994)

Results and Discussion

The year wise mortality of both the breed with Herd strength is shown in Table I.

The period wise and breed mortality is shown Table II. From table II, the overall mortality in Deoni and Holdeo crossbred cattle is 12.34 %. Average mortality for Holdeo cattle is 20.44 % ranging from 4.94 % in P_7 (2006-2010) period to 28.69 % in P_2 period (1981-1985), whereas in Deoni cattle it varies from 1.84 % in P_4 period (1991-1995) to 6.28 % in P_1 period (1976-1980) with an average mortality of 4.12 %. A similar mortality in Zebu Taurus crossbreds (average 21.78 %) was reported by Khera (1981 a,b) and Aglave *et al.*, reported slightly lower overall mortality (18.70 %) in Holdeo crossbred cattle. Kulkarni and Bansod (2001) reported higher overall mortality rate of 16.58 % in Zebu and Zebu crossbreds, respectively. Prasad *et al.*, (2004) reported higher mortality values in Sahiwal (14.35%), Tharparkar (7.21%) and lower in Karan Swiss (17.12%) and Karan Fries (13.49 %) breeds. Parekh and Singh (1981) reported lower values (8.87%) in Holstein Friesian crosses.

Kulkarni and Bansod (2001) also reported lower rates of mortality in different reciprocal crosses of cattle (16.58 %) and Sharma *et al.*, (1975) also reported higher mortality rate (18.70 %) than the present findings.

The lowest mortality rate was in Deoni, this may be due adaptability to environment and pasture because study area is in breeding tract of Deoni. The higher mortality in Holdeo crossbreds may indicate lower survivability of this breed compared with Deoni or indigenous breeds under the prevailing conditions of Parbhani, Maharashtra. The higher mortality in second, third and fourth period may be explained by the introduction of exotic blood, difficulty of crossbreds to adjust the prevailing environmental conditions, including the managemental and climatological aspects.

The table II reveals that the period P_7 (2006-10) shows lowest mortality (4.11%) whereas mortality was reducing from period P_2 to P_7 and that might be due to development of effective standard managemental practices at the project. Chi-square analysis of the data did not indicate any significant differences among different breeds and periods (see Table V) as reported by Mishra and Taneja (1991) and Prasad *et al.*, (2004). In contrast,

significant differences among genetic groups were reported by Mukherjee and Tomar (1999) and Sharma and Jain (1982) and significant differences in different years were observed by Sharma *et al.,* (1975) and Chavai (1996).

Table III depicts the seasonal and breed mortality of two breeds in different periods. The period wise mortality of Holdeo crossbred varied between 6.56 % in winter to 7.07 % in monsoon whereas in Deoni cattle it varies between 0.96 % in winter to 1.91 % in monsoon season. Mortality of crossbred is highest (11.83 %) in P_3 (1986-90) in monsoon followed by 9.86 % in summer and 9.79 % in winter season, whereas highest mortality in Deoni cattle (2.74 %) is observed in P_1 (1976-80) in summer season followed by 2.34 % (P_2 1981-85)in monsoon and 1.52 % in winter (P_1 1976-80).

The seasonal comparison of mortality rates indicated that the overall mortality rate varied between 3.77% (winter season) to 4.50% (summer season) and the effect was not statistically significant (Table V). Similar results were observed by Aglave *et al.,* (2012) in case of Holdeo cattle.

The comparison among different breeds also indicated that the mortality did not vary appreciably between seasons as observed by Rao and Nagarcenkar (1980), Chaudhary *et al.,* (1986), Roy *et al.,* (1997) Chavai (1996), Prasad *et al.,* (2004) and Aglave *et al.,* (2012). The mortality was slightly higher in the summer season in Deoni breed and was slightly higher in the monsoon season in Holdeo. The trends in study indicate the better adaptability of the indigenous Deoni and crossbred Holdeo cows for the winter climate and higher susceptibility to Monsoon season. This might be due to hot-humid condition, which is favourable for growth of micro-organism and propagation of parasitic infections during monsoon season.

The age and breed mortality in different periods is shown in table IV. Mortality was highest up to 3 month of age, which accounted for 40 – 50 per cent or more of total deaths in two different breed groups, indicating the importance of protecting the animals against infection during this critical period. Highest mortality at 0-3 month age group in Holdeo is observed in P_2 (1981-85) i.e. 20.26 % followed by P_3 (1986-1990) period (18.85 %) with an average mortality of 13.69 % and lowest mortality in the age group of 12-36 month with an average mortality of 0.47 %. Similar values were reported by Kale and Mandakmale (1993) and Chavai (1996). However, Parekh and Singh (1981) Tomar (1973), Prasad and Singh (1975), Behra and Sirohi (1979), Khera (1981b), Sekhar *et al.,* (1981), Mishra and Taneja (1991) and Mukherjee and Tomar (1999) have reported lower mortality than the present findings in different cattle breeds and their crosses.

High mortality during 0-3 months of age in Murrah buffalo calves (Pradhan and Panda 1994). Aglave *et al.,* (2012b) reported 21.79 % overall mortality in Holdeo cattle and Jadhav *et al.,* (1995) in the range of 28.13 % in animals below 3 months of age.

From the third month onwards, there was a progressive decline in mortality rates, which is in agreement with the trends reported by NRC (1968), Srivastava *et al.,* (1973), Rao and Nagarcenkar (1980), Sharma and Jain (1982) and Jain and Sharma (1982). The mortality was higher during the productive life stage of the animals (above 36 months). The breed mortality during that period was 1.69 % and 1.89% for Deoni and Holdeo, respectively, with an average of 1.76 %.

Table.1 Year wise percent mortality at CCBP

Year	Herd Strength	No of cases died	Per cent mortality
1976-77	400	25	6.25
1977-78	367	14	3.81
1978-79	445	43	9.66
1979-80	478	31	6.49
1980-81	531	42	7.91
1981-82	578	102	17.65
1982-83	506	90	17.79
1983-84	469	78	16.63
1984-85	449	89	19.82
1985-86	436	65	14.91
1986-87	385	75	19.48
1987-88	323	58	17.96
1988-89	316	60	18.99
1989-90	325	60	18.46
1990-91	347	45	12.97
1991-92	357	48	13.45
1992-93	355	70	19.72
1993-94	364	62	17.03
1994-95	304	45	14.80
1995-96	288	23	7.99
1996-97	227	33	14.54
1997-98	186	8	4.30
1998-99	149	12	8.05
1999-00	145	15	10.34
2000-01	136	6	4.41
2001-02	137	12	8.76
2002-03	137	3	2.19
2003-04	146	9	6.16
2004-05	145	5	3.45
2005-06	150	8	5.33
2006-07	160	7	4.38
2007-08	167	8	4.79
2008-09	173	7	4.05
2009-10	155	5	3.23
Total	10236	1263	12.34

Table.2 Period wise mortality at CCBP

Period	Herd Strength			No of cases died			Per cent mortality
	Holdeo	Deoni	Total	Holdeo	Deoni	Total	
P_1 (1976-1980)	580	1641	2221	8.97 (52)	6.28 (103)	155	6.99
P_2 (1981-1985)	1328	1110	2438	28.69 (381)	3.87 (43)	424	17.49
P_3 (1986-1990)	1040	656	1696	26.92 (280)	(2.74) 18	298	17.54
P_4 (1991-1995)	1016	652	1668	23.23 (236)	1.84 (12)	248	14.88
P_5 (1996-2000)	519	324	843	12.52 (65)	2.78 (9)	74	8.79
P_6 (2001-2006)	343	372	715	6.71 (23)	3.76 (14)	37	5.17
P_7 (2006-2010)	324	331	655	4.94 (16)	3.32 (11)	27	4.18
	5150	5086	10236	20.44 (1053)	4.12 (210)	(12.33) 1263	12.34

Table.3 Period wise and Seasonal Mortality (%) in Holdeo crossbred cattle and Deoni cattle at CCBP

Period / Season	Breed	P_1 (76-80)	P_2 (81-85)	P_3 (86-90)	P_4 (91-95)	P_5 (96-00)	P_6 (01-06)	P_7 (06-10)	Total	Seasonal overall
Summer	Holdeo	3.97 (23)	9.86 (131)	8.08 (84)	8.27 (84)	3.85 (20)	1.46 (05)	1.23 (04)	6.82 (351)	4.05 (415)
	Deoni	2.44 (40)	0.99 (11)	0.76 (05)	0.77 (05)	---	--	0.91 (03)	1.26 (64)	
Monsoon	Holdeo	1.38 (08)	9.04 (120)	11.83 (123)	7.78 (79)	4.05 (21)	2.04 (07)	1.85 (06)	7.07 (364)	4.50 (461)
	Deoni	2.32 (38)	2.34 (26)	1.52 (10)	0.46 (03)	1.85 (06)	2.69 (10)	1.21 (04)	1.91 (97)	
Winter	Holdeo	3.62 (21)	9.79 (130)	7.02 (73)	7.19 (73)	4.62 (24)	3.21 (11)	1.85 (06)	6.56 (338)	3.77 (387)
	Deoni	1.52 (25)	0.54 (06)	0.46 (03)	0.61 (04)	0.93 (03)	1.08 (04)	1.21 (04)	0.96 (49)	
Overall	Holdeo	8.97 (52)	28.69 (381)	26.92 (280)	23.23 (236)	12.52 (65)	6.71 (23)	4.94 (16)	20.45 (1053)	12.34 (1263)
	Deoni	6.28 (103)	3.87 (43)	2.74 (18)	1.84 (12)	2.78 (09)	3.76 (14)	3.32 (11)	4.13 (210)	

Table.4 Period wise mortality at different age groups in Holdeo crossbred and Deoni cattle

Period / Age	Breed	P_1 (76-80)	P_2 (81-85)	P_3 (86-90)	P_4 (91-95)	P_5 (96-00)	P_6 (01-06)	P_7 (06-10)	Total	overall
0-3 Months	Holdeo	6.90 (40)	20.26 (269)	18.85 (196)	14.67 (149)	5.97 (31)	4.37 (15)	1.54 (05)	13.69 (705)	7.68 (787)
	Deoni	2.68 (44)	0.27 (03)	1.37 (09)	0.46 (03)	1.85 (06)	2.96 (11)	1.81 (6)	1.61 (82)	
3-6 Months	Holdeo	0.69 (04)	1.73 (23)	3.27 (34)	3.94 (40)	1.73 (09)	0.29 (01)	0.93 (03)	2.21 (114)	1.23 (125)
	Deoni	0.37 (06)	0.09 (01)	0.46 (03)	0.15 (01)	---	---	---	0.22 (11)	
6-9 Months	Holdeo	0.34 (02)	2.64 (35)	2.31 (24)	1.48 (15)	1.35 (07)	0.29 (01)	0.62 (03)	1.67 (86)	0.96 (97)
	Deoni	0.49 (08)	0.09 (01)	---	0.15 (01)	0.31 (01)			0.22 (11)	
9-12 Months	Holdeo	0.17 (01)	1.13 (15)	0.87 (09)	0.89 (09)	0.77 (04)	---	0.31 (01)	0.76 (39)	0.39 (40)
	Deoni	---	---	---	0.15 (01)				0.02 (01)	
12-36 Months	Holdeo	---	0.83 (11)	0.29 (03)	0.30 (03)	0.77 (04)	---	0.93 (03)	0.47 (24)	0.33 (33)
	Deoni	---	0.09 (01)	---	0.46 (03)	0.62 (02)	0.27 (01)	0.60 (02)	0.18 (09)	
36 M onward	Holdeo	0.86 (05)	2.11 (28)	1.35 (14)	1.97 (20)	1.93 (10)	1.75 (06)	0.62 (02)	1.65 (85)	1.76 (181)
	Deoni	2.74 (45)	3.33 (37)	0.91 (06)	0.46 (03)	---	0.54 (02)	0.91 (03)	1.89 (96)	
Total	Holdeo	8.97 (52)	28.69 (381)	26.92 (280)	23.23 (236)	12.52 (65)	6.71 (23)	4.94 (16)	20.45 (1053)	12.34 (1263)
	Deoni	6.28 (103)	3.87 (43)	2.74 (18)	1.84 (12)	2.78 (09)	3.76 (14)	3.32 (11)	4.13 (210)	

Table.5 Chi- square analysis for mortality

Source	df	X^2 calc	X^2 tab	Results
Between breeds and Periods	12	14.88	21.03	NS
Between breeds and seasons	4	0.22	9.49	NS
Between breeds and age	10	4.12	18.31	NS
Between breeds and causes	20	1.14	31.41	NS
Between breeds and sex	2	0.20	5.99	NS

df, degrees of freedom; calc, calculated; tab, tabulated; NS, not significant

Table.6 Period wise mortality (%) in Holdeo crossbred and Deoni cattle due to disease

Period / Disease	Breed	P_1 (76-80)	P_2 (81-85)	P_3 (86-90)	P_4 (91-95)	P_5 (96-00)	P_6 (01-06)	P_7 (06-10)	Total	Disease Mortality
ADS	Holdeo	1.21 (07)	4.22 (56)	6.54 (68)	7.68 (78)	1.54 (08)	2.04 (07)	0.31 (01)	4.37 (225)	2.56 (262)
	Deoni	0.85 (14)	0.72 (08)	0.46 (03)	0.31 (02)	1.23 (04)	0.81 (03)	0.91 (03)	0.73 (37)	
DD	Holdeo	1.72 (10)	12.42 (165)	11.63 (121)	5.51 (56)	1.93 (10)	0.87 (03)	0.62 (02)	7.13 (367)	4.02 (410)
	Deoni	1.77 (29)	0.45 (05)	0.61 (04)	0.15 (01)	---	0.54 (02)	0.60 (02)	0.85 (43)	
RD	Holdeo	2.07 (12)	4.07 (54)	4.04 (42)	2.17 (22)	3.85 (20)	1.75 (06)	2.16 (07)	3.17 (163)	1.98 (202)
	Deoni	1.04 (17)	0.63 (07)	0.61 (04)	0.15 (01)	0.93 (03)	1.08 (04)	0.91 (03)	0.77 (39)	
PD	Holdeo	0.17 (01)	1.20 (16)	1.15 (12)	0.30 (03)	2.12 (11)	0.87 (03)	---	0.89 (46)	0.64 (66)
	Deoni	0.91 (15)	0.18 (02)	0.15 (01)	---	0.62 (02)	---	---	0.39 (20)	
GD	Holdeo	0.52 (03)	1.20 (16)	0.67 (07)	1.57 (16)	0.39 (02)	0.29 (01)	---	0.87 (45)	0.50 (51)
	Deoni	0.12 (02)	0.09 (01)	0.15 (01)	0.31 (02)	---	---	---	0.12 (06)	
CD	Holdeo	---	0.90 (12)	---	---	----	---	--	0.23 (12)	0.20 (20)
	Deoni	0.49 (08)	---	---	---	---	---	---	0.16 (08)	
POD	Holdeo	0.52 (03)	0.08 (01)	0.10 (01)	0.10 (01)	---	0.29 (01)	0.62 (02)	0.17 (09)	0.15 (15)
	Deoni	0.12 (02)	0.18 (02)	0.15 (01)	---	---	---	0.30 (01)	0.12 (06)	
UD	Holdeo	0.34 (02)	0.75 (10)	0.10 (01)	0.10 (01)	0.19 (01)	---	---	0.29 (15)	0.25 (25)
	Deoni	0.30 (05)	0.36 (04)	0.15 (01)	---	---	---	---	0.20 (10)	
NMD	Holdeo	1.03 (06)	0.23 (03)	---	---	0.19 (01)	---	0.62 (02)	0.23 (12)	0.19 (19)
	Deoni	0.18 (03)	0.09 (01)	---	---	---	0.54 ()02	0.30 (01)	0.14 (07)	
MSD	Holdeo	---	0.38 (05)	0.19 (02)	0.39 (04)	---	---	---	0.21 (11)	0.17 (17)
	Deoni	---	0.27 (03)	0.15 (01)	0.31 (02)	---	---	---	0.12 (06)	
MD	Holdeo	1.38 (08)	3.24 (43)	2.50 (26)	5.41 (55)	2.31 (12)	0.58 (02)	0.62 (02)	2.87 (148)	1.72 (176)
	Deoni	0.49 (08)	0.90 (10)	0.30 (02)	0.61 (04)		0.81 (03)	0.30 (01)	0.55 (28)	
Overall	Holdeo	8.97 (52)	28.69 (381)	26.92 (280)	23.23 (236)	12.52 (65)	6.71 (23)	4.94 (16)	20.45 (1053)	12.34 (1263)
	Deoni	6.28 (103)	3.87 (43)	2.74 (18)	1.84 (12)	2.78 (09)	3.76 (14)	3.32 (11)	4.13 (210)	

Table.7 Effect of sex on mortality (%) of Holdeo and Deoni cattle

Period / Sex	Breed	P_1 (76-80)	P_2 (81-85)	P_3 (86-90)	P_4 (91-95)	P_5 (96-00)	P_6 (01-06)	P_7 (06-10)	Total	Overall
Male	Holdeo	4.83 (28)	13.03 (173)	12.12 (126)	10.93 (111)	6.17 (32)	3.21 (11)	2.47 (08)	9.50 (489)	5.49
	Deoni	2.44 (40)	0.27 (08)	1.52 (10)	0.61 (04)	1.54 (05)	1.08 (04)	1.81 (06)	1.42 (72)	
Female	Holdeo	4.14 (24)	15.66 (208)	14.81 (154)	12.30 (125)	6.36 (33)	3.50 (12)	2.47 (08)	10.95 (564)	6.85
	Deoni	3.84 (63)	3.60 (40)	1.22 (08)	1.23 (08)	1.24 (04)	2.69 (10)	1.51 (05)	2.71 (138)	
Overall	Holdeo	8.97 (52)	28.69 (381)	26.92 (280)	23.23 (236)	12.52 (65)	6.71 (23)	4.94 (16)	20.45 (1053)	12.34
	Deoni	6.28 (103)	3.87 (43)	2.74 (18)	1.84 (12)	2.78 (09)	3.76 (14)	3.32 (11)	4.13 (210)	

Chi-square analysis revealed that there was no significant difference between breed and age mortality (Table V), which is in agreement with Aglave *et al.,* (2012b) for crossbred cattle, contrary to the results of Sharma *et al.,* (1975), Sharma and Jain (1982), Mishra and Taneja (1991), Santra and Pachlag (1996) for several different breed groups.

The period wise mortality due to causes in two breeds is shown in Table VI. Digestive diseases followed by Anemia / Debility/ Senility and respiratory diseases together accounted for over 70-80 % of the total mortality in the breeds. Digestive disorders (DD) accounted for 7.13 % of the deaths in Holdeo and 0.85 % in Deoni cattle. The contribution of DD to the overall mortality was 4.02 %. Similarly, Anemia / Debiliti/ Senility (ADS) accounted for 4.37 % of the deaths in Holdeo and 0.73 % in Deoni cattle. The contribution of ADS to the overall mortality was 2.56 % and RD accounted for 3.17 % of the deaths in Holdeo and 0.77 % in Deoni cattle. The contribution of RD to the overall mortality was 1.98 %. These results also indicate that mortality due to digestive diseases, Anemia / Debiliti/ Senility and respiratory diseases was highest in Holdeo than Deoni cattle. The overall mortality due to diseases was decreased as the period advances (P_2- P_7). The mortality due to other diseases is almost nil since P_5, P_6 and P_7 and the mortality observed during this period are only due to miscellaneous diseases (accidental deaths) and senility in both breeds. Similar results were observed by Damodaran and Sundararaj (1974), Behra and Sirohi (1979), Khera (1981a, b), Santra and Pachlag (1996), Roy *et al.,* (1997), Kulkarni and Bansod (2001) and Chaudhary *et al.,* (2013). On the other hand, Sharma and *et al.,* (1975), and Rao and Nagarcenkar (1980) reported that the respiratory disorders caused the highest mortality, followed by digestive disorders. In agreement to our results, Chavai (1996) reported that maximum mortality in crossbred cattle was due to anaemia, debility, weakness and senility followed by pneumonia. Dhangar and Patel (1990) and Roy *et al.,* (1997) observed that Enteritis and Pneumo-entritis were major cause for mortality in Kankrej half-bred and inter-se.

The overall mortality due to miscellaneous diseases (MD) was 1.72%, with the highest found in Holdeo (2.87 %) than Deoni (0.30 %). The remaining causes were of lesser significance since their contribution to the total death pool was small. Chi-square values for various causes of mortality did not show any significant difference between

different causes and breeds (Table IV) which is in agreement with the findings of Rao and Nagarcenkar (1980) in crossbred cattle.

The sex and breed mortality is shown in table VII. In crossbred Holdeo cattle, mortality is more (10.95 %) in females than (9.50 %) in males with overall mortality of 20.45 %, whereas similar trend is observed in indigenous Deoni cattle with 2.71 % mortality in females and 1.42 percent mortality in males with overall mortality of 4.13 %. The highest mortality was observed in P_2, P_3 and P_4 period which is declined as period progresses. The overall mortality in both the breed is observed as 5.49 % in male and 6.85 % in females.

This may be due to early culling / disposal of males from the herd. Similar results were reported by Chavai, *et al.,* (1999) and Singh *et al.,* (2005) Aglave *et al.,* (2012a) reported overall mortality of 21.79 % in Holdeo cattle and Female calves mortality was highest than male calves (Kinjavdekar *et al.,* 1994) and Somawanshi (1995). Sex did not show any distinct variation (Chavai *et al.,* 1999; Kumar *et al.,* 2002 and Aglave *et al.,* 2012a).

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Conflict of interest

The authors declare that they have no conflict of interest.

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