

Retrospective epidemiological analysis of mortality trends in neonatal and growing Murrah buffalo calves at an organized herd

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Calf mortality is considered to be an index of the general health management of any dairy farm. Calf mortalities reduce herd size thereby affecting sire evaluation, sire testing and herd expansion programmes, which may eventually reduce selection differential and protract the time taken for sire evaluation. The herd replacement becomes costlier and financial liabilities increase due to animal loss and through interference in milk production of dams of dead calves (Sastry and Varma 1988). Knowledge of trends of mortalities in the calves, therefore, assumes significance for designing improved managerial practices for containment of calf mortality within the acceptable limits. Several studies have been carried out in the past (Verma and Kalra 1974, Bhullar and Tiwana 1985, Khan and Khan 1996 and Ramakrishna 2007) reporting considerable variability in mortality estimates for buffalo calves of varying age groups. The present study provides comprehensive epidemiological analysis of calf mortality in an organized buffalo herd over a span of 14 years.

Buffaloes at the Central Institute for Research on Buffaloes, Hisar, are reared under semi-intensive managerial conditions and calves are not weaned and regularly dewormed. Necropsy analysis of 467 Murrah buffalo calves was conducted for the period 1993–94 to 2006–07. Different epidemiological parameters used to assess mortality trends in buffalo calves like neonatal calf mortality rate (NCMR), sex-specific mortality rate, season-specific mortality rate, proportional mortality rate and the overall mortality rate were calculated as per Thrusfield (2005).

Owing to their immune status, buffalo neonates are more susceptible to infectious diseases as compared to cow neonates (Khan and Khan 1991). A high neonatal mortality is generally encountered in buffalo calves, particularly during the first 3 months of their postnatal life. The immunoglobulins

(Ig_s) are transmitted from mother to the offspring solely through colostrum and latter besides being a source of Ig_s serves as an excellent source of energy, some vitamins and essential minerals (Khan and Khan 1996). One of the major reasons for high mortality of buffalo calves is low trans-placental transfer of maternal immunoglobulins and poor absorption of the same from gastrointestinal tract (Logan *et al.* 1974). This does not seem to be the case in the study as calves were not weaned and allowed to remain throughout lactation along with their dams, thereby precluding any chances of non-availability of maternal antibodies to them. The other associated factors might have been their genetic susceptibility to diseases or other factors that need detailed investigations.

Influence of age on calf mortality: An overview of analysis revealed that while the fetal death rate ranged from nil to 11.94% with an overall average of 3.74%, the maximum mortalities with an average of 7.03% were observed in neonatal calves comprising the age group of 0–1 months followed by those in 1–3 m (4.04%), 3–6 m (3.96%) and 6–12 m (3.10%) suggesting a corresponding decrease in mortality with the increase in age group of calves (Table 1). With the advancement of age there is a potential increase in the immunity of calves as a result of which they get better equipped to defend themselves against a wide variety of infections. There is not a universal agreement on the age at which animals cease to be neonates in veterinary medicine (Thrusfield 2005). The NCMR ranged from 2.27% (1995–96) to 15.00% (2006–07). This data is in agreement with the findings of Verma and Kalra (1974) on buffalo calf mortality during 1966–70 at this institute, erstwhile known as Progeny Testing Farm. They concluded that average figures for NCMR varied from 6.3% to 13.6%. Of 467 mortalities observed up to 1 year of age, 39.79% occurred before 1 month of age, 22.29% and 22.02% occurred up to 1–3 month and 3–6 months of age, respectively and the least mortality (15.48%) was encountered in the 6 month-1 year age group (Table 1).

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Highest mortality rates observed in the first month of birth corroborate the findings of Ramakrishna (2007). Sreedhar *et al.* (2010) reported the highest mortality of 19.5% in buffalo calves below 1 month of age. The overall calf mortality from birth to 12 months of age in this study was 18.15%, which is in contrast with the findings of Sreedhar *et al.* (2010) Ramakrishna (2007) and Balakrishnan *et al.* (1996) whose figures were 22.0%, 32.4%, and 40.94%, respectively, for this age group.

Influence of sex on calf mortality: Biologically speaking, either sex has equal probability of acquiring diseases or undergoing eventual mortality, however, a perusal of data in Table 1 revealed that 67.86% of the deaths up to 1 year of age in 2001–02 were recorded in females, while males comprised 32.14% of the deaths. Conversely, in the subsequent year 2002–03, males recorded a much higher mortality (64.86%) vis-à-vis females (35.14%). Higher mortality pattern in males has previously been reported by Verma and Kalra (1974) and Ramakrishna (2007), while higher mortality pattern for females has been documented by Sharma *et al.* (1984). Recently, Sreedhar *et al.* (2010) reported higher mortality in male calves vis-à-vis female calves. Reasons for sexual differences in mortalities observed are not known. Neglecting tendencies by the management with a bias in favour of females has predominantly been argued for higher rate of mortality in males. Though the differences were apparent in the mortality percentages of males and females over different years, yet no significant difference was observed in the overall average sex-specific calf mortality, being 50.95 and 49.04% for males and females, respectively (Table 1).

Influence of season on calf mortality: The seasonal pattern of deaths is presented in Table 2. Maximum overall average mortalities constituting 40.00% of the total deaths were

recorded during winter (December–February). These findings are in direct agreement with those of Ramakrishna (2007). Sudden climatic changes and rigours of cold inclement weather result in stress and immuno-compromised calves may become predisposed to certain infections leading to mortality. Though the highest percentage of calvings (46.52%) over the period of 14 years was observed during autumn season vis-à-vis winter (23.97%), yet mortality percent during autumn (25.59%) was lower than during winter. Nevertheless, wet shed-floor conditions during autumn are very conducive to spread of infections and resultant stress may help in precipitation of infections. Moreover, buffaloes are in their early stage of lactation during this period and produce more milk. Overconsumption of milk by calves coupled with infection may lead to digestive disturbances eventually causing diarrhoea. The least mortalities (14.36%) were encountered during rainy season.

Influence of diseases on calf mortality: In the present study, pneumonia, enteritis and pneumoenteritis together accounted for about 80% of the total mortalities among calves < 1 year of age. Disease-wise temporal distribution of proportional calf mortality for the study period is presented in Table 2. As regards the proportional distribution, pneumoenteritis was responsible for 29.17% of the mortalities, followed by pneumonia or enteritis, which contributed 27.15 and 24.75%, respectively. The types of enteritis could be categorized into acute gastroenteritis, diphtheritic enteritis, catarrhal enteritis and haemorrhagic enteritis. Mucoid enteritis with abomasitis was also a common finding. Unilateral or bilateral pneumonic lungs with suppurative, pleuropneumonia or bronchopneumonia were the major findings in pneumonic deaths. Miscellaneous causes of mortalities including septicemia, toxemia, heat stroke, hemorrhages of internal organs, colibacillosis,

Table 1. Age-dependent and sex-specific calf mortality rates and still birth rate at the institute animal farm

Year	Calf mortality rates (%)				Sex-specific calf mortality rate (%)		Fetal death rate/Still birth rate (%)
	NCMR 0–1 m	1–3 m	3–6 m	6–12 m	M	F	
1993–94	13.30	2.29	3.21	1.37	53.70	46.30	0.45
1994–95	6.47	5.29	7.05	4.11	41.02	58.98	1.16
1995–96	2.27	5.11	6.81	6.81	62.16	37.84	2.76
1996–97	7.94	1.98	3.97	6.62	61.29	38.71	7.92
1997–98	5.38	2.39	4.79	3.59	51.85	48.15	0.00
1998–99	6.41	6.95	2.13	2.13	60.60	39.40	4.10
1999–20	6.04	2.19	1.09	1.09	47.36	52.64	3.70
2000–01	7.03	2.51	3.51	0.50	40.74	59.26	5.23
2001–02	4.73	2.10	3.68	4.21	32.14	67.86	0.00
2002–03	9.13	3.04	4.56	2.03	64.86	35.14	2.47
2003–04	2.71	4.97	4.97	2.71	41.17	58.83	3.07
2004–05	7.89	5.78	3.68	2.63	57.89	42.11	2.06
2005–06	5.40	5.94	4.32	1.08	54.83	45.17	7.5
2006–07	15.00	6.42	1.42	0.00	43.75	56.25	11.94
Overall averages	7.03	4.04	3.96	3.10	50.95	49.04	3.74

Table 2. Proportional and season-specific mortality rates in calves up to 1 year of age

Year	Proportional mortality rate (%)				Season-specific death rate (%)			
	P*	E	PE	M	Mar-May (Spring/Summer)	June-Aug (Rainy)	Sep-Nov (Autumn)	Dec-Feb (Winter)
1993–94	13.43	35.82	19.40	29.85 (1)	9.25	16.66	31.48	42.59
1994–95	14.58	33.33	22.91	27.08 (1)	41.02	7.69	23.07	28.20
1995–96	30.23	25.58	30.23	13.95	21.62	8.10	24.32	45.94
1996–97	22.22	20.00	35.55	17.77 (2)	35.48	16.12	22.58	25.80
1997–98	24.24	18.18	36.36	21.21	18.51	11.11	18.51	51.85
1998–99	25.00	37.50	25.00	12.50	9.09	15.15	33.33	42.42
1999–00	34.61	26.92	26.92	11.53	21.05	21.05	31.57	26.31
2000–01	39.39	21.21	33.33	3.03 (1)	14.81	14.81	33.33	37.03
2001–02	22.85	22.85	34.28	20.00	25.00	28.57	25.00	21.42
2002–03	25.00	28.57	28.57	16.07 (1)	13.51	21.62	21.62	43.24
2003–04	33.33	15.78	22.80	22.80 (3)	14.70	8.82	23.52	52.94
2004–05	20.00	18.46	35.38	26.15	18.42	2.63	15.78	63.15
2005–06	43.47	17.39	30.43	8.69	12.90	19.35	35.48	32.25
2006–07	31.81	25.00	27.27	15.90	25.00	9.37	18.75	46.87
Overall average	27.15	24.75	29.17	17.60	20.02	14.36	25.59	40.00

*P, Pneumonia; E, enteritis; PE, pneumoenteritis; M, miscellaneous causes; figures in parentheses show autolyzed cases.

intestinal torsion, urea poisoning, dog bite, snake bite, intestinal rupture, nephrosis of kidneys, circulatory failure, hepatitis, lung abscess, hydropericardium, pericarditis, gastritis, liver rupture, peritonitis, hemorrhagic shock, ruptured lungs and pleurisy contributed to 17.60% of all deaths (Table 2). These findings are in contrast with those of Sreedhar *et al.* (2010), Ramakrishna (2007) and Khan and Khan (1991) who reported enteritis as the predominant cause of mortality among buffalo calves over and above pneumoenteritis and pneumonia.

A regular surveillance and monitoring of infectious diseases associated with fatality in buffalo calves will generate baseline information for prioritization of diseases to be carried out for their specific control. Based on the present survey, studies are in progress to determine specific serotypes of *E. coli* and *Salmonella* spp. presently in circulation among buffalo calves for their eventual control.

SUMMARY

Retrospective epidemiological analysis based on necropsy examination of 467 buffalo calves (up to 1 year of age) from 1993–94 to 2006–07 was carried out to assess principal infectious causes of mortality in young calves. Neonatal mortality rate, sex-specific mortality rate and overall calf mortality rate due to various diseases or their syndromes were determined. Maximum mortalities (*i.e.* 7.03%) were observed in neonatal calves (< 1 month of age). Seasonal pattern revealed maximum mortalities during winters (40.00%), followed by that in the autumn (25.59%), summers (20.02%) and rainy (14.36%) seasons. The disease-specific mortality

trends revealed that pneumoenteritis (29.17%), pneumonia (27.15%) and enteritis (24.75%), were the principal infectious causes, which together constituted about 80% of mortalities in buffalo calves.

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