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Quantifying morbidity and mortality losses in bovine due to *Haemorrhagic septicaemia* (hs) in Haryana

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Abstract
The present study was carried out to analyse morbidity and mortality rate in bovines in the Haryana state. The data of total 936 cattle were collected from 240 cattle owners by stratified two-stage random sampling design and analysed statistically by SPSS V. 20. Overall morbidity and mortality rates in bovines due to HS were 2.78 percent and 2.56 percent, respectively whereas case fatality rate was 92.30 percent. It was found that indigenous animals, crossbred animals and buffaloes have the morbidity rates higher in milch animals than the other age categories like calves; heifer *etc.* Study also portrays that mortality rate was highest for crossbred cattle followed by indigenous cattle and buffaloes. Morbidity and mortality studies provide an important tool for determining the health status and guidelines for managemental practices, which will ultimately help in increasing the milk production and improve the economic status of livestock owners.

Keywords: Bovine, morbidity, mortality

Introduction
Livestock population in India is threatened by disease outbreak, drought, floods and other climatic anomalies. Among these, several disease affecting livestock are at the epitome causing serious effect on the production of animals, human health, trade of livestock and animal products affecting overall economic development of the livestock sector. One of the major obstacles in achieving the targeted growth rates in the sector is the prevalence and outbreaks of diseases, particularly diseases like Foot and Mouth diseases (FMD), *Haemorrhagic Septicaemia* (HS), Mastitis, and Brucellosis in ruminants, particularly in the cattle. These diseases have numerous impacts including productivity loss, loss of income from activities using animal resources, prevention or control costs and suboptimal use of production potential [3] with an estimated economic losses in India due to HS is Rs. 5255 crore, for FMD recorded Rs 12000 to 14000 crore and Rs. 8895.12 crore for *Peste des petits ruminants* [6].
Haemorrhagic Septicaemia (HS) has emerged as a disease of great economic importance with proven endemicity in India causing significant contagious infection in cattle and buffaloes in India [7]. It is an acute, fatal and septicemic disease of cattle, buffaloes and wild animals caused by *Pasteurella multocida* [5]. Being normal inhabitants of upper respiratory tract of bovines, can assume pathogenic role whenever resistance of the host is lowered (beginning of monsoon season) precipitating clinical disease. Dreadfulness of the disease can be featured by the fact that the organism is the normal inhabitant of the animal body with the role reversal capability, prolong survival outside the animal in wet season, responsible for approximately 60 percent bovine mortality in India, difficult to predict the exact time of outbreak of the disease and number of prevalent serotypes in the sub-continent. Moreover, this OIE-World Organisation for Animal Health listed B disease regarded as the second most reported disease in India during the last two decades causing maximum number of livestock deaths India [4].
Following above said affections of the disease, it is imperative to have robust surveillance for HS in the Indian subcontinent to understand disease pattern and for providing better control measures for the disease to reduce losses to livestock owners. However, irregularity of reporting by certain state agencies or absence of reported outbreaks lead to an underestimate of disease. In the above context, a comprehensive assessment of incidence, morbidity and mortality losses among bovine due to *Haemorrhagic Septicaemia* (HS) in Haryana is of utmost importance before formulating the various livestock health intervention efforts. However, scant literature is available on implications of HS based on data from the field level in the

Haryana state. Considering above, present study was undertaken to quantify incidence, morbidity and mortality status and economic impact of HS among bovines in Haryana.

Materials and Method

The present study has been conducted in Haryana extending from 76° 74' E Longitude to 30° 44' N Latitude holding total area of 42,212 sq. kms distributed among 22 districts. State boasts 8819.52 thousand livestock and 42821.35 thousand poultry population. Of the total livestock population, cattle constitutes 1808.12 thousand and 6085.31 thousand buffaloes [1]. Two districts *viz.*, Hisar and Rohtak were selected purposively based on the highest population of cattle and buffalo and randomly among 22 districts, respectively. Thereafter, stratified multistage random sampling was used to select two blocks from each of the selected district, randomly. From each selected block, three villages were selected, randomly. Thus, the sample for the study comprised of 2 districts, 4 blocks and 12 villages. Then, simple random sampling without replacement was followed to select 20 livestock owners/households. Thus, 240 livestock owners/households constituted the ultimate sampling units for the study.

Data were collected from a primary field survey of the selected households by personally interviewing the household heads with the help of a comprehensive and pre-tested questionnaire specifically designed for the study. Data pertaining to incidence of HS was collected on the basis of farmers' recall for the reference period (January, 2016 to December, 2016). The interviewer, being a veterinarian and with the help of standard symptoms checklist validated by experts, HS affected animals was identified by the standard symptoms as elicited by the livestock owner. Identification of disease was then further corroborated with the local veterinarian who was already in the knowledge in regard to outbreak areas of the diseases and livestock owners whose animals have been affected by such outbreaks. Data on epidemiological rates due to HS *viz.* morbidity, mortality and case fatality rates was collected and determined using standard statistical indices as follows.

$$\text{Morbidity Rate (\%)} = \frac{\text{No. of cases observed during study period}}{\text{Total number of Population}} \times 100$$

$$\text{Mortality Rate (\%)} = \frac{\text{No. of deaths observed during study period}}{\text{Total number of Population}} \times 100$$

$$\text{Case Fatality Rate (\%)} = \frac{\text{No. of animals died during study period}}{\text{No. of cases of diseases during study period}} \times 100$$

In addition, proportional morbidity and mortality were ascertained by computing the shares of total cases and deaths accounted for different breeds/species of bovines. Similarly, within each breed/species, the distribution of cases and deaths and their proportion across different age categories, sex, lactation order, lactation stage and month were assessed and necessary inferences drawn regarding the epidemiology of the diseases.

Results and Discussion

A total of 240 cattle owners were interviewed and information regarding the morbidity, mortality and case fatality rate was recorded. A total of 936 bovines of different species and age group were maintained by 240 livestock owners selected for the study. Among 936 bovines there were 147 (15.71%) indigenous cattle, 69 (7.37%) cross-bred cattle and 720 (76.93%) buffaloes. Among total bovines there were 168 (17.95%) males and 768 (82.05%) female. Also, there were 263 (28.10) calves, 179 (19.13) young stocks and 494 (52.77) adults of both male and female bovines (Table 1).

Table 1: Distribution of cattle population maintained by livestock owners

Variables	Class	IC	CB	B	Overall Bovines
Male	Calf	10	7	69	86 (9.19)
	Young Stocks	5	0	31	36 (3.85)
	Adults	38	0	8	46 (4.91)
	Male Total	53	7	108	168 (17.95)
Female	Calf	18	22	137	177 (18.91)
	Young Stocks	22	5	116	143 (15.28)
	Adults	54	35	359	448 (47.86)
	Female Total	94	62	612	768 (82.05)
Total		147 (15.71)	69 (7.37)	720 (76.92)	936 (100)

Figures in parenthesis indicate percentage; IC: Indigenous Cattle, CB: Cross-Bred, B: Buffaloes

Morbidity rate analysis Overall morbidity rate related to HS in bovines (Table 2) reveals that out of 936 animals a total 26 animals were affected due to diseases condition, this made annual prevalence rate 2.78 percent in bovines. However, slight variation was found between species, where morbidity rate was highest in case of cross-bred cattle (7.25%) followed by indigenous cattle (3.40%) and buffalo (2.22%) (Table 2) which is similar to the earlier findings of Singh *et al.* [6] who also reported higher morbidity in crossbred cattle (5.30%) followed by buffaloes (4.50%) and indigenous cattle (4%) in India. However, in this study the morbidity was less (2.78%) clearly indicates proper vaccination done in Haryana. Further, Table 3 elicits the morbidity rates for different categories of various breeds/species. The morbidity rate among indigenous animals was highest (1.36%) in milch animals followed by 0.68 percent in dry and pregnant and more than one year and less than one year calves. Among cross-bred animals, the morbidity rates was 4.34 percent in-milk non pregnant animals, 1.45 percent in dry and not pregnant animals, 1.45 percent in female calves of age more than one year. Among buffaloes, the morbidity rates were 0.83 percent in-milk non pregnant animals, 0.28 percent in milk and pregnant, 0.41 percent in dry and pregnant animals, 0.14 percent in pregnant heifer and 0.56 percent in female calves of more than one year. Thus it can be concluded that indigenous animals, crossbred animals and buffaloes have the morbidity rates higher in milch animals

Table 2: Morbidity, Mortality and Case Fatality rates across breeds/species

Breeds/Species	Number of diseased	Morbidity	Number of died	Mortality	CFR
Indigenous Cows*	5	3.40	5	3.40	100
Cross Bred Cows*	5	7.25	5	7.25	100
Buffaloes*	16	2.22	14	1.94	87.5
Total**	26	2.78	24	2.56	92.30
Available	936		936		

* Epidemiological rates based on population of species/breeds, ** Epidemiological rates based on total bovine population

Mortality rate analysis

The overall crude mortality rate among bovines (Table 2) in survey area was found 2.56 percent *i.e.* 24 animals out of 936 cattle died due to the diseases selected under the study. Table 2 also portrays that mortality rate was highest for crossbred cattle followed by indigenous cattle and buffaloes (7.2%, 3.40% and 1.94% respectively). The above findings reveals that not only the cross-bred cattle and indigenous cattle are more prone to contracting the disease, but buffalo more likely to succumb to the disease once the disease has been contacted. Among, different age categories of breeds/species (Table 3), mortality rates of indigenous animals was highest (1.36%) in milk and not pregnant while 0.68 percent in dry and pregnant calves less than one year. Among crossbred animals, the mortality rates were 4.35 percent in-milk non pregnant animals, 1.45 percent dry and non pregnant animals, 1.45 percent in female calves of age > 1 year. Among buffaloes, the mortality rates were 0.83 percent in-milk non pregnant animals, 0.28 percent in milk and pregnant as well as dry and pregnant and 0.56 percent in calves of more than one year. Similar trend was also seen in mortality rates among different age categories of breed/species of bovines.

Table 3: Morbidity and mortality rates of different categories for various breeds/species

S. No.	Category of animal	Morbidity			Mortality		
		IC	CB	B	IC	CB	B
1.	In milk and not pregnant	1.36	4.35	0.83	1.36	4.35	0.83
2.	In milk and pregnant	0	0	0.28	0	0	0.28
3.	Dry and pregnant	0.68	0	0.41	0.68	0	0.28
4.	Dry and not pregnant	0	1.45	0	0	1.45	0
5.	Dry and unfit for breeding	0	0	0	0	0	0
6.	Not calved even once	0	0	0	0	0	0
7.	Pregnant heifer	0	0	0.14	0	0	0
8.	Calves < 1 year	0	0	0	0	0	0
9.	1 male	0	0	0	0	0	0
10.	2 female	0.68	0	0	0.68	0	0
11.	Calves > 1 year	0	0	0	0	0	0
12.	1 male	0	0	0	0	0	0
13.	2 female	0.68	1.45	0.56	0.68	1.45	0.56
14.	Adult Male	0	0	0	0	0	0
Total		3.40	7.25	2.22	3.40	7.25	1.94

IC: Indigenous Cattle, CB: Cross-Bred, B: Buffaloes

Month-wise morbidity and mortality pattern

Distribution of cases across months (Table-4) revealed that morbidity was seen in the month of August and September in buffaloes (0.14%) whereas in cattle breeds it was not reported throughout the year. It is interesting to note that mortality was seen among cattle which represent per-acute nature of disease and found maximum (0.32%) during June while 0.21 percent in January for indigenous cattle. In case of cross-bred it was 0.11 percent in February and 0.21 percent for both June and July month. For buffaloes, mortality was high in the July (0.85%) followed by May (0.43%) and June (0.21%). It can be inferred that most of the deaths due to HS was in the month of June and July which is well justified by the fact that the disease is prevalent and endemic in Asia during wet season [2].

Table 4: Month-wise morbidity and mortality

Month	Morbidity			Mortality		
	Indigenous	Crossbred	Buffaloes	Indigenous	Crossbred	Buffaloes
January	0	0	0	2 (0.21)	0	0
February	0	0	0	0	1(0.11)	0
May	0	0	0	0	0	4(0.43)
June	0	0	0	3(0.32)	2(0.21)	2(0.21)
July	0	0	0	0	2(0.21)	8(0.85)
August	0	0	1 (0.14)	0	0	0
September	0	0	1(0.14)	0	0	0
October	0	0	0	0	0	0
Total	0	0	2 (0.28)	5 (0.53)	5 (0.53)	14 (1.49)

Proportional Morbidity and Mortality

Table 5 represent overall proportional morbidity and mortality across breeds/species and found that it was highest for buffaloes (61.54% and 58.33%), whereas homologous for indigenous and crossbred animals which was 19.23 percent and 20.83 percent, respectively.

Table 5: Proportional morbidity and mortality across breeds/species

Breeds/Species	Morbidity	Mortality
Indigenous Cows	19.23	20.83
Cross Bred Cows	19.23	20.83
Buffaloes	61.54	58.33

Study also assessed distribution of cases for each breed/species across different age categories. Milk and not pregnant animals accounted for the maximum number of cases in crossbred (60%), whereas milk and not pregnant animals in case of buffalo and indigenous cattle, accounted for 37.50 percent and 40 percent, respectively of total number of cases. Heifers (more than 1 year) comprised of the second highest share of total number of cases *i.e.* 20 percent, 20 percent and 25 percent for indigenous cattle, cross-bred cattle and buffaloes, respectively, whereas indigenous and crossbred heifers constituted almost equal proportions (20%) of cases in the sample.

Table 6: Proportional morbidity across different category of animals for each breed/species

Category of animal	Proportional Morbidity Rate			Proportional Mortality Rate		
	IC	CB	B	IC	CB	B
1. In milk and not pregnant	40	60	37.50	40	60	42.86
2. In milk and pregnant	0	0	12.50	0	0	14.29
3. Dry and pregnant	20	0	18.75	20	0	14.29
4. Dry and not pregnant	0	20	0	0	20	0
5. Dry and unfit for breeding	0	0	0	0	0	0
6. Not calved even once	0	0	0	0	0	0
7. Pregnant heifer	0	0	6.25	0	0	0
8. Calves < 1 year	0	0	0	0	0	0
8.1 male	0	0	0	0	0	0
8.2 female	20	0	0	20	0	0
9. Calves > 1 year	0	0	0	0	0	0
9.1 male	0	0	0	0	0	0
9.2 female	20	20	25	20	20	28.57
10. Adult Male	0	0	0	0	0	0
Total	100	100	100	100	100	100

IC: Indigenous Cattle, CB: Cross-Bred, B: Buffaloes

Table 6 also revealed that in milk and not pregnant female accounted for the maximum share of deaths in crossbred cattle (60%), whereas under indigenous animals 40 percent mortality was in milk and not pregnant while 20 percent cases was reported in dry and pregnant animal, female calves of less than one year and female calves female more than one year equally. Among crossbred animals mortality was 60 percent in milk and not pregnant and 20 percent was in the both dry and not pregnant and heifers. Further, distribution of cases across sexes (Table 7) revealed that cent-percent proportion of cases were accounted by females of indigenous cattle, crossbred cattle and buffaloes.

Table 7: Proportional morbidity and mortality across sexes in different breeds/species

Breeds/Species	Proportional morbidity				Proportional mortality			
	Male	Female	Male	Female	Male	Female	Male	Female
Indigenous Cows	0	5	0	100	0	5	0	100
CB Cows	0	5	0	100	0	5	0	100
Buffaloes	0	16	0	100	0	14	0	100
Total	0	26	0	100	0	24	0	100

Conclusion

Cross-bred cattle showed high morbidity and mortality as compared to indigenous cattle and buffaloes as they are more prone to stress conditions and develop the diseases easily. Study also showed that mortality and morbidity rates were very high in milk and non pregnant animals of all the species/breeds with the maximum incidence of morbidity seen among buffaloes in august and September whereas in June and July maximum mortality was reported in buffaloes suggesting that management care are needed in pre-monsoon season. This study will provide the important tool for determining the epidemiological status of HS among bovines in the state and provide the guidelines for proper use of management practices which will ultimately help in increasing production and improvement of economic status of livestock owners.

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