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Estimation of Economic losses due to Haemorrhagic septicaemia in Haryana

Rishi Pal, Sanjay Kumar, Dwaipayan Bardhan, Anandasekaran.G, Med Ram Verma*, Gulab Singh, Chilambarasan M. and Rishi Kumar Singh
Division of Livestock Economics, Statistics and Information Technology
ICAR- Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh
*Corresponding Author: medramverma@rediffmail.com

ABSTRACT
The present study was conducted to estimate economic loss due to Haemorrhagic septicaemia in Haryana. For the present study data were collected from Rohtak and Hisar districts of Haryana state by using well structured schedules by using multi stage sampling. The total economic loss was computed with the help of models designed specifically for this study and worked out as a sum of mortality loss, direct milk loss, milk loss due to increased abortion, value of calves lost due to increased abortion, loss in animal draught power, treatment cost and additional labour cost. The total annual economic loss due to HS in Haryana was INR 648.12 crores. Among that mortality loss accounted for 91.40 per cent and treatment cost for 5.54 per cent. Breed wise share of economic loss was calculated to INR 23.90 crores, INR 163.93 crores and INR 460.29 crores respectively for indigenous (3.69%), crossbred animals (25.29%) and buffaloes (71.02%). Direct losses contributed maximum of 92.7 per cent and indirect losses contributed 7.3 per cent to the total economic loss due to HS in Haryana.
Key words: *Buffalo, Cattle, Economic losses, Haemorrhagic septicaemia*

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INTRODUCTION

India's livestock sector is one of the largest in the world. It has 56.7%, 12.5%, 20.4%, 2.4%, 1.4%, 1.5% and 3.1% of world's buffalo, cattle, small ruminant, camel, equine, pig and poultry population, respectively. Gross value added from livestock sector at current prices in 2013-14 was Rs. 4060 billion [1]. Livestock sector contributes 3.9% of total Gross Domestic Product (GDP) and 26.1% of agricultural GDP (AgGDP).Demand for animal food products is responsive to income changes, and as a result of rising per capita income and increasing urbanization, it is expected to increase in future. Between 1991-92 and 2008-09, India's per capita income grew at an annual rate of 4.8% and urban population at a rate of 2.5% [4].These trends are likely to continue. By the end of 12th Plan, demand for milk is expected to increase to 141 million tons and for meat, eggs and fish together to15.8 million tons. Poor livestock health, as a technological constraint, remains one of the principal factors limiting livestock development. Livestock diseases cause major economic loss through mortality, reduced productivity, lower fertility, condemned products and restricted access to potential markets. Diseases in animals act as a negative influence on the livestock production system, thus setting off a cascading affect of low production, low income, and subsistent livelihood. The consequences of animal diseases in livestock can be complex and generally go well beyond the immediate effects on affected producers. In the last two decades, world has seen epidemics of diseases like Avian Influenza, Swine Influenza, FMD, RP, PPR, CBPP as well as RVF which have greatly affected the livelihood of livestock

producers as well as other stakeholders in the livestock supply chain.Haemorrhagic septicaemia is an acute, highly fatal, septicaemic disease of cattle and buffalo caused by *Pasteurella multocida,*this is one of the most important bacterial disease responsible for approximately 60 per cent of bovine mortality in India and prevalent throughout the country. Around 97 per cent of the HS outbreak reports are in large ruminants (Cattle and buffaloes). In India, in most HS endemic districts, outbreaks do occur throughout the year but epidemics occur during wet seasons. HS has emerged as a disease of great economic importance in India and it features as the second most reported disease in India during the last two decades [2]. In spite of the economic significance of the disease, scant literature is available in Indian context documenting the economic losses caused due to Haemorrhagic septicaemia. The present study aims to address this research gap by estimating the annual economic loss due to HS in Haryana. It is expected that the findings of the study will aid in optimization of resource allocation decisions for animal disease control in Haryana. In estimation of economic losses due to Haemorrhagic septicaemia, values of different parameters associated with disease and its effect on production and reproduction traits could be obtained from sample surveys.

DATA AND METHODOLOGY

The study was carried out in the state of Haryana which is having livestock population of 7,505,589. Multistage sampling technique was adopted for the selection of districts, blocks, villages and households. In first stage two districts Rohtak and Hisar, were selected from Haryana state on the basis of one district with highest livestock population and another district randomly as per the 19th Livestock Census [3]. In the next stage, 2 blocks were selected from each district randomly. Three villages were selected from each block and from each village 20 farmers were selected, randomly. Thus a total of 240 livestock rearing households were covered in the survey from a total of 12 villages in 4 administrative blocks from 2 districts of the state. Primary data were collected through a household survey by personally interviewing the head of selected households with the help of pre-tested questionnaire specifically designed for this study. Data pertaining to the incidence of disease and the economic loss incurred due to the disease were collected from the farmers for period of 1st January 2016 to 31st December 2016.

Analytical framework:

The total economic loss due to HS in bovines was worked out as sum of mortality loss (A), direct loss in milk yield (B), losses due to reproductive failure (C), loss in animal draught power (D), cost of treatment of affected animals (E) and additional labour costs (F). The models used to estimate the different components of economic losses for cattle and buffalo are given as under:

A. Mortality Loss:

This was worked out as the product of number of died animals (separately for calves, young and adult animals) due to HS and their respective market values. Mortality losses were divided as per losses in males (A_M)and females (A_F) . For both males and females, the mortality losses were obtained across different age groups (young and adult animals for males and calves, young and adult breedable animals for females).

$A = A_F$ (Mortality loss in females) + A_M (Mortality loss in males)

$A_F = P_{F1} \times D_1 \times V_1 + P_{F2} \times D_2 \times V_2 + P_{F3} \times D_3 \times V_3$

P_{F1} = Female Calves Population

P_{F2} = Young Female Population

P_{F3} = Breedable Adult Female Population

D_1 = Proportion of female calves died.

D_2 = Proportion of young females died.

D_3= Proportion of adult breedable females died

V_1 = Average market value of a female calf

V_2 = Average market value of a young female animal

V_3 = Average market value of an adult breedable female animal.

$A_M = P_{M1} \times D_4 \times V_4 + P_M2 \times D_5 \times V_5$

P_{M1} = Young Male Population

P_{M2} = Adult Male Population

D_4 = Proportion of young males died.

D_5 = Proportion of adult males died.
V_4 = Average market value of a young male
V_5 = Average market value of an adult male

B.Direct Milk Loss (B)

For the proportion of animals in milk in a year, the losses were expressed in terms of reduction in milk yield, which through the price of milk could be directly converted into monetary terms. The loss due to direct decline in milk production was calculated using the formula:

$B = P_{F3} \times P_L \times C_1 \times D \times ML \times P$

P_L = Proportion of adult breedable female animals in-lactation (%)
C_1 = Proportion of in-milk animals infected (%)
D = Average duration of the disease (days)
ML = Milk loss per day per animal (Litre)
P = Price of milk (INR)

C.Losses due increased abortions

C = C1 + C2

C1: Milk Loss due to increased abortion

The disease can cause abortions, particularly in the late pregnancies and leads to increased inter calving period, besides loss of calves. Given the time of abortion (LS months) from conception, and a delay in next oestrus (DE months), the inter calving period gets increased by (LS + DE months) in aborting cases, and the milk loss due to increased abortions was estimated from following equation:

$$C1 = \left[\frac{12}{ICP} - \frac{12}{ICP + LS + DE}\right] P_{F3} \times P_L \times C_1 \times A \times L \times M_Y \times P$$

A = Increased abortion rate (%)
L = Average Lactation length (days)
M_Y = Average per day milk yield (litre)
ICP = Inter-calving period (months)
LS = Stage at which abortion occurred (months)
DE = Delay in next oestrus (months)

C2 : Value of calves lost due to increased abortion

Reduction in the number of calves due to more abortions in animals after infection with a disease caused loss, which was estimated by the formulae

$$C1 = \left[\frac{12}{ICP} - \frac{12}{ICP + LS + DE}\right] P_{F3} \times P_L \times C_1 \times A \times VC$$

VC= Average value of new born calves (INR)

D. Loss in animal draught power

In work animals, HS causes significant loss to the farmers by making them unavailable for ploughing, traction and other draught animal led crop farm works. This loss is worked out using the formulae:

$D = P_{M2} \times C_2 \times D_W \times H_W$

C_2 = Proportion of adult males (> 1.5 y INR) affected (%)
D_W = Average duration of disease in adult males (days)
H_W = Average hiring charges per day (INR)

E. Treatment Cost

$E = P_A \times P_T \times T_C$

P_T = Total Population
P_A = Proportion of animals infected (%)
T_C = Average Treatment cost of an infected animal

F. Additional Labour Cost

This was computed by multiplying the number of diseased animals with the product of duration of disease, per day per animal extra labour hours given in taking care of the animals and the wage rate prevailing in the region.

$F = P_A \times P_T \times L_H \times W_R \times D_A$

L_H = Total no. of labour hours devoted by family members per day per animal
W_R = Wage rate prevailing in the region (INR) / 8
D_A = Duration of the disease in affected animal (days)

RESULTS AND DISCUSSION

The total annual economic loss due to HS in bovines in Haryana was estimated at INR 648.12 crores, which is higher than the previous finding of economic loss due to HS by Singh *et al* [5] who have reported a total loss of INR 3.7 lakhs in central India and also relevant to the earlier finding of Singh *et al* [6] who have reported economic loss of INR 5255 crores for whole India. Mortality loss contributed INR 592.40 crores; which is higher than earlier finding of Singh *et al* [6] who reported mortality loss of INR 351150 in central India. This results are relevant to earlier finding of Singh *et al* [5] who reported mortality loss was INR 4039 crores for whole India. Direct milk loss contributed INR 8.18 crores; treatment cost contributed 35.91 crores; and additional labour cost contributed INR 11.63 crores. Thus, the maximum loss of about 91.11 percent was due to mortality and 8.89 per cent due to morbidity in bovines which is similar to the earlier findings of Singh *et al* [5] and Singh *et al* [6] who reported that mortality and morbidity loss contributed maximum of 92.2 per cent, 76.6 per cent and 7.76 per cent, 23.11 per cent in central India and for the whole of India respectively. Among different components of morbidity losses, the highest loss was due to treatment cost (5.54%), followed by extra labour cost (1.79%).Disaggregated analysis across different breeds/species revealed that the total economic losses due to HS in case of crossbred cattle and buffaloes were maximum in buffalo INR 460.29 crores followed by crossbread cattle INR 163.93 crores, respectively). Annual economic losses in case of indigenous cattle was relatively lesser at INR 23.90 crores. Thus, crossbred cattle and buffaloes accounted for the maximum share of total economic losses caused by HS (25.29% and 71.02%, respectively). Indigenous cattle accounted for 3.69 per cent of the total economic loss due to HS. The above finding is similar from the earlier finding of Singh et al (2014) who reported buffaloes (INR 272805) were contributing maximum for economic loss of HS among bovines than crossbred (INR 61342) and indigenous animals (INR 37692.5). The finding of Singh *et al* [5] also states that buffaloes (INR 3506 crores) contributed maximum in economic loss than cattle (INR 1748 crores).

Table 1: Total annual economic loss due to HS (in crores)

Components of economic loss		Indigenous cattle	Crossbred cattle	Buffalo	Total
A	Mortality loss	21.15(88.51%)	151.87(92.64 %)	419.37(91.11 %)	592.40(91.40%)
B	Direct Milk loss	0.12(0.51%)	1.59(0.97%)	6.47(1.41%)	8.18(1.26%)
C 1	Milk loss due to increased abortion	-	-	-	-
C 2	Value of calves lost due to increased abortion	-	-	-	-
D	Loss in Draught power	-	-	-	-
E	Treatment cost	2.21(9.24%)	9.39(5.73%)	24.32(5.28%)	35.91(5.54%)
F	Additional labour cost	0.41(1.73%)	1.08(0.66%)	10.13(2.20%)	11.63(1.79%)
	Total	23.90(3.69%)	163.93(25.29 %)	460.29 (71.02%)	648.12

Among Indigenous animals, maximum contribution of economic loss was by morality of the animals INR 21.15 crores (88.51%), which was followed by treatment cost INR 2.21 crores (9.24%) and then by additional labour cost INR 0.41 crores (1.73%), which is similar from earlier finding of Singh *et al* (2014) who reported that mortality loss (88.47%) was giving maximum contributing for economic loss. In case of Crossbred animals, maximum contribution of loss was by mortality INR 151.87 crores(92.64%) followed by treatment cost INR 9.39 crores (5.73%). Distribution of economic loss among Buffaloes was maximum for mortality INR 419.37 crores(91.11%) which was followed by treatment cost INR 24.32 crores(5.28%) which is similar to earlier finding of Singh et al (2014) who reported that

mortality loss for crossbred animals (92.51%) and buffaloes (95.69%) contributed maximum for the total economic loss which was followed by Treatment cost.

CONCLUSION

The present study was carried out to estimate the economic losses due to Haemorrhagic septicaemia in Haryana. The total annual economic loss because of HS in Haryana was INR 648.12 crores. Among that mortality loss accounts for 91.40 per cent and treatment cost accounts for 5.54 per cent. Breed wise share of economic loss accounts INR 23.90 crores, INR 163.93 crores and INR 460.29 crores for indigenous (3.69%), crossbred animals (25.29%) and buffaloes (71.02%) respectively. This study is coinciding with literature as mortality loss is contributing maximum for economic loss followed by treatment cost. Direct losses contribute maximum of 92.7 per cent and indirect losses contribute 7.3 per cent of economic loss.

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