Journal of Animal Research: v.15 n.01, p. 31-36. February 2025

DOI: 10.30954/2277-940X.01.2025.6

Determinants of Respiratory Tract Affections in Equines: A Detailed Study from Northern Part of India

Nitesh Yadav[1], Neelesh Sindhu[1], Sumit Mahajan[2], Sunil Punia[3] and Tarun Kumar[1*]

[1]*Department of Veterinary Medicine, LUVAS, Hisar, Haryana, INDIA*
[2]*Department of Dairy Business Management, LUVAS, Hisar, Haryana, INDIA*

**Corresponding author: T Kumar; E-mail: tarunvet@gmail.com*

Received: 02 Oct., 2024 **Revised:** 22 Nov., 2024 **Accepted:** 29 Nov., 2024

ABSTRACT

In India, equines support people's livelihoods in a wide range of sectors including agriculture, construction, tourism, mining, and public transport. The equines are prone to respiratory affections which directly result in economic losses to the people who rear them. The present study was conducted to identify the determinants of respiratory tract affections in clinically affected equines at a university referral hospital, Hisar over a period of 3 years (2018-2020). Primary data were used for analysis purpose with the sample size of 405 cases. Descriptive statistics revealed that in majority of cases, respiratory affections were observed in horses and, equines mainly in age group of 5-10 years. Results of logistic regression showed that the winter season and high body temperature positively influenced the occurrence of respiratory tract affections. Further, donkey/mules were less likely to suffer from respiratory tract affections as compared to horses. Other factors like age and sex of animal do not have statistically significant effect. The analysis of marginal effects revealed that probability of occurrence of respiratory tract affections was maximum in Winter season (28.5%) followed by rainy and summer season 23.6% and 20.2%, respectively. Similarly, the probability of occurrence of respiratory tract affections in horses was 25.7% and in mule/donkey it was 13%. Likewise, probability of occurrence of respiratory tract affections in animals having higher body temperature (>101°) was 51.5%.

HIGHLIGHTS

- Probability of occurrence of respiratory tract affections in equines is maximum in winter season.
- Donkey/mules are less likely to suffer from respiratory tract affections as compared to horses.

Keywords: Equines, Logistic regression, Respiratory tract affections, Winter season

Equines are the animals which are grouped under odd toed foot animals in the order Perissodactyla. They are known for serving the community by transportation, and also in some country their meat has been taken as food (Sussi *et al.,* 2001). India possesses 1.46% of the world's total horse population and stands 12th in the world for horses and 9th for donkeys, mules and hinnies (Parker, 2008). According to 20th livestock census, total population of Horses, Ponies, Mules & Donkeys in the country is 0.55 million during 2019 and has decreased by 51.9% over previous Livestock Census conducted in 2012 (Government of India, 2019). In Haryana, horse and ponies' population has decreased from 0.37 lakh in the year 2012 to 0.10 lakh in 2019. Major population of Equidae comprising donkeys, mules and ponies that provide livelihood to the rural societies living in arid, semi-arid and hilly regions. Working donkeys, horses and mules make up approximately 112 million of the livestock population in less developed countries. They support people's livelihoods in a wide range of sectors including agriculture, construction, tourism, mining, and public transport. Most of the equines are used to support rural societies especially in the foot hills of Himalayas through transport and draught, whereas remaining rest

How to cite this article: Yadav, N., Sindhu, N., Mahajan, S., Punia, S. and Kumar, T. (2025). Determinants of Respiratory Tract Affections in Equines: A Detailed Study from Northern Part of India. *J. Anim. Res.,* **15**(01): 31-36.

Source of Support: None; **Conflict of Interest:** None

small population of equines is used in army, police, border security force, racing industry and sports. The equine industry serves unlimited potential in terms of contribution to the country's GDP mainly by export of best breeding equines breeds to all over the world.

The most common group of diseases of equines are viz., respiratory diseases, lymphatic system diseases and GIT diseases. Respiratory tract infections are considered to be the major problem of equines worldwide (Abdisa, 2018). Disorders of the respiratory system are second in importance only to those of the musculoskeletal system in limiting the athletic performance of the horse and causes major economic loss (Ainsworth and Hackett, 2004). Respiratory system is highly integrated with other body systems such as the musculoskeletal, central nervous, and endocrine systems, and it is well recognized as the limiting factor in determining athletic performance. So even early, mild, or subclinical respiratory disease, reduce the performance capacity of horses.

Respiratory diseases have a major impact on racehorses and are often cited as the second most common reason for loss of training days and significant veterinary costs (Carvallo *et al*., 2017). Respiratory infections are resulting from complex interaction with parasitic, bacterial and viral factors as well as environmental conditions. Pneumonia, the most commonly reported condition in working horses is basically the inflammation of the pulmonary parenchyma, which may be associated with viruses, mycoplasma, bacteria, (or combination of three), fungi, metazoan parasites, and physical and chemical agents (Constable *et al*., 2017). The infectious viral agents like Equine herpes virus, Equine influenza, Equine rhinitis virus, bacterial agents like *Streptococcus equi* (most common agent of Upper respiratory tract causing Strangles*), Rhodococcus equi* (most common agent of Lower respiratory tract causing Foal Pneumonia) and *Burkholderia mallei* (causing Glanders) and Parasitic agents like lungworm (*Dictyocaulus arnfeldi*, common agent of lower respiratory tract), *Parascaris equorum* commonly affect the respiratory tract of equines. The non-infectious affections cause include inflammatory airway disease due to exercise intolerance, recurrent airways obstruction due to allergens, neoplasia of trachea, lung, guttural pouch, recurrent laryngeal hemiplegia due to paresis, sinusitis, guttural pouch empyema, tracheitis, epistaxis, pleuritis etc. (Constable *et al*., 2017). Sikder *et al. (*2012) conducted a retrospective study to identify equine clinical diseases and their prevalence in farm conditions in Bangladesh from January'04 to December'10. They found that prevalence of integumentary systemic diseases was 40.25% followed by digestive system (24.56%), musculoskeletal system (21.74%) and respiratory system (2.05%).

Indigenous horses are reared under traditional husbandry practice in many parts of India. They do not maintain any record of pedigree or diseases except army is maintaining horses in ideal farm conditions keeps all records. But in India, there is scarcity of significant reports on equine diseases (mainly respiratory diseases). Further, in our knowledge, no other studies in equines have used the clinical data to identify the factors causing the respiratory affections using binary models. In this backdrop, present study was conducted to identify the determinants of respiratory tract affections in clinically affected equines at Veterinary Clinical Complex (VCC), Hisar by using clinical data over a period of 3 years (2018-2020). Also, it will provide an idea about the prevalence of equine respiratory diseases and their demographic distribution in nearby areas of Hisar. It will also support the planning and implementation of equine disease control and eradication program for future.

MATERIALS AND METHODS

Study area

Hisar district lies between 28° 53′ 45″N and 29° 34′ 50″ N latitude and between 75° 19′ 44″ E and 76° 18′ 15″ E longitude. The climatic conditions of Hisar are tropical arid type. The annual average maximum and minimum temperature at Hisar are 31.5° and 16.2° with average annual rainfall of 450 mm. The relative humidity increases with onset of monsoon during first week of July and which again falls with withdrawal of monsoon. The study is based on the primary data available in Veterinary Clinical Complex (VCC) a university referral hospital, at Hisar, Haryana from the period 2018-2020. The VCC is a premier centre for treatment of animals and serve as a referral Veterinary Clinics for Haryana and neighbouring states. Veterinary diagnostic facilities at VCC include radiology, ultrasonography, complete blood testing, testing of faecal, urine etc. of animals.

Source of data

The recorded cases of respiratory tract diseases of horses were done on the basis of the primary data available in a referral university hospital (VCC), Hisar from the period 2018-2020. Data including age, sex (male/female) and species, and location (state), body temperature and year of sampling were collected. All the diseased horses came under treatment were registered in the patient register book. Date, sex, body weight, breed, initial complain and clinical findings were recorded accordingly. Most of the cases reporting respiratory affections belonged to Hisar district with some cases being brought from Bhiwani, Churu, and Jhunjhunu districts.

Model specification and analysis

Both descriptive statistics and econometric methods were employed for data analysis. The logit model is used for binary response analysis. Given the binary response of the variable under consideration (occurrence of respiratory affections), the econometric specification followed a logistic regression. Logistic regression is a useful statistical modelling technique in which the probability of a binary outcome is related to a set of potential explanatory variables.

For estimation of contribution of different factors for the occurrence of respiratory tract affections, it is assumed that an occurrence of respiratory tract affections on clinically affected animals are a random phenomenon affected by a set of factors that could explain the outcome. This binary variable is then regressed onto a set of explanatory variables. As the dependent variable is binary, we cannot use least squares method to estimate the coefficients. Instead, we can use maximum likelihood estimation technique for calculation of the coefficients.

In this study, we have used logit model to calculate marginal contributions of different factors for occurrence of respiratory tract affections. To predict the dependent variable, clinically affected animals have been classified into two groups – those who have more chance of disease occurrence and those who do not, and we used the logit model as discussed below:

$$P_n = \frac{1}{1+e^{-Z_n}}$$

Where, P_n is the probability of occurring of respiratory affections

$$1-P_n = 1-\frac{1}{1+e^{-Z_n}},$$

Where, $1 - P_n$ is the probability of not occurring of respiratory affections

The Odd's ratio = $\left(\frac{P_n}{1-P_n}\right) = e^{Z_n}$

Taking logarithm on both sides

$$\ln\left(\frac{P_n}{1-P_n}\right) = Z_n = \alpha + \beta_n X_n + e_n$$

Where α is the intercept, β the vector of response coefficient, *e* the vector of random disturbance and X_n is the set of explanatory variables.

The estimable equation can be written as:

Respiratory disease occurrence = $\beta_0 + \beta_1$ age + β_2 species + β_3 season + β_4 body temperature + β_5 sex + e_n

Where $\beta_1 \ldots \beta_5$ are coefficients associated with each explanatory variable and e_n is the error term. Several factors were hypothesized to influence occurrence of respiratory disease. A description of these factors is presented in Table 1. The choice of above explanatory variables was mainly based on the general predisposing factors and partly on empirical findings from the literature.

Table 1: Description of dependent and explanatory variables used in the analysis

Variables	Description of the variable (Score)
Respiratory disease occurrence (dependent variable)	Yes=1, No=0
Age (Yrs.)	(0-5=1), (5-10=2) and >10=3
Species	Horse=1 and Mule/Donkey=2
Season (Month)	March-June (Summer) = 1, July-September (Rainy) = 2 and October-February (Winter) = 3
Sex	Male-1 and Female = 2
Body Temperature (C°)	98-100 = 1 and>100 = 2

RESULTS AND DISCUSSION

A total of 409 clinical affected animals (equines) were analysed from the period 2018-2020 and out of which 24% cases were of respiratory tract affections.

Table 2: Descriptive statistics of selected variables

Variables		Number	Percentage
Total data (animals)		409	—
Respiratory signs		98	24.19
Age (Yrs.)	0-5	91	22.3
	5-10	185	45.2
	>10	133	32.5
Season	July-September	94	22.9
	October-February	163	39.8
	March-June	152	37.3
Species	Horse	363	88.8
	Mule/Donkey	46	11.2
Sex	Male	109	26.6
	Female	310	75.7
Body Temperature (°F)	98-100	286	70
	>100	123	30

From table 2, it can be observed that 45.2% of the animals in the age group (5-10) showed occurrence of respiratory tract affections. About 40% of the cases occurred during winter season (i.e., from October to February), implying that season may have effect on occurrence of respiratory tract affections. Nearly 90% of cases were observed in horses suggesting more occurrence of respiratory affections in horses as compared to mules/donkeys. Similarly, 30% of the cases belonged to animals showing higher body temperature. Further, 75.7% of the cases were observed in females of various equine animals which were more affected with respiratory tract affections.

The results of logistic regression have been illustrated in table 3. Given that the model included several binary variables, the chosen levels of statistical significance were 1% and 5%. Out of the 5 influential factors, 3 were statistically significant at 1% and 5% level. However, the explanatory power of logit model is quite low, as pseudo R^2 value is 0.1607. But goodness of fit is not as important as statistical and economic significance of the explanatory variables (Wooldridge, 2002; Gujarati, 2003).

In the present study, similar to the dependent variable, all the explanatory variables are categorical too. The coefficients observed in logistic regression suggest the effect of various categories of respective explanatory

Table 3: Binary logit model coefficient estimates for determining the factors for occurrence of respiratory affections

Sl. No.	Explanatory Variables	Coefficients	Standard Error	Z	P>Z
1	Age (Yrs.)				
	5-10	-0.07411	0.343037	-0.22	0.829
	>10	0.218944	0.351979	0.62	0.534
2	Sex				
	Female	0.079312	0.296145	0.27	0.789
3	Season				
	Rainy Season	0.242367	0.356279	0.68	0.496
	Winter Season	0.553456	0.297172	1.86	0.043*
4	Temperature				
	>100°	2.060027	0.265232	7.77	0**
5	Species				
	Mule/Donkey	-1.00334	0.474017	-2.12	0.034*
	Constant	-2.25767	0.428512	-5.27	0
	Pseudo R^2	0.1607			

Significant at 1% (**) and 5% (*).

variables on dependent variable in comparison to base category chosen for each variable. In variable 'Age', the base category chosen was 0-5 years. Similarly, in variable 'Season', the base category chosen was summer season while in variable 'Sex', male was chosen as base category. Likewise, for variables 'Body Temperature' and 'Species', the 98-100° and Horses were chosen as base categories, respectively. It was observed that winter season positively influenced the occurrence of pulmonary affections in equines as compared to summer season. Many researchers have reported that cold air in winter season can dry the tissues lining the respiratory tract, resulting in impaired local defences (e.g., the mucociliary apparatus), increased risk of broncho-constriction, potentially increasing their susceptibility to irritation and respiratory pathogens (Lascola, 2019). Riihimaki *et al.* (2008) had also reported that cold weather exercise can cause asthma-like airway disease in performance horses.

Table 4: Marginal effects of explanatory variables

Sl. No.	Explanatory Variables	Margin	Standard Error	Z	P>Z
1	Season				
	Summer	0.2028	0.0289	7.01	0
	Rainy	0.2368	0.0409	5.78	0
	Winter	0.2850	0.0322	8.84	0
2	Temperature				
	98-101°	0.1257	0.0195	6.45	0
	>101°	0.5158	0.0448	11.52	0
3	Breed				
	Horse	0.2576	0.0209	12.34	0
	Mule/Donkey	0.1301	0.0443	2.94	0.003
4	Number of observations	405			
5	Log likelihood	188.096			
6	LR $Chi^2(7)$	72.02			

Therefore, above finding of winter season affecting the occurrence of respiratory affections is in agreement with the literature. Likewise, higher body temperature (>100°) had higher positive influence on the occurrence of pulmonary affections as compared to normal body temperature. Mules/donkeys were less likely to get affected by pulmonary affections as compared to horse as depicted by positive and statistically significant coefficient. Thiemann (2011) has reported that the non-athletic nature of the donkey enhances resistance to some transboundary and parasitic diseases, and therefore, they are less likely to suffer from respiratory affections as compared to horses.

Table 4 presents marginal effects of the variables with significant coefficients for occurrence of respiratory tract affections which are presented in Table 3. These probabilities show how changes in specific variables affect the probabilities of occurring of respiratory tract affections. Truly, marginal effect computed for continuous variables is not comparable with those computed for binary variables.

The probability of occurring of respiratory tract affections in winter season was 28.5% while in rainy and summer season it was 23.6% and 20.2%, respectively. Likewise, probability of occurrence of respiratory tract affections in animals having higher body temperature (>101°) was 51.5% while for normal body temperature it was 12%. Similarly, probability of occurrence of respiratory tract affections in horses was 25.7% and in mule/donkey it was 13%.

CONCLUSION

The study has shown the importance of identifying variables/factor that determined the occurrence of respiratory tract affections in clinically affected equines in veterinary clinical complex, (university referral hospital) Hisar. Descriptive statistics revealed that in majority of cases of respiratory affections were observed in horses and, equines mainly in age group of 5-10 years. Logit analysis suggested that horses are likely to suffer more from respiratory affections as compared to mules and donkey. Respiratory tract affections are likely to be found in equines having higher body temperature. There is higher likelihood of contracting respiratory affections in winters as compared to rainy and summer season and therefore, equine keepers should offer protection against cold temperatures.

ACKNOWLEDGMENTS

Dean COVSc, Dean P.G., HOD- VCC, HOD-VMD.

REFERENCES

Abdisa, T. 2018. Systematic Review: Effect of Strangle on Health of Equine Animals and its Prevention. *Curr. Trends Biomed. Eng. Biosci*., **16**(1): 555927.

Ainsworth, D.M. and Hackett, R.P. 2004. Disorders of the Respiratory System. *Equine Internal Medicine*, pp. 289–353.

Carvallo, F.R., Uzal, F.A., Diab, S.S., Hill, A.E. and Arthur, R.M. 2017. Retrospective study of fatal pneumonia in racehorses. *J. Vet. Diagn. Invest.,* **29**(4): 450–456.

Constable, P.D., Hinchcliffe, K.W., Done, S.H. and Grunberg, W. 2017. A Textbook of the Diseases of Cattle, Horses, Sheep, Pigs, and Goats. *Saunders Ltd.* Philadelphia, PA, (11th Ed. Vol. 1).

Gujarati, D.N. 2003. Basic Econometrics, McGraw-Hill, New York, 4th Edn.

Lascola, K.M. 2022. How Cold Air Affects Equine Airways. *The Horse.https://thehorse.com/182620/how-cold-air-affects-equine-airways/*

Martuzzi, F., Catalano, A.L. and Sussi, C. 2001. Characteristics of horse meat consumption and production in Italy. *Ann. Faculty Vet. Med.,* **21**: 213-233.

Parker, S. 2008. Status and future of horse industry. *In:* Textbook of Equine Science. 3rd Edn. **2**: 28-33.

Riihimaki, M., Raine, A., Elfman, L. and Pringle, J. 2008. Markers of respiratory inflammation in horses in relation to seasonal changes in air quality in a conventional racing stable. *Can. J. Vet. Res*., **72**(5): 432-439.

Sikder, S., Rahman, A.M.E., Rima, U.K., Alim, M.A., Das, B.C and Faruque, M.R. 2012. Equine diseases: a retrospective prevalence study in farm conditions in Bangladesh. *Wayamba J. Anim. Sci.,* **12**: 1329045675.

Thiemann, A.K. 2011. Respiratory disease in the donkey. *Equine Vet. Educ.,* **24**: 469-478.

Wooldridge, J.M. 2002. Econometric Analysis of Cross Section and Panel Data, MIT Press, Cambridge, Massachusetts.