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Sero-epidemiology of Bluetongue and Caprine arthritis-encephalitis in goats of middleIndo-Gangetic plains

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ABSTRACT

The study was undertaken in middle of Indo-Gangetic plains of India. Bluetongue (BT) is endemic throughout the country. However Caprine arthritis-encephalitis virus (CAE)issporadically reported from India. The study was undertaken to evaluate the burden of these diseases due to unavailability of systemic study. Commercial ELISA kits were used for the study. BTV antibody sero-surveillance was undertaken in 504 random serum samples and Lentivirus antibody sero-surveillance for CAEin 280 random serum samples. None of the goats covered under the study had any form of clinical manifestations of these diseases. The study revealed moderate (15.64%) sero-positivity of BTV antibody and only two cases of sero-positivity of CAE.Two positive cases of CAE in Sirohi breed was brought from Rajasthan. Overall sero-positivity of BTV antibody in male was higher than female goats. The binary regression of circulating BTV antibody was significant for Sirohi and Black Bengal breeds under the study.

Key words: Sero-epidemiology, Bluetongue, Caprine arthritis -encephalitis, Goat, Indo-Gangetic plains

The middle indo-Gangetic plainis situated between 24°–27° N latitude and 82°–88° E longitude.It possess about 7.63% of India's total goat population and ranks 5thin country. The region is divided intoZone 1 (North West alluvial plains), Zone 2 (North East alluvial plains) and Zone 3 (South Bihar alluvial plains). Goat rearing in the region is mostly restricted to small and marginal farmersand is source of livelihood.Bluetongue (BT) is an important endemic viral disease of goat transmitted by *Culicoides* species andapproximately 22different serotypes has been reported based on isolation and serology. Rao *et al*. (2016) has isolated 13 serotype from India. It is mostly asymptomatic in goats. Caprine arthritis and encephalitis (CAE) of Lentivirus (LV)in goats causes significant economic losses and hampers exports.CAE in goatsis sporadically reported. Most CAE infectionsin goats are subclinical(Larruskainand Jugo 2013).Sero-epidemiological studies for BT and CAE in ruminants has not been reported from middle Indo-Gangetic Plains. The sero-epidemiology of diseases in particular geographical area is important for planning effective prevention and control measures. Thus the present study was undertaken to know the sero-prevalence of BT and LVantibody for CAE in goats of middle Indo-Gangetic plains.

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MATERIALS AND METHODS

Study Area:A total of eight districtswere randomly selected for the study representing all the agro-climatic zone of the region viz. Sitamarhi and Vaishali in zone 1, Purnia and Katihar in zone 2, Buxar, Patna, Gaya, and Jehanabad in zone 3. This study was conducted over a period of threeyears from February 2013 to January 2016.

*Serum samples:*For samples collection goatsof all ages, breed and gender were selected randomly for the study area. Data were collected through pre-tested schedule developed for the study. Blood (5 ml) samples were collected from jugular vein using plain vacutainers or sterile disposable syringesand serum was harvested. With proper identification, serum samples were transported to laboratory under refrigeration in cool box and stored at –20 °C till further analysis. A total of 504 random samples were used for BTV antibody sero-epidemiology and 280 random samples for LV antibody sero-epidemiology.

Assay for Bluetongue antibodies: Sero-epidemiology of BTV circulating antibody was done using monoclonal antibody- Competitive Enzyme Linked Immunosorbent Assay (MAb c-ELISA) kits manufacturedby Veterinary Medical Research and Development (VMRD, Product code 5010.20), USA with a claimed specificity of 99.0% and

sensitivityof 100%. Optical density (OD) value was measured by ELISA reader (ECIL Microscan MS5608A) at 620nm wavelength. Sero-positivity was recorded based on test validation method provided by the manufacturer.

Assay for lentivirus antibodies: Sero-epidemiology of CAE based on detection of circulating antibody of LVby measuring the titre using small ruminant Lentivirus antibody c-ELISA kitmanufactured byVeterinary Medical Research and Development (VMRD, product code 5139.20), USA. Thekit has99.0% specificity and 100% sensitivity for LV antibodies.Optical density (OD) value was measured by ELISA reader (ECIL Microscan MS5608A) at 620nm wavelength. Sero-positivity was recorded based on test validation method provided by the manufacturer.

Statistical analysis: Apparent prevalence was calculated by number of sero-positivity divided by total number of serum samples tested. Corrected prevalence was calculated using formula described (Kumar *et al*. 2017). Results obtained from c-ELISA test were statistically analysed for testing the significance by analysis of variance and odds ratio of age, gender, zones and breeds of goat using logistic regression model.

RESULTS AND DISCUSSION

The present study was carried out in three agro-climatic zones of middle Indo-Gangetic plains for investigating sero-positivity of BT and CAE in goats, its percent prevalence and physiological state, gender and/or breed as risk factors.None of the goats under the study had any form of reported clinical manifestations of either BT or CAE. The study revealed moderate sero-positivity of BTV antibody (apparent prevalence of 15.48% and corrected prevalence of 15.64%) and onlytwo cases of sero-positivity for LV antibody corresponding to CAE infection. In neighbouring state of Jharkhand, comparatively higher sero-positivity (43.33%; n=91) of circulating BTV antibody has been reported in goats (Tigga *et al*. 2015). Similar, report from Odisha and Assam had also higher sero-positivity (31.25% and 31.79%, respectively) of BTV antibody in goats (Joardar *et al*. 2013, 2014).The sero-prevalence of circulating BTV antibody was comparatively lower in goats of Bihar than those reported from Assam, Odisha and Jharkhand. It can be inferred that this lower prevalence could be due to possible low vector population and/or comparatively larger sample size in this study.The non-significantly higher prevalence% of circulating BTV antibody were observed in Purnia district of Zone 2 (Table 1). However, thebinary regression between circulating BTV antibody and sero-positivity in Zone 2 wassignificant. Higher incidence of BTV sero-positivity was reported from Zone 2could be attributed to seasonally water-logged topography with high organic content which favours the breeding and survival of *Culicoides* (Chand *et al*. 2015). The Zone 2 also has comparatively higher goat population (9.0% of the total goat population in Purnia and Katihar) compared to other districts of Bihar (DAHD 2012).Higher prevalence% of BTV antibodywasalso observed in Gaya district of zone 3 attributed to very high summer temperature which favours vector movement. Circulating BTV antibody was highest in Sirohi breed followed by Black Bengal type and other breeds under study (Table 2). The significantbinary regression was observed between circulating BTV antibody and breeds of Sirohi and Black Bengal type (Table 3). The higher incidence of this circulating virus in non-native goat breed (Sirohi) indicates possible spread of diseases due to inter-state marketing of goat population. Thevariation in sero-positivity amongst breed may also be attributed to variable sample size of breeds and influx of Sirohi breed goat population from other states. Gender and age as risk factor were analysed for determining sero-positivity of BTV antibody. Overall sero-positivity of BTV antibody in male was higher than female goats though the probability of higher circulating BTV antibody in male was non-significantlydifferent (Table 3). However, circulating BTV antibody was higher in adult compared to kids of any gender and the binary regression between BTV virus antibody and agewas found to be highly significant(P=0.006) with high odds ratio. In general, intact maleswerenot sold for meat purpose and usually retained for longer period in the region. This may be the possible

Table 1. Agro-climatic zone-wise sero-prevalence of BTV antibody in goats of Bihar

Zone	Districts	Female (n=351)		Male (n=153)		Apparent Prevalence %	Corrected Prevalence %	Zone Prevalence %
		Kid (n=42)	Adult (n=309)	Kid (n= 29)	Adult (n=124)			
1	Vaishali(n= 56)	0.00(n=5)	13.79(n=29)	0.00(n=4)	11.11(n=18)	10.71	10.83	12.37[a]
	Sitamarhi (n=41)	0.00(n=1)	15.00(n=20)	0.00(n=3)	17.65(n=17)	14.63	14.79	
2	Purnia(n= 43)	0.00(n=4)	29.63(n=27)	0.00(n=2)	10.00(n=10)	20.93	21.15	19.40[a]
	Katihar(n=24)	0.00(n=2)	17.65(n=17)	0.00-	20.00(n=5)	16.67	16.85	
3	Patna(n=112)	0.00(n=8)	12.50(n=56)	0.00(n=10)	15.79(n=38)	11.61	11.74	14.71[a]
	Jehanabad(n=97)	0.00(n=9)	19.44(n=72)	0.00(n=3)	7.69(n=13)	15.46	15.63	
	Gaya(n=90)	0.00(n=9)	18.18(n=66)	20.00(n=5)	20.00(n=10)	16.67	16.85	
	Buxar(n=41)	0.00(n=5)	19.05(n=21)	50.00(n=2)	15.38(n=13)	17.07	17.25	
	Total (n=504)	0.00	8.16±1.87	8.75±6.39	14.70±1.64	15.48±1.15	15.64±1.16	15.49±2.07
Confidence Interval at 95%		-	13.74to22.57	-6.36 to 23.86	10.82to 8.58	12.76 to 18.18	12.90 to 18.37	6.60 to 24.39

Values with different superscript differ significantly ($P \leq 0.05$) and values in parenthesis indicates sample size.

Table 2: Breed-wise prevalence % of BTV antibody in goats of different districts of Bihar

Zone	Districts	Black Bengal type (n=231)	Sirohi (n=68)	Others (n=205)
1	Vaishali	6.45	50.00	13.04
	(n= 56)	(n=31)	(n=2)	(n=23)
	Sitamarhi	21.05	-	9.09
	(n=41)	(n=19)		(n=22)
2	Purnia	15.79	100.00	14.29
	(n= 43)	(n=19)	(n=3)	(n=21)
	Katihar	23.08	-	9.09
	(n=24)	(n=13)		(n=11)
3	Patna	9.84	16.67	12.12
	(n=112)	(n=61)	(n=18)	(n=33)
	Jehanabad	17.07	40.00	4.88
	(n=97)	(n=41)	(n=15)	(n=41)
	Gaya	16.67	54.55	6.98
	(n=90)	(n=36)	(n=11)	(n=43)
	Buxar	9.09	26.32	9.09
	(n=41)	(n=11)	(n=19)	(n=11)
	Total	14.88 ± 2.09[a]	47.92 ± 11.93[b]	9.82 ± 1.12[c]
Confidence Interval at 95%		9.94 to 19.82	17.27 to 78.58	7.18 to 12.46

Values with different superscript differ significantly ($P \leq 0.05$) and values in parenthesis indicates samples size.

Table 3. Binary logistic regression of BTV sero-positivity and zones, breeds, gender and age

Log regression of BT with	B	S.E.	Z	Sig.	Odds ratio Exp (B)
Gender	-0.16	0.30	-0.53	0.59	0.85
Age	2.04	0.74	2.76	0.006*	7.71
Black Bengal breed	0.53	0.31	1.70	0.09*	1.46
Sirohi Breed	1.95	0.38	5.16	0.00*	5.22
ND Breeds			Omitted		
Zone 1	0.20	0.36	0.57	0.57	1.23
Zone 2	0.54	0.36	1.49	0.14*	1.72
Zone 3			Omitted		
Constant	-4.37	0.78	-5.61	0.00	0.00

Log likelihood = -192.72 Pseudo R^2 = 0.098

Where B= Regression coefficient, S.E. = Standard error, Z= random variable that has a standard normal distribution and calculated as B/S.E, Sig.= level of significance

reason for higher sero-positivity of BTV antibody in addition to lesser representation of male goat population in the study. Thus, indicating that prevalence of BT was not affected markedly by the sex. The gender as risk factor varies non-significantly for BTV antibody corroborates with findings of Shringi and Shringi (2005) and Bitew *et al*. (2013). Higher sero-positivity of BTV in adult goats compared to kids indicates possible temporal factor for exposure to the BTV in adults. The present finding of higher sero-positivity in adults is in agreement to the findings of Christi (2010) who found that flock level sero-prevalance was higher among the adult population (25.93%) than young animals (3.7%). Incontrast to our findings, Bitew *et al*.(2013) reported that risk factors like sex, age and body condition had no significant impact on the sero-prevalence. Sero-positivity of BTV antibody in kids also indicates possibility of trans-placental transmission of infection in agreement to the findings of Belbis *et al*. (2013).

Circulating LV antibody for CAE in goats was negative in most samples, except for the two cases of sero-positivity found in adult femaleSirohi goats newly introduced in village Tetariya (24°47'27.8"N 85°04'06.0"E) in Manpur block of Gaya District under zone 3. The goats were procured from middle man which were said to be brought from Rajasthan. Thus, apparent sero-prevalence of LV antibody circulating was very low (0.71%). Further analysis of data was not done for CAE. Similar low prevalence (3.33%) of CAE in goats was reported by Waseem*et al*. (2015). Ourfindings of sero-positivity in female goats is in agreement with the findings of Waseem*et al*. (2015).

This indicates the importance of such surveillance study for emerging animal diseases which were not reported and occurring sporadically. Periodical surveillancewill bring awareness about possible state migration of new diseases and consequently help the Government agencies to take suitable action for preventing the spread of these diseases and from becoming endemic.

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