

SEROEPIDEMIOLOGICAL SURVEY OF CAPRINE ARTHRITIS ENCEPHALITIS VIRUS AND BLUETONGUE VIRUS IN GOAT HERDS FROM PARAIBA STATE, NORTHEASTERN BRAZIL

(Levantamento soropidemiológico do vírus da artrite-encefalite caprina e vírus da língua azul em rebanhos caprinos do estado da Paraíba)

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ABSTRACT - Caprine arthritis encephalitis (CAE) and bluetongue (BT) are viral diseases affecting goats and sheep, respectively, worldwide. Both diseases are characterized by being slow and progressive, causing a variety of clinical signs and determining economic and production losses. The objective of this study was to evaluate the seroprevalence of CAE and BT and its associated factors in dairy and beef goat herds in the state of Paraíba, Northeast Brazil. In total, 6.4% and 1.8% of the animals were positive for caprine arthritis encephalitis and bluetongue, respectively, by Agarose Gel Immunodiffusion assay (AGID). No significant statistical association was found between diseases and risk factors, herd size, age, gender, and type of management in most animals evaluated. The risk factors, production system and grazing of multispecies can influence the prevalence of viral infections in goats in the state of Paraíba.

Keywords: BTV; CAEV; epidemiology; serology; goat production.

RESUMO - A artrite encefalite caprina (CAE) e a Língua Azul (BT) são doenças virais que afetam cabras e ovelhas, respectivamente, em todo o mundo. Ambas as doenças são caracterizadas por serem lentas, progressivas e determinarem sinais clínicos variáveis nos animais, ocasionando prejuízos econômicos para o produtor. O objetivo deste estudo foi avaliar a soroprevalência de CAE e BT e seus fatores associados em rebanhos leiteiros caprinos de leite e de corte no estado da Paraíba, no Nordeste do Brasil. No total, 6,4% e 1,8% dos animais foram positivos para artrite encefalite caprina e língua azul, respectivamente, pelo teste de Imunodifusão em Gel de Agarose (IDGA). Não foi encontrada associação estatística significativa entre essas doenças e os fatores de risco, tamanho do rebanho, idade, gênero e tipo de manejo na maioria dos animais avaliados. Os fatores de risco, sistema de produção e pastoreio por multiespécies podem influenciar a prevalência de infecções virais em caprinos no estado da Paraíba.

Palavras-chave: BTV; CAEV; epidemiologia; sorologia; caprinocultura.

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INTRODUCTION

Small ruminants have particular importance in sustainability and household incomes, especially in low income populations from developing countries (Pineiro et al., 2009). Brazil is the 22nd largest producer of goats worldwide, with 92% of all herds concentrated in the northeastern region of the country (FAO, 2015; IBGE, 2015). In the State of Paraíba, the production is mostly focused on family subsistence. It is characterized by low productive rates due to inappropriate management practices and poor sanitary conditions, which may facilitate the dissemination of pathological agents within the herd (PINHEIRO et al., 2000).

Caprine arthritis encephalitis (CAE) is a viral disease caused by caprine arthritis encephalitis virus (CAEV); an RNA virus that belongs to the family *Retroviridae* and genus *Lentivirus*, also considered endemic in northeastern Brazil. CAE may cause large productive losses in the herds due to polyarthritis, clinical or subclinical mastitis, neurological, respiratory and reproductive complications (BANDEIRA et al., 2009; CALLADO et al., 2001). Seropositive animals remain as asymptomatic carriers throughout life, and are considered reservoirs within the herd (DOMÍNGUEZ et al., 2017). Milk, colostrum and iatrogenic forms are the main sources of infection during the first year of animal's life (CALLADO et al., 2001; MACLACHLAN and DUBOVI, 2011).

Bluetongue (BT) is a non-contagious, insect-borne viral disease transmitted by hematophagous insects of the genus *Culicoides*. The bluetongue virus (BTV) belongs to the genus *Orbivirus* of the *Reoviridae* family, and it is replicated in all ruminants. Sheep are more susceptible to the infection than goats and cattle, which are generally asymptomatic or show nonspecific clinical signs (CAPORALE et al., 2014). To prevent entry of BTV into a country, it is necessary to identify the serotypes from the exporting country and the *Culicoides* occurrence for these serotypes in the importing country (OIE, 2016).

Both pathogens, CAEV and BTV, have been identified in most countries that raise sheep and goats, including Norway, Somalia, Poland, United Kingdom, Japan and Spain (CAPORALE et al., 2014; DOMÍNGUEZ et al., 2017; GHANEM et al., 2009; GJERSET et al., 2007, 2009; KABA et al., 2013). Previous studies in goats have found seroprevalence rates ranging from 1.9–13.4% for CAEV, in the Brazilian states of Bahia, Paraíba, Pernambuco, Ceará, Rio Grande do Norte and Tocantins (ALMEIDA et al., 2001; BANDEIRA et al., 2009; MELO et al., 2016; OLIVEIRA et al., 2006; PEIXOTO et al., 2016; PINHEIRO et al., 2004; SILVA et al., 2005; SOBRINHO et al., 2010), and 24.4% for BTV in Pernambuco state (MOTA et al., 2011).

The study has aimed to determine the occurrence of CAEV and BTV in goat farms from Paraíba State, Northeastern Brazil, by diagnostic methods officially recommended by the Brazilian Ministry of Agriculture, Livestock and Supply (BRASIL, 2004).

MATERIAL AND METHODS

Ethics statement

This study was approved by the Ethics Committee on Animal Experimentation and Animal Welfare of the Federal University of Paraíba (protocol 3305/14), State of Paraíba, Northeast Brazil.

Herd locations, samples and database

The herds were located in seven cities distributed in two state mesoregions: Agreste Paraibano mesoregion, including Algodão de Jandaíra ($n=39$), Cuité ($n=46$), Olivedos ($n=48$), Juarez Távora ($n=54$); and Borborema mesoregion, including Caturité ($n=94$), Gurjão ($n=43$) and Serra Branca ($n=61$). A total of 385 serum samples previously surveyed for other pathogens (Braz et al., 2017) were used in this study.

Farm owners answered an epidemiological survey, which included questions about goat gender and age, production system, herd size, management system and multispecies grazing. Goats were age-stratified into groups of ≤ 1 year and > 1 year. The goat herd located in Juarez Távora presented a high-quality management practices and was considered the reference farm for statistical comparison.

Detection of anti-CAEV and anti-BTV antibodies by AGID

Detection of antibodies against CAEV and BTV was performed by commercial Agar Gel Immunodiffusion (AGID) kits, according to manufacturer's recommendations. For anti-CAEV and anti-BTV antibodies, an antigen specific for capsid protein p28 (Biovetech®, Recife, Pernambuco, BRA) and antigen VP7 (VMRD®, Pullman, Washington, USA) were used, respectively.

Statistical analysis

The Chi-square or Fisher's exact test were used to determine correlation of individual, risk factors and seropositivity to CAEV or BTV. Odds ratio (OR), 95% confidence interval (IC) and P-values were calculated separately for each variable. Results were considered significantly different when $P < 0.05$. Data was compiled and analyzed by Epi Info™ Software (version 7.1.5, CDC).

RESULTS

A total of 25/385 (6.49%; 95% CI: 4.44-9.41%) goats were seropositive for CAEV, and 5/8 (62.5%) properties had at least one seropositive animal. The dairy goat farms Caturité II and Serra Branca, showed the highest seroprevalence. Dairy goats were more

likely to be seropositive for CAEV than beef animals ($P < 0,05$). Additionally, goats from farms with multispecies grazing were more likely to be seropositive for CAEV ($P < 0,05$).

Seven out of 385 (1.82%; 95% CI: 0.88-3.70%) animals were seropositive for BTV, with 3/8 (37.5%) properties presented at least one seropositive animal. Beef goats were more likely to be seropositive for BTV than dairy animals ($P < 0,05$). Association between seropositivity to BTV and management system was not found ($P > 0,05$). Association between herd size, age or gender, and seropositivity to CAEV or BTV was not found ($P > 0,05$). Seroprevalence of CAEV and BTV in goats and factors associated are presented in Table 1.

Table 1 – Seroprevalence of CAEV and BTV in eight different goat farms from Paraíba State, Northeastern Brazil and correspondent testing of associated factors.

Variables	Category	CAEV – AGID					BTV – AGID				
		+/n	(%)	OR	95% CI	P-value	+/n	(%)	OR	95% CI	P-value
Algodão	Dairy	0/39	0.0	-	-	-	0/39	0.0	-	-	0.50
Caturité I	Dairy	1/44	2.27	-	-	0.44	0/44	0.0	-	-	0.50
Caturité II	Dairy	12/50	24.00	-	-	0.00007	0/50	0.0	-	-	0.49
Gurjão	Dairy	1/43	2.33	-	-	0.44	0/43	0.0	-	-	0.50
Serra Branca	Dairy	10/61	16.39	-	-	0.0015	0/61	0.0	-	-	0.21
Cuité	Beef	0/46	0.0	-	-	-	1/46	2.17	0.5778	0.05-6.58	1.00
Olivedos	Beef	1/48	2.08	-	-	0.47	4/48	8.33	2.3636	0.41-13.52	0.41
Juarez*	Beef*	0/54	0.0				2/54	3.70			
Age	>1	24/320	7.50	5.1892	0.69-39.06	0.09	5/320	1.56	0.5000	0.09-2.63	0.33
	≤1	1/65	1.54				2/65	3.08			
Gender	Female	24/352	6.82	2.3415	0.31-17.88	0.71	6/352	1.70	0.5549	0.06-4.75	0.46
	Male	1/33	3.03				1/33	3.03			
Production system	Dairy	24/236	10.17	16.754	2.24-125.2	0.00007	0/236	0.0	-	-	0.0012
	Beef	1/149	0.67				7/149	4.70			
Herd size	>50	25/346	7.23	-	-	0.09	7/346	2.02	-	-	1.00
	≤50	0/39	0.0				0/39	0.0			
Management	Semi-intensive	15/285	5.26	0.5000	0.22-1.15	0.09	7/285	2.46	-	-	0.19
	Extensive	10/100	10.00				0/100	0.0			
Grazing of multispecies	Yes	24/295	8.14	7.8819	1.05-59.10	0.01	6/295	2.03	1.8478	0.22-15.55	1.00
	No	1/90	1.11				1/90	1.11			

+ = Number of positive animals; n = number of samples; 95% CI = 95% confidence interval. *Reference goat farm

DISCUSSION

In the present study anti-CAEV and anti-BTV antibodies have been found in 6.5% and 1.8% goats from the State of Paraíba, Northeastern Brazil, respectively; CAEV and BTV were found in 62.5% and 37.5% of goat farms, respectively. Our data attempts for the need of control measures recommended by MAPA to reduce productive losses, mainly mastitis, ill-thrift, ascending paralysis and arthritis, pneumonia, ascending paralysis and encephalitis in kids.

A previous study in Paraíba state has found 8% goats seropositive for CAEV (Bandeira et al., 2009). Our data are in agreement with previous studies in goats from Brazil which have found a seroprevalence variation of 1% to 13.4% in region (ALMEIDA et al., 2001; MELO et al., 2016; OLIVEIRA et al., 2006; PEIXOTO et al., 2016; PINHEIRO et al., 2004; SILVA et al., 2005), including 8.2% in Paraíba state (BANDEIRA et al., 2009). The differences between studies may be due the type of population and sample size, management system and climatic variances.

In the present study, dairy farms presented a higher seroprevalence for CAEV ($p < 0.05$) compared with beef goat farms analyzed. Previous studies have reported that CAE mainly affects dairy herds of high productivity with intensive management due to the animal agglomeration, which facilitates the dissemination of the etiological agent (PINHEIRO et al., 2004; SOBRINHO et al., 2010).

The contact between different herd species, which one specie plays as a mechanic vehicle in agent transmission, could be a reason for the dissemination of lentiviruses, even though lentiviruses are well known as a specific-species agent (SOBRINHO et al., 2010). In our study this variable was associated with higher seroprevalence for CAEV. And it is a striking feature in the Northeast region (PINHEIRO et al., 2010).

In our study, the seroprevalence for BTV was significantly low, correlating our data with other studies in the Northeast region (KONRAD et al., 2003). Among analyzed properties, the only variable that revealed a significant association ($p < 0.05$) was the goat production system. In previous studies, there are reports that BTV is widespread in all ruminant species, but the disease is more frequent in beef farms (PINHEIRO et al., 2010).

Multispecies grazing, especially among sheep and goats, is common in the properties of the Brazilian Northeast (SILVA, 2002). The BT virus can be transmitted directly between goats, sheep and cattle (PINHEIRO et al., 2004), being this variable one of the most important risk factors when it comes to this disease. However, in our study, there was no significant association between this variable and seropositivity for BTV, considering the low number of seropositive animals in our study. The present study did

not evaluate the risk factors associated to indirectly transmission by insects (as genus *Culicoides*), although it cannot be excluded as a potential hypothesis to explain the occurrence of BTV in Paraíba state mesoregions. Further investigations may include this type of transmission in analysis.

The present study was characterized as a search of convenience, in relation to the chosen properties. This research format is performed when information needs to be obtained quickly, but there is no availability of resources. Much is discussed because it is a study that limits the accuracy of the data, since it is not possible to measure sampling errors or has a definitive position on the results obtained. However, this type of study opens new possibilities of research for the executors, since other diagnostic techniques can be used and correlated with the technique used in our study and with our results.

CONCLUSION

Based on the data obtained, we can observe that the antibodies against CAEV and BTV were detected in the herds of the study. As a form of control for the herds of the analyzed properties, owners could implement a routine CAEV and BTV diagnostic approach, associated with the sacrifice of CAEV seropositive animals, as well as keeping the newly acquired animals separate from the herd and during that period performing diagnostic procedures for both agents before introduction into the herds, with management in the control and prophylaxis for these important diseases.

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