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SEROPREVALENCE SURVEY OF CAPRINE ARTHRITIS-ENCEPHALITIS IN THE MUNICIPALITIES OF SÃO DOMINGOS AND VALENTE, SISAL TERRITORY (BA)

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ABSTRACT

This study investigated the prevalence of Caprine Arthritis Encephalitis (CAE) in the municipalities of São Domingos and Valente, located in the Sisal territory, Bahia, using the Agar Gel Immunodiffusion (AGID) technique. A total of 702 samples from 28 farms (14 in each municipality) were analyzed, showing a seroprevalence of 2.99% (21/702) and 17.86% (5/28) of farms with positive animals. Among breeds, Alpine Brown and undefined breed animals (UB) had the highest seropositivity rates ($p \leq 0.05$), with prevalences of 52.38% (11/21) and 47.62% (10/21), respectively. Farms using semi-intensive management systems were the only ones with positive animals. Participation in agricultural fairs was identified as a risk factor, with higher positivity among attendees ($p \leq 0.05$). The main diseases reported in the herds were helminthiasis (92.86%), caseous lymphadenitis (78.57%), and mastitis (75.00%). The findings highlight the need for rigorous sanitary control measures, including regular testing and the removal of positive animals, to reduce the spread of CAE.

Keywords: CAEV; goat farming; prevalence; viruses.

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INTRODUCTION

Goat farming is an economic activity practiced worldwide, as it can be developed in various climates, soils, and vegetation types. However, its exploitation predominantly occurs with low technological input, in extensive systems (Pomponet, 2009; Monteiro et al., 2021). The northeastern region of Brazil stands out for housing over 90% of the country's goat herd (IBGE, 2023). Goat farming in this region is responsible for generating employment and income, having both economic and social importance (Costa et al., 2011; Souza, 2007).

Several diseases affect the productivity of these herds, with Caprine Arthritis Encephalitis being one of the most notable. It is a chronic infectious disease caused by a virus of the genus Lentivirus, non-oncogenic, from the family Retroviridae. It mainly affects dairy goats, regardless of age or sex. The disease is responsible for clinical signs such as arthritis, progressive weight loss, and reduced production capacity, which causes various losses to the goat farming industry in the country, resulting in significant economic losses (Rosa et al., 2009; Martinez et al., 2010; Constable et al., 2017; Alamerew et al., 2022).

The transmission of the virus can occur through direct contact, primarily via the ingestion of colostrum and milk, or through indirect contact via fomites (Souza et al., 2014). Early detection of infected animals is crucial for the eradication of viral infection within the herd, forming the basis for the success of control programs (Brinkhof et al., 2010).

The Caprine Arthritis Encephalitis Virus (CAEV) was introduced into Brazil due to the growth of dairy goat farming, driven by the increased demand for specialized goat breeds that were imported from several countries where the disease was endemic (Gillet, 1990). In Bahia, the first report of seropositivity in goats occurred in 1988, in animals imported from Canada (Fiterman, 1988).

The Sisal region, in the state of Bahia, stands out as the main goat milk production area in the state. In a survey conducted in this region, across ten municipalities (Araci, Cansanção, Conceição do Coité, Itiúba, Monte Santo, Nordestina, Queimadas, Santaluz, São Domingos, and Valente), the presence of CAE was discreetly identified. Among the 49 farms surveyed in the territory, 12.24% (6/49) had seropositive animals (Pinheiro et al., 2018). Therefore, the objective of this study was to investigate in detail the prevalence of CAE in the municipalities of Valente and São Domingos, where goat milk production has significant economic and social importance, using the Agar Gel Immunodiffusion (AGID) technique.

MATERIALS AND METHODS

Sampling and experimental design

A simple random sampling was conducted, in which 702 animals were selected for material collection. These animals were chosen from 28 rural farms located in the municipalities of São Domingos and Valente, with 14 farms in each municipality, determined randomly to ensure that each sampling unit had an equal probability of being selected (probabilistic sampling), as shown in Table 1. In cases involving suspected vesicular disease, considered a veterinary emergency, it is essential to alert various authorities, such as the Ministry of Agriculture, Livestock, and Food Supply, the Municipal Health Department, and the Regional Health Directorate - 16th DIRES, among others.

Table 1. Municipalities in the Sisal region of Bahia that participated in the project, including the number of goats in their herds (IBGE, 2019), annual milk production in 2017, percentage share in total milk production, minimum number of samples to be collected, and the number of farms to be visited.

Municipality	Number of milking goats	Annual milk production (L)	Percentage share	Minimum number of samples	Number of farms
São Domingos	4.755/897	426.000	50%	351	14
Valente	7.906/616	190.000	50%	351	14
TOTAL	**12.661/1.153**	**616.000**	**100%**	**702**	**28**

The animals in the study were clinically evaluated to identify characteristic changes associated with CAE, such as arthritis, neurological signs, mastitis, pneumonia, and progressive weight loss (Constable et al., 2017; Alamerew et al., 2022). The age of the animals was estimated based on the number of tooth replacements. In each farm, a questionnaire was administered containing the identification of the producer and the farm, as well as herd data, information on the sanitary management practices adopted, and the main diseases and clinical alterations frequently observed in the herd. The aim was to characterize the farming systems in the studied region and to correlate risk factors with the occurrence of CAE.

Sample collection

Using physical restraint, blood samples were collected from the goats by puncturing the external jugular vein with disposable needles (25×8 mm) attached to vacuum tubes without anticoagulant, obtaining a total volume of 10 mL per animal, following local asepsis with 2% iodinated alcohol. All collected samples were individually identified according to their farm of origin. Information on sex was recorded, and age was estimated. After clot retraction, the tubes were centrifuged at 1600 g for 10 minutes to obtain the serum, which was stored in Eppendorf-type

tubes at -20°C until serological testing. The protocol is in accordance with and approved by Law No. 11.794, of 2008, and the Brazilian Guideline for the Care and Use of Animals for Scientific and Educational Purposes – DBCA (CEUA No. 23007.007965/2017-15), from the Federal University of Recôncavo da Bahia.

Laboratory examination

The serological test used to detect anti-CAEV antibodies was the Agar Gel Immunodiffusion (AGID) assay, using a national antigen produced by Biovetech. The AGID tests were performed in plastic petri dishes (90x15 mm) containing 13 mL of 1% agarose gel in phosphate-buffered saline (PBS). After confirming polymerization, the gel was perforated with a hexagonal metal rosette, forming seven wells with a capacity of 25 µL each. The central well received the antigen, while the peripheral wells were alternately filled with the test sera and the positive standard serum. The plates were incubated in a humid chamber at 25°C. Readings were performed after 48 and 72 hours under a light source with a dark background, observing the formation of precipitation lines (Pinheiro et al., 2010).

Statistical analysis

The statistical analyses were conducted in two stages: a descriptive analysis, using tables containing the proportions of the corresponding variables, and an inferential analysis, applying the chi-square test and risk factor analysis through the Odds Ratio, both performed using the PAST statistical package (Hammer et al., 2013). Simultaneously, confidence intervals for the proportions were calculated using Excel, following the methodology proposed by Arango (2005). Throughout the analysis, the significance of the results was verified at a 95% confidence level ($p \leq 0.05$).

RESULTS E DISCUSSION

The serological evaluation showed that, out of the 702 animals tested in the studied municipalities, 2.99% (21/702) were seroreactive according to the AGID test. Among the seroreactive animals in the surveyed municipalities, 2.85% (10/351) were from São Domingos and 3.13% (11/351) from Valente (Table 2).

RESULTADOS E DISCUSSÃO

A avaliação sorológica constatou que, dos 702 animais testados nos municípios estudados, 2,99% (21/702) foram sororreagentes pelo teste IDGA. Entre os animais soro reagentes nos municípios pesquisados, 2,85% (10/351) foram de São Domingos e 3,13% (11/351) de Valente (Tabela 2).

Table 2. Serological prevalence of Caprine Arthritis Encephalitis in the Sisal Territory - BA, according to the AGID test.

Municipality	Number of samples collected per municipality	Number of positive samples	Prevalence (%)
São Domingos	352	10	2,85
Valente	352	11	3,13
TOTAL	**702**	**21**	**2,99**

Similar results had already been reported by Pinheiro et al. (2018) in the Sisal Territory - BA, in goats from the municipalities of Conceição do Coité, São Domingos, and Valente, with seropositivity rates of 5.00% (1/20), 9.57% (9/94), and 2.44% (3/123), respectively, exceeding only in the municipality of São Domingos, possibly related to the small sample size of the previous study, which was conducted in only five farms in that municipality. However, the results obtained in our study were lower when compared to those of Veschi et al. (2012), who evaluated dairy goats in the municipalities of Valente, Santa Luz, and São Domingos and found a 12.05% (135/1,120) seropositivity rate for caprine lentivirus.

Moreover, our results differ from those obtained by Lima et al. (2009), who investigated specific antibodies to CAEV in eight municipalities belonging to the Juazeiro Microregion and did not detect the occurrence of seropositive animals in the AGID test (0/150), and by Torres et al. (2009), who analyzed 343 goat samples from municipalities in the Metropolitan Region of Salvador and the interior of the state of Bahia, detecting 8.75% (30/343) seropositivity.

A similarity was observed between our study and the one conducted by Rodrigues et al. (2018), who evaluated a strategic control of caprine arthritis-encephalitis in a dairy goat herd, analyzing 148 animals in the state of Ceará and obtaining a seropositivity rate of 6.80% (10/148) using the AGID test. A similar seroprevalence of CAE in goats was reported by Rizzo et al. (2016) in Sergipe, a neighboring state of Bahia, where 3.63% (10/276) of the animals were seroreactive in 15 herds from the municipality of Poço Verde-SE.

Results with varying prevalence rates have been reported by several authors in different Brazilian states, such as those by Silva et al. (2005), who found a prevalence of 2.71% (5/184) in herds, a result similar to that found by Sobrinho et al. (2010), with 2.7% (23/843) in the state of Rio Grande do Norte. In Tocantins, the prevalence was 4.2% (20/480), according to Sampaio Júnior et al. (2011); while in Piauí, it was 1.84% (7/369), according to Melo et al. (2016).

In Pernambuco, Teixeira et al. (2016) determined a prevalence of 2.8% (47/1,703), and Mourão et al. (2016) obtained a prevalence of 7.4% (14/176) in the state of Maranhão. Nonetheless, the prevalence found in this research was higher than that observed by Lima et al. (2013), in which 693 samples were collected from 46 farms in the Baixo Médio São Francisco region, with two positive samples, revealing a prevalence of 0.29% (2/693). This is probably due to the ultra-extensive management system used in the Juazeiro region and the adoption of the fundo de pasto regime (traditional communal grazing regime). Also in Bahia, Sardi et al. (2012) evaluated goats raised on farms in the Portal do Sertão, Bacia do Jacuípe, and Sisal regions, also in the state of Bahia, where they detected 0.6% (5/755) seropositivity for CAEV, a result lower than ours.

Studies conducted in other states have also reported positivity for Caprine Arthritis Encephalitis, such as in Goiás, with 34.5% (10/29) according to Santin et al. (2006). In Rio de Janeiro, Lilenbaum et al. (2007) found 14.2% (79/541), Madureira & Gomes (2007) obtained 34.9% (96/275), and Lara et al. (2011) found 15.5% (30/199) in São Paulo. Bandeira et al. (2004) found 14.5% (87/600), and Silva et al. (2013) observed 44.6% (49/110) in Paraíba; Vinicius et al. (2009) found 22.8% (13/57), while Nascimento-Penido et al. (2017) identified 49.5% (531/1,072) in the state of Minas Gerais; and Mendes et al. (2018) determined 17.31% (9/52) in the state of Ceará. This demonstrates the wide dissemination of CAE in Brazil, and these variations are likely due to the purpose of the herds surveyed, as higher prevalence rates are linked to dairy herds, while lower rates are associated with predominantly meat herds raised under extensive systems.

Out of the 28 farms participating in the research, 17.86% (5/28) had seropositive animals for CAEV (Table 3). Similar but lower results were reported by Pinheiro et al. (2018), who identified a prevalence of 12.24% (6/49) of positive farms in the municipalities of Conceição do Coité, São Domingos, and Valente.

Table 3. Number of positive farms in the serological survey of Caprine Arthritis Encephalitis in the municipalities of São Domingos and Valente, Sisal Territory - Bahia, using the AGID technique.

Municipality	Number of farms	Number of positive farms	Prevalence (%)
São Domingos	14	2	14,2
Valente	14	3	21,4
TOTAL	**28**	**5**	**17,8**

In other studies conducted in Bahia, Lima et al. (2013) identified seropositivity in 15.22% (7/46) of the farms analyzed in a serological survey for CAE in the semi-arid region of Bahia. Ramalho et al. (2000), in their evaluation of herds in the metropolitan and semi-arid regions of the state of Bahia, identified 65.2% (15/23) of positive farms, thus showing a higher result compared to the present study. Research conducted in other Brazilian states indicated either similar or higher and variable seropositivity rates for CAEV in farms with goat herds, such as: 26.7% (4/15) in Sergipe (Rizzo et al., 2016); 100% (5/5) in Minas Gerais (Nascimento-Penido et al., 2017); 12.9% (8/62) and 44.6% (49/110) in Paraíba (Guilherme et al., 2017; Silva et al., 2013); 54.4% (31/57) in Maranhão (Mourão et al., 2016); and 22.6% (12/53) in São Paulo (Lara et al., 2013).

Regarding sex as an evaluation parameter, it can be stated that it was not possible to demonstrate an association between the occurrence of CAEV and the sex of the animals, as all samples referred to female goats. Despite collecting samples from both sexes, Pinheiro et al. (2018) did not show a significant difference ($p \leq 0.05$) between the sexes of the animals. However, results obtained in a study conducted in Pernambuco revealed a higher prevalence in males, 23.81% (5/18), compared to females, 20.95% (35/167). Similarly, a small, albeit non-significant, difference in infection rates between males and females was also identified by Araújo et al. (2008). Likewise, Mourão et al. (2016) observed that females had an anti-CAEV antibody prevalence of 8.1% (48/591) and males of 7.0% (5/66). Araújo et al. (2008) and Melo et al. (2016) concluded that goats, regardless of sex, are equally exposed to the main risk factor for CAEV infection, which is the ingestion of colostrum and/or milk from positive goats.

When comparing the results obtained regarding caprine lentivirus seroprevalence by breed, it was found in the present study that Alpine Brown and its crossbreeds (SPRD) had a significantly higher seropositivity ($p \leq 0.05$) compared to other breeds (Table 4).

Table 4. Seropositivity prevalence for CAEV using the AGID test in Alpine Brown and SPRD breeds in the studied municipalities.

Bred	Positive Animals	Negative Animals	Total samples
Parda Alpina (%)	11(52, 3)	301(44,2)	312(44,4)
SPRD (%)	10(47,6)	54(07,9)	64(09,1)
Total	**21(100)**	**355(100)**	**376(100)**

The significantly higher CAEV prevalence in purebred animals compared to crossbreeds and SPRD was also reported by Silva (2011) and Sampaio Júnior et al. (2011). In the studied region, this finding is consistent with previous data, as one of the main founding herds was composed of Alpine Brown goats, which had a known history of CAEV-positive animals. However, the seroprevalence of SPRD detected in the present study is considered low when compared to other studies conducted in Minas Gerais, with 22.80% (13/57) (Vinícius et al., 2009), and in Piauí, with 35.3% (7/20) (Sampaio Júnior et al., 2011). Similar to

our results, Rizzo et al. (2016) showed that 7.7% (2/26) of Alpine Brown goats had a higher prevalence of CAEV than SPRD animals, which showed 4.4% (4/91); the Saanen breed showed a prevalence of 2.8% (4/141), and the Anglo-Nubian breed, 0% (0/14). Unlike our results, Sobrinho et al. (2010) observed the highest percentage of seroreactive animals in the Saanen breed, with 11.7% (7/60). For animals without a defined breed, the percentage was 0.6% (2/310), and for the Anglo-Nubian breed, 3.0% (14/466).

Regarding the animals that participated in agricultural events such as exhibitions and auctions, a significant difference was observed between this practice and seropositivity to caprine lentivirus ($p \leq 0.05$), indicating an association between positivity and participation in events (Table 5).

Table 5 - Seropositivity prevalence for CAEV using the AGID test in Alpine Brown and SPRD breeds in the studied municipalities.

Exhibition Animals	Positive Animals	Negative Animals	Total
yes(%)	10(47,6)	155(22,7)	165(23,5)
No(%)	11(52,3)	526(77,2)	537(76,5)
Total(%)	**21(100)**	**681(100)**	**702(100)**

$\chi 2 = 7{,}00$; $p \leq 0{,}05$

However, Pinheiro et al. (2018) and Lima et al. (2013) did not find a significant difference between this risk factor and CAEV infection. Nevertheless, it is emphasized that the transportation of CAEV-carrying animals to other locations without proper sanitary control facilitates the spread of the virus across the regions traveled (Martinez et al., 2010).

Regarding pasture division on the farms, it can be concluded that there is an association ($p \leq 0.05$) between properties that have their pastures divided by age, sex, breed, or type of pasture, as only farms with divided pastures showed CAEV positivity (Table 6). It is known that in ultra-extensive farming systems, such as the fundo de pasto system, there is a lower risk of infection, as the reduced contact between animals mitigates viral dissemination (Lara et al., 2002).

Table 6. Frequency of seropositivity in relation to pasture division on farms in São Domingos and Valente, according to the AGID test.

Divisão de pastagem	Animais Positivos	Animais Negativos	Total
Sim(%)	21(100,0)	542 (79,5)	563 (80,2)
Não(%)	0 (0,0)	139 (20,4)	139 (19,8)
Total(%)	**21 (100)**	**681 (100)**	**702 (100)**

$\chi 2 = 5{,}34$; $p \leq 0{,}05$

There were no positive animals in the intensive and extensive farming systems, leading to the conclusion that all positive animals originated from herds raised under semi-intensive systems, 100% (21/21). Thus, the production system adopted on the farm was not significant for the seropositivity casuistry ($p \leq 0.05$). Different results were obtained by Pinheiro et al. (2018), Nascimento-Penido et al. (2017), Mourão et al. (2016), Lima et al. (2013), and Rodrigues (2018), who found a significant difference in the production system and type of farming.

Regarding the management system, the results of the present study are consistent with previous evaluations, which describe a higher occurrence of CAEV seropositivity in properties using semi-intensive farming systems, as reported by Pinheiro et al. (2018) and Moura Sobrinho et al. (2008). It is noteworthy that the farming system has a strong influence on the spread of the virus, as the crowding of animals is highly favorable to the dissemination of CAEV (Sobrinho et al., 2010).

On the other hand, Lara et al. (2002) reported that, in extensive farming, close and constant contact between individuals in the herd occurs less frequently, thereby hindering viral dissemination and reducing the chances of horizontal viral transmission. In contrast, intensive and semi-intensive farming systems provide greater physical contact between animals, facilitating the spread of the virus within the herd (Lima et al., 2013; Mussi, 2014; Nascimento-Penido et al., 2017). However, although herds raised under intensive and semi-intensive systems are more susceptible to viral infection, animals in extensive systems can also be infected by CAEV (Souza et al., 2013; Lima et al., 2013).

Regarding the types of farming systems, it was found that there is no significant association ($p \leq 0.05$) between mixed farming of goats with other animal species. This was also observed by Pinheiro et al. (2018), Mendes et al. (2018), and Rizzo et al. (2016), who did not find an association between the joint farming of goats and sheep. However, genetic and phylogenetic studies indicate that both viruses are widespread in sheep and goats, showing that cross-species transmission is possible under natural conditions. It has been demonstrated that CAEV can be transmitted to sheep neonates through the ingestion of colostrum and milk contaminated with caprine lentivirus, as well as through prolonged direct contact between adult goats and sheep (Lara et al., 2005; Souza et al., 2014).

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Regarding the type of production evaluated in the herds surveyed, which were exclusively dairy producers, the results are consistent with other studies that have investigated these differences, as observed by Pinheiro et al. (2018), who found a statistically higher probability of infection compared to animals raised for meat production. In Minas Gerais, Nascimento-Penido et al. (2017) observed a prevalence of up to 69.6% (156/224) of seropositive animals in dairy-producing farms. It can thus be inferred that dairy animals, as they are generally raised in semi-intensive or intensive systems and remain longer in the production system, become more susceptible to viral infection.

Despite the positive serology and the history of some animals showing signs of arthritis at some point, no animals with symptoms compatible with CAEV were observed during the visits. Based on the questionnaire, it was found that various diseases affect these herds (Table 7); however, verminosis stands out as the most frequent disease in this population, which is consistent with Pinheiro et al. (2018), who stated that verminosis is widespread in a large part of small ruminant farms in the Sisal Territory - BA. Fonseca et al. (2011) affirmed that this condition results from the feeding habits in extensive pastures.

Tabela 7 .Principais enfermidades relatadas nas 28 propriedades dos municípios de São Domingos e Valente-BA.

Disease	Farms	CI (%)
Verminous Disease	26	92,86% (100 – 82,93)
Diarrhea	22	78,57% (95,25 – 61,88)
Caseous Lymphadenitis	22	78,57% (95,25 – 61,88)
Mastitis	21	75,00% (91,69 – 58,31)
Ectoparasites (lice and ticks)	15	53,57% (72,80 – 34,34)
Abortion	12	42,86% (61,94 – 23,78)
Keratoconjunctivitis	9	32,14% (50,14 – 14,00)
Weak Kid Syndrome	9	32,14% (50,14 – 14,00)
Weight Loss	7	25,00% (41,69 – 8,31)
Dyspnea	7	25,00% (41,69 – 8,31)
Myiasis	6	21,43% (37,25 – 5,61)
Return to Estrus	6	21,43% (37,25 – 5,61)
Arthritis	5	17,86% (32,63 – 3,09)
Footrot	5	17,86% (32,63 – 3,09)
Exercise Intolerance	4	14,29% (27,78 – 0,08)
Contagious Ecthyma	3	10,71% (22,63 – 0,0)
Neurological Disorders	2	7,14% (17,07 – 0,0)
Low Fertility	1	3,57% (10,72 – 0,0)
Epididymitis	0	0% (0,00)

Our results regarding the frequency of diseases are similar to those obtained by Mourão et al. (2016), who reported the following health issues: myiasis (78.9%), caseous lymphadenitis (59.6%), footrot (47.4%), abortion (43.9%), mastitis (31.6%), diarrhea (29.8%), arthritis (28.1%), keratoconjunctivitis (24.6%), pneumonia (22.8%), nervous system disorders (22.8%), ectoparasites (21.1%), and contagious ecthyma (14.0%).

Other sanitary management characteristics are presented in Table 8, highlighting the important information regarding the use of deworming practices, since, according to the producers,

verminous disease is one of the major health problems observed in small ruminant herds (Bandeira et al., 2007; Moura Sobrinho et al., 2008). The percentage of farms that carry out deworming is 78.6% (22/28), which is slightly lower than that observed by Pinheiro et al. (2018) and Mourão et al. (2016), who found 100% (49/49) and 91.2% (52/57), respectively, in farms in the Sisal Territory - BA and the Western Maranhão mesoregion. The percentage of farms that use vaccination was 92.85% (26/28), which is higher than the 78.65% observed by Santos et al. (2011) in the state of Paraíba, where rabies vaccine was the most commonly used. This percentage is also higher than that found by Pinheiro et al. (2018) at 65% (32/49) and comparable to the percentage found in the dairy region of the state of Sergipe, 85% (18/21).

Table 8. Characteristics of Sanitary Management Practices Employed in the 28 Farms Visited in the Municipalities of São Domingos and Valente, BA.

Characteristics	Farms	CI(%)
Vaccination	27	96,30% (100 – 81,85)
Colostrum Intake	27	96,30% (100 – 81,85)
Deworming	26	86,59% (96,64 – 76,54)
Navel Cutting and Care	18	66,67% (85,27 – 48,07)
Breeding Season	21	14,49% (30,17 – 0,00)

CONCLUSION

The results obtained in the present study indicated that the municipalities of São Domingos and Valente have a low prevalence of infection by Caprine Arthritis Encephalitis Virus in herds raised under a semi-intensive system. However, as this region stands out for its goat milk production, hosting dairy processing agribusinesses and having a significant herd of this species, it is necessary to implement the Caprine Arthritis Encephalitis control and prophylaxis program, as recommended by the National Health Plan for Goats and Sheep (PNSCO), in order to promote the control of caprine lentivirus and its risk factors in these municipalities.

Educational approaches and practices aimed at combating diseases should be implemented from elementary school onwards, enabling children and adolescents to understand and contribute to the development and formulation of actions for a healthier society in which they are part. There is an urgent need for joint actions involving the Health Department and schools, not only at the local level but also regionally, emphasizing the importance of coordinated interventions in various regions to control and prevent CAE.

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REFERENCES

Alamerew EA, Demis C, Asfaw T, Gemeda BA, Asres FA, Yitagesu IE, Wondifra Y, Areya A. Serological evidence of caprine arthritis encephalitis in north shewa zone, ethiopia: clinical case analysis. Vet Med Res Rep. 2022;13:287-97. doi: 10.2147/vmrr.s378605. Acesso em: 04 ago. 2024.

Almeida MGAR, Anunciação AVM, Figueredo A, Martinez TCN, Laborda SS. Dados sorológicos sobre a presença e distribuição da artrite-encefalite caprina (CAE) no Estado da Bahia. Rev Bras Saúde Prod Anim. 2001;3:78-83.

Andrioli AP. Vírus da Artrite e Encefalite Caprina: PCR e Isolamento Viral em Amostras de Sêmen, Fluido Uterino e Embriões [tese]. Belo Horizonte (MG): Universidade Federal de Minas Gerais; 2001.

Araújo SAC. Avaliação in vitro da Atividade Antiviral de Produtos Sintéticos e Naturais contra Lentivírus de Pequenos Ruminantes [dissertação]. Fortaleza (CE): Universidade Estadual do Ceará; 2008. Disponível em: http://siduece.uece.br/siduece/trabalhoAcademicoPublico.jsf?id=94532. Acesso em: 14 ago. 2024.

Arango HG. Bioestatística: Teórica e Computacional. 2. ed. Rio de Janeiro: Guanabara Koogan; 2005. v.1. 423 p.

Assis APM, Gouveia AMG. Evidência de lentivirus (Maedi-Visna/CAE) em rebanho nos Estados de MG, RJ, BA e CE. In: Congresso Brasileiro de Medicina Veterinária, 23., 1994, Recife. Anais. Recife: Sociedade Brasileira de Medicina Veterinária; 1994. p. 104.

Bandeira DA, Castro RS, Azevedo EO, Melo LSS, Melo CB. Seroprevalence of caprine arthritis–encephalitis virus in goats in the Cariri region, Paraiba state, Brazil. Vet J. 2009;180(3):399-401. doi: 10.1016/j.tvjl.2008.02.007. Acesso em: 05 ago. 2024.

Brasil. Projeto Cadastro de Fontes de Abastecimento por Água Subterrânea: Diagnóstico do Município de Conceição do Coité – Bahia. Salvador: Ministério de Minas e Energia; 2005.

Brinkhof JMA, Moll L, van Maanen C, Houwers DJ. Use of serology and polymerase chain reaction for the rapid eradication of small ruminant lentivirus infections from a sheep flock: A case report. Res Vet Sci. 2010;88(1):41-43. doi: 10.1016/j.rvsc.2009.05.014. Acesso em: 05 ago. 2024.

Callado AKC, Castro RS, Teixeira MFS. Lentivírus de pequenos ruminantes (CAEV e Maedi-Visna): revisão e perspectivas. Pesq Vet Bras. 2001;21(3):87-97. doi: 10.1590/S0100-736X2001000300001.
CEUA. nº 23007.007965/2017-15, Diretriz Brasileira para o Cuidado e a Utilização de Animais para Fins Científicos e Didáticos – DBCA. Intitulado: Levantamento soroepidemiológico da artrite-encefalite caprina nos municípios de Valente, São Domingos e Conceição de Coité- Território do Sisal-BA.

Constable P, Hinchcliff KW, Done S, Gruenberg W. Veterinary Medicine: A textbook of the diseases of cattle, horses, sheep, pigs and goats. 11th ed. Elsevier; 2017.
Costa JN, Souza TS, Lima CCV, Araújo BR. Doenças infecciosas de pequenos ruminantes. Vet Zootec. 2011 Dez;18(4 Suppl. 3). IX Congresso Brasileiro Buiatria; 2011 Out 04-07; Goiânia, Goiás, Brasil.

Costa ABB, Emery BD, Araújo MV, Teles JAA, Abreu SRO. Inquérito Soroepidemiológico de Lentivírus de Pequenos Ruminantes no Município de Delmiro Gouveia, Alagoas- Brasil. Rev Semente. 2011;6(6):229-39.

Cruz JCM, Gouveia AMG, Souza KC, Braz GF, Teixeira BM, Heinemann MB, et al. Caprine arthritis-encephalitis virus (CAEV) detection in semen of endangered goat breeds by nested polymerase chain reaction. Small Rumin Res. 2009;82(2-3):149-52. doi: 10.1016/j.smallrumres.2009.07.010. Acesso em: 05 ago. 2024.

Denner J. Transspecies transmissions of retroviruses: New cases. Virology. 2007 Dec;369(2):229-33. doi: 10.1016/j.virol.2007.07.026. Acesso em: 10 ago. 2024.

Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA). Relatório de consultoria – Programa de Controle da Artrite Encefalite Caprina a Virús (PCAEV) (subprojeto Nº 06.0.94.102-01). Centro Nacional de Pesquisa de Caprinos; 1994. 125 p.

Fiterman R. Constatação do complexo artrite-encefalite em um plantel de caprinos no estado da Bahia. In: Congresso Brasileiro de Medicina Veterinária, 21.; 1988; Salvador, BA. Anais. Salvador; 1988. p. 33.

Fonseca ZAA, Bezerra ACA, Avelino DB, Nascimento JO, Marques ASC, Vieira LS, Ahid SMM. Relação sexual do parasitismo por Haemonchus contortus em Caprinos (Capra hircus). Pubvet. 2011;5(31). doi: 10.22256/pubvet.v5n31.1200. Acesso em: 10 ago. 2024.

Gillet T. Brésil: les chèvres de la “caatinga”. La chèvre. 1990;178:40-6.

Guilherme RF, Azevedo SS, Higino SSS, Alves FSF, Santiago LB, Lima AMC, et al. Caracterização epidemiológica e fatores de risco associados à infecção por lentivírus de pequenos ruminantes na região do semiárido paraibano, Nordeste do Brasil. Pesq Vet Bras. 2017;37(6):544-8. doi: 10.1590/S0100-736X2017000600002. Acesso em: 09 ago. 2024.

Hammer O, Harper DAT, Ryan PD. Past: Palaeontological Statistics, version 1.78. In: Hammer O, Harper DAT, Ryan PD. PAST: Paleont. Stat.; 2013.

Instituto Brasileiro de Geografia e Estatística (IBGE). Produção da pecuária municipal. Tabela 3939 - Efetivo dos rebanhos, por tipo de rebanho – ano 2017 [Internet]. 2019 [citado em 14 mar. 2019]. Disponível em: http://www.sidra.ibge.gov.br/bda/tabela/listabl.asp?z=t&o=1&i=P&e=l&c=3939

Instituto Brasileiro de Geografia e Estatística (IBGE). Produção agropecuária caprinos [Internet]. Rio de Janeiro: IBGE; 2024 [citado em 28 jul. 2024]. Disponível em: https://www.ibge.gov.br/explica/producao-agropecuaria/caprinos/br
Lara MCCSH, Birgel Junior EH, Fernandes MA, Birgel EH. Infecção experimental do vírus da artrite encefalite dos caprinos em cabritos. Arq Inst Biol. 2002 Jan-Mar;70(1):51-4.

Lara MCCSH, Birgel Junior EH, Birgel EH. Possibility of vertical transmission of caprine arthritis-encephalitis virus in neonate kids. Arq Bras Med Vet Zootec. 2005;57(4):553-5.

Lara MCCSH, Villalobos EMC, Cunha EMS, Chiebao D, Gabriel FH, Paulim L, et al. Inquérito sorológico de lentiviroses de pequenos ruminantes (Maedi-Visna e artrite-encefalite caprina) no estado de São Paulo. Braz J Vet Res Anim Sci. 2013;50(1):18-25. doi: 10.11606/issn.1678-4456.bjvras.2013.55820. Acesso em: 29 jul. 2024.

Lilenbaum W, Souza GN, Ristow P, Moreira MC, Fraguas S, Cardoso VD, Oelemann WMR. A serological study on Brucella abortus, caprine-encephalitis vírus and Leptospira in dairy goats in Rio de Janeiro, Brazil. Vet J. 2007;173:408-12.

Lima CCV, Souza TS, Martinez PM, Costa JN, Almeida MGA, Anunciação AVM, Pinheiro RR. Prevalência sorológica da artrite-encefalite caprina em rebanhos caprinos do município de Juazeiro – Bahia, Brasil. Ciênc Anim Bras. 2009;1:551-6. doi: 10.5216/cab.v1i0.7857. Disponível em: https://revistas.ufg.br/vet/article/view/7857.

Lima CCV, Costa JN, Souza TS, Martinez P, Costa Neto AO, Anunciação AVM, et al. Inquérito soroepidemiológico do lentivírus caprino e perfil das criações de caprinos na região do Baixo Médio São Francisco (BA). Arq Inst Biol. 2013;80(3):288-96. doi: 10.1590/s1808-16572013000300005.

Madureira KM, Gomes V. Prevalência da artrite encefalite caprina (CAE) em propriedades leiteiras do Estado de São Paulo. Rev Cien Vet. 2007;5:86-90.

Magalhães KA, Martins EC, Souza JDF, Barbosa CMP, Guimarães VP. Panorama e perspectiva nacional da Ovinocultura e Caprinocultura. [Internet]. Disponível em: https://www.embrapa.br/documents/1355090/0/Panorama+Nacional+Caprinocult

ura+e+Ovinocultura/39160f17-81e8-495f-837b-4233aa63832e. Acesso em: 02 nov. 2017.

Martins GA. Estatística Geral e Aplicada. 3rd ed. São Paulo: Atlas; 2006. p. 428.

Martinez PM, Costa JN, Souza TS, Costa Neto AO, Pinheiro RR. Sistemas de criação de ovinos e ocorrência de anticorpos contra o vírus da Maedi-Visna na microrregião de Juazeiro, BA. Rev Bras Saúde Prod Anim. 2010;11(2):342-53.

Melo EX, Almeida EC, Mendonça KMN, Nascimento SS, Silva JCR, Marvulo MFV, et al. Soroprevalência da infecção por lentivírus de pequenos ruminantes em abatedouros do estado de Pernambuco, Brasil. Arq Inst Biol. 2016;83:1-4. doi: 10.1590/1808-1657000462015. Acesso em: 02 nov. 2017.

Mendes BKM, Brandão IS, Lopes AKC, Peixoto RM, Pinheiro RR, Pinheiro AA. Prevalência sorológica do lentivírus caprino na mesorregião norte do estado do Ceará. In: Encontro de iniciação científica da Embrapa caprinos e ovinos; 2018; Sobral, Brasil. Anais. Sobral: Embrapa Caprinos e Ovinos; 2018. p. 39-37.

Monteiro MG, Brisola MV, Filho JEV. Diagnóstico da Cadeia Produtiva de Caprinos e Ovinos no Brasil. Texto para Discussão. 2021;1-31. doi: 10.38116/td2660. Disponível em: https://doi.org/10.38116/td2660. Acesso em: 28 jul. 2024.

Mourão PA, Lamark L, Oliveira MMM, Silva ALB. Estudo epidemiológico das lentiviroses de pequenos ruminantes na Mesorregião do Oeste Maranhense, Brasil. Pubvet. 2016;10(7):550-5. doi: 10.22256/pubvet.v10n7.550-555. Acesso em: 02 nov. 2017.

Moura Sobrinho PAM, Fernandes CHC, Ramos TRR, Campos AC, Costa LMC, Castro RS. Prevalência e fatores associados à infecção por lentivírus de pequenos ruminantes em ovinos no estado do Tocantins. Ciênc Anim Bras. 2010;11(1):117-24. doi: 10.5216/cab.v11i1.3957. Disponível em: https://revistas.ufg.br/vet/article/view/3957. Acesso em: 15 nov. 2017.

Mussi JMS. Perfil das propriedades comerciais com caprinos em Minas Gerais e sua relação com a soroprevalência do lentivírus de pequenos ruminantes [dissertação]. Belo Horizonte: Universidade Federal de Minas Gerais; 2014. 83 p.

Nascimento-Penido PMP, et al. Ocorrência do vírus da artrite encefalite caprina (CAEV) em cabras leiteiras produzidas em sistema intensivo confinado no estado de Minas Gerais. Pesq Vet Bras. 2017;37(6):577-81. doi: 10.1590/S0100-736X2017000600007. Acesso em: 15 nov. 2017.

Pinheiro RR, Andrioli A, Gouveia AMG, Ragão MAC, Martinez PM. Avaliação de antígenos para o diagnóstico de lentivírus em rebanho caprino sob programa de controle. Arq Inst Biol. 2010;77(1):133-7.

Pinheiro DNS, Costa JN, Souza TS, Lima CCV, Macedo DR, Correia GS, et al. Serum epidemiological survey and risk factors investigation for lentivirus in goats from Sisal Region, Bahia, Brazil. Arq Inst Biol. 2018;85:1-6. doi: 10.1590/1808-1657000812016. Acesso em: 15 nov. 2019.

Pomponet AS. Do consumo ao Mercado: Os Desafios Atuais para a Caprinocultura no Nordeste Semiárido da Bahia. Rev Desenbahia. 2009;(10).

Ramalho EJ. Artrite-encefalite caprina - CAE: prevalência de anticorpos séricos em caprinos criados no Estado da Bahia [tese]. São Paulo: Universidade de São Paulo; 2000. 109 p.
Rizzo H, Jesus TKS, Castro RS, Pinheiro Júnior JW, Soares LLS, Oliveira CCM, et al. Ocorrência e fatores de risco associados à infecção por lentivírus de pequenos ruminantes no Estado de Sergipe. Pesq Vet Bras. 2018;38(6):1043-50. doi: 10.1590/1678-5150-pvb-5363. Acesso em: 15 nov. 2019.

Rodrigues AS, Pinheiro RR, Brito RLL, Andrioli A, Oliveira EL, Sider LH, et al. Avaliação de um controle estratégico da artrite encefalite caprina em rebanho caprino leiteiro. Arq Bras Med Vet Zootec. 2018;70(1):139-46. doi: 10.1590/1678-4162-9537.
Rosa EP, Amorim RM, Ferreira DOL, Chiacchio SB, Rafael J. Soroprevalência da Pneumonia Progressiva Ovina (Maedi-Visna) na Região de Botucatu, SP. Ciênc Anim Bras. 2009;10(3):847-52. doi: 10.5216/cab.v10i3.1622. Disponível em: https://revistas.ufg.br/vet/article/view/1622. Acesso em: 17 nov. 2019.

Sampaio Júnior A, Batista MCS, Cruz MSP, Silva RAB, Bona Nascimento C, Werneck GL. Prevalência da infecção por lentivírus de pequenos ruminantes em caprinos em Teresina, Piauí. Arq Bras Med Vet Zootec. 2011;63(3):757-60. doi: 10.1590/s0102-09352011000300032. Acesso em: nov. 2017.

Santin A, Brito WM, Reischak D, Brito LA. Artrite Encefalite Caprina: identificação de animais soropositivos no estado de Goiás. Ciênc Anim Bras. 2006;3(1):67-71. doi: 10.5216/cab.v3i1.26813. Disponível em: https://revistas.ufg.br/vet/article/view/26813. Acesso em: nov. 2017.

Santos TCP, Peñaalfaro CE, Figueiredo SM. Aspectos sanitários e de manejo em criações de caprinos e ovinos na microrregião de Patos, região semiárida da Paraíba. Ciênc Anim Bras. 2011;12(2):206-12. doi: 10.5216/cab.v12i2.4420. Disponível em: https://revistas.ufg.br/vet/article/view/4420. Acesso em: 2017.

Sardi SI, Sena GSR, Campos GS, Santos GS, Neto ALM, Avila LN. Ocorrência de Lentivírus de Pequenos Ruminantes no Semiárido Baiano e Perfil da Caprino/ovinocultura na Região. Ciênc Anim Bras. 2012;13(4):494-503. doi: 10.5216/cab.v13i4.17429. Disponível em: https://revistas.ufg.br/vet/article/view/17429. Acesso em: ago. 2024.

Silva JS, Castro RS, Melo CB, Feijó FMC. Infecção pelo vírus da artrite encefalite caprina no Rio Grande do Norte. Arq Bras Med Vet Zootec. 2005;57(6):727-31. doi: 10.1590/s0102-09352005000600003. Acesso em: ago. 2024.

Silva RAB. Caracterização Epidemiológica das Lentiviroses de Pequenos Ruminantes na Microrregião Homogênea de Teresina, Piauí [dissertação]. Teresina: Universidade Federal do Piauí; 2011. 100 p.

Silva MLCR, Castro SC, Maia RC, Nascimento SA, Gomes ALV, Azevedo SS. Lentivírus em Caprinos Leiteiros do Semiárido Paraibano: Prevalência de Anticorpos, Fatores de Risco e Detecção Molecular. Pesq Vet Bras. 2013;33(4):453-8. doi: 10.1590/s0100-736x2013000400007. Acesso em: jul. 2024.

Sobrinho PAM, Ramos TRR, Fernandes CHC, Campos AC, Costa LMC, Castro RS. Prevalência e fatores associados à infecção por lentivírus de pequenos ruminantes em caprinos no estado do Tocantins. Ciênc Anim Bras. 2010;11(1):117-24.

Souza WH. O agronegócio da caprinocultura de corte no Brasil. Tecnol Ciên Agropec. 2007;1(1):51-8.

Souza KC, Pinheiro RR, Santos OS, Brito RLL, Rodrigues AS, Sider LH, et al. Transmission of the caprine arthritis-encephalitis virus through artificial insemination. Small Rumin Res. 2013;109(2-3):193-8. doi: 10.1016/j.smallrumres.2012.07.031. Acesso em: jul. 2024.

Souza TS. Transmissão Interespécies de Lentivírus de Caprinos para Ovinos [tese]. Salvador: Universidade Federal da Bahia; 2014. 124 p.
Teixeira WC, Santos HP, Veschi JLA, Nascimento SA, Silva JCR, Marvulo MFV, et al. Prevalência da infecção pelo vírus da Artrite Encefalite Caprina em rebanhos do estado do Maranhão, Brasil. Rev Bras Med Vet. 2016;38(1):1-6.

Rodrigues AS, Pinheiro RR, Brito RLL, Andrioli A, Oliveira EL, Sider LH, et al. Avaliação de um controle estratégico da artrite encefalite caprina em rebanho caprino leiteiro. Arq Bras Med Vet Zootec. 2018;70(1):139-46. doi: 10.1590/1678-4162-9537.

Thrusfield M. Epidemiologia Veterinária. 2nd ed. São Paulo: Roca; 2004. 556 p.

Torres JA, Campos GS, Freitas MM, Brandão CFL, Sardi SI. Produção de antígeno viral para o sorodiagnóstico da artrite-encefalite caprina utilizando um teste imunoenzimático (ELISA). Rev Cienc Med Biol. 2009;8(2):107-14. doi: 10.9771/cmbio.v8i2.4059.

Veschi JLA, Martins RJ, Zafalon LF, Costa MM, Ramos EM, Peixoto RM, Castro RS. Soroprevalência da CAE em caprinos leiteiros do território do sisal, Bahia. Biológico. 2012;73(Supl. 2):25. Disponível em:

https://ainfo.cnptia.embrapa.br/digital/bitstream/item/102867/1/PROCI-2012.00106.pdf

Vinicius MAS, Salaberry SRS, Pinheiro RR, Oliveira VSA, Andrioli A, Bombonato NG. Ocorrência da infecção pelo vírus da artrite encefalite caprina em Patos de Minas, Minas Gerais, Brasil. In: Anais 33º Congresso Brasileiro de Medicina Veterinária; 2009; Porto Seguro, BA. Porto Seguro; 2009. p. 61-89.

Yorinori EH, Pinheiro RR, Gouveia AMG, Nunes MABC, Haddad JPA. Estudo epidemiológico da artrite encefalite caprina nas regiões norte e nordeste de Minas Gerais. Rev Univ Rural. 2003;23:259-60.