

Humoral immune response to caprine arthritis-encephalitis virus in goat herds

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Abstract

The serological study was performed to assess the humoral immune response to caprine arthritis-encephalitis virus infection in goat herds. The collection of 1074 sera harvested in 76 randomly selected breeding herds was tested using commercial ELISA test. Positive and inconclusive results were verified with AGID test. As serial mode of testing was applied, only these sera which turned out positive in the latter test were classified truly positive. Eventually, 161 goats (15.0%) produced humoral immune response to CAEV. They originated from 20 (26.3%) herds. Within-herd prevalence rate of caprine arthritis-encephalitis CAE ranged from 4.2 to 80.0% with a median 33.3%. The prevalence of CAE was lowest (16.5%) in young goats and highest (55.7%) in a group of four year-old goats. The results of our investigation indicate that CAEV infection tends to spread slowly within a goat herd but eventually the seroprevalence can reach such high values that the only way to eradicate the disease is to cull the entire herd. That shows the importance of early detection of CAE in a herd which allows eradication of the disease by culling only seropositive animals.

Key words: caprine arthritis-encephalitis, lentivirus, seroprevalence, goat.

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Introduction

Caprine arthritis-encephalitis (CAE) is an infectious contagious disease of goats caused by single-stranded RNA virus belonging to the family *Retroviridae* genus *Lentivirus* [1]. Caprine arthritis-encephalitis virus infects monocytes where, thanks to the enzyme – reverse transcriptase – it changes into DNA provirus and becomes integrated into the host genome [2]. Such latent infection is life-long and persists despite vigorous humoral immune response mounted by the host usually in 2 to 8 weeks after infection. Intensively produced neutralizing antibodies are incapable of eliminating the virus although they markedly reduce its load. The virus is able to evade the humoral immune response by making various antigenic variants of itself [3]. Infected monocytes migrate to the various tissues, mainly synovium, lung, udder and central nervous system where they differentiate into macrophages. Caprine arthritis-encephalitis virus replication takes place exclusively at this moment. Infected macrophages secrete inflammatory

cytokines which attract lymphocytes and induce chronic immune-mediated inflammation in infected tissues [4, 5]. As it is a very slow process, the disease develops slowly with clinical manifestation not sooner than 12 months after infection [6]. By now no cases in which goats have cleared the infection have been reported, which is consistent with observations in other lentiviral infections in animals [7]. Therefore humoral immune response is rather the hallmark of the life-long infection than of any protective value.

Caprine arthritis-encephalitis was first described in the United States, in 1974 [8]. Even though the neurologic form was the manifestation primarily reported, it soon turned out that four other clinical presentations – polyarthritis, induration of the udder with hypogalactia, chronic interstitial pneumonia and wasting syndrome – can also be encountered, with chronic progressive polyarthritis being the most common [9]. By now CAE has been reported from all over the world [10] with confirmation in Poland in 1996 [11].

The objective of the study was to evaluate humoral immune response to CAEV infection in goat herds.

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Material and methods

The study was performed using the collection of 1074 sera from 76 randomly selected breeding goat herds in Poland, collected for diagnostic purpose. The herds were chosen out of the total number of 349 breeding herds in the one-step group sampling method in 1996. Sera originated only from adult goats (older than one year of age). There were 1004 females and 70 males.

The sera were checked using commercial immunoenzymatic test – ELISA Checkit CAEV/MVV (Dr. Bommeli AG, Bern, Switzerland). The test was performed according to the manufacturer's manual using ELISA reading device ICN Flow Titertek Multiscan Plus Mk11 (Labsystems, Espoo, Finland). All positive and inconclusive sera were confirmed with agar gel immunodiffusion test – Capriclear (Central Veterinary Laboratory, Weybridge, Great Britain). Each serum was dropped to one well, twice 24 hours apart and the ultimate result was read 48 hours of the first addition of a serum. A result was recognized positive when precipitation lines with surface antigen gp135 or core antigen p28 were clearly visible. Weak lines were classified as inconclusive. Only goats in which both tests revealed antibodies were found seropositive to CAEV.

For each herd in which seropositive goats could be detected within-herd prevalence rate (proportion of seropositive goats) was calculated. Relative frequency distribution of prevalence rate in six age groups (1, 2, 3, 4, 5 and ≥ 6 year-olds) was presented.

Results

Using ELISA test antibodies against CAEV could be detected in 187 goats from 22 herds. Results from 14 goats were inconclusive whereas in 873 goats antibodies to CAEV could not be revealed. The total number of 201 sera positive or inconclusive in ELISA was retested with AGID

and 30 of them were ruled out as negative while 2 as inconclusive. Eventually 161 goats (15.0%) turned out to mount humoral immune response to CAEV. They originated from 20 (26.3%) herds.

Within-herd prevalence rate of CAE ranged from 4.2 to 80.0% with a median 33.3% (Fig. 1). The prevalence of CAE was lowest (16.5%) in young goats and highest (55.7%) in a group of four year-old goats (Fig. 2).

Discussion

In the study humoral immune response was evaluated using two serological methods most commonly applied for diagnosis of CAE [12]. Both methods can be considered complementary for each other. ELISA is more sensitive than AGID, thus finds more seropositive animals but gives also more false positive results [13]. On the other hand AGID's specificity is superior to ELISA, hence it is a method of choice to confirm positive and verify inconclusive results. Serial testing with both aforementioned tests is likely to identify seropositive goats with the highest possible precision [14].

The results show that in the entire study population (breeding goats in Poland in 1996) specific antibodies to CAE virus were detected in 26.3% of herds and 15.0% of goats were infected. In individual herds the proportion of seropositive goats varied significantly. Variations in time which has elapsed since the first infected goat was introduced to a herd probably best explains this observation [6]. The longer CAEV is present in a herd, the more goats acquire the infection and seroconvert. In 5 of 20 (25%) herds the within-herd prevalence was low ($< 20\%$) and it seems that the disease has appeared in there recently. On the other hand in 6 (30%) herds more than a half of all goats were seropositive. Since the only way to eradicate the disease from a herd is to cull seropositive animals such high prevalence poses significant threat [6]. The only solution in such situation is to eliminate all the animals.

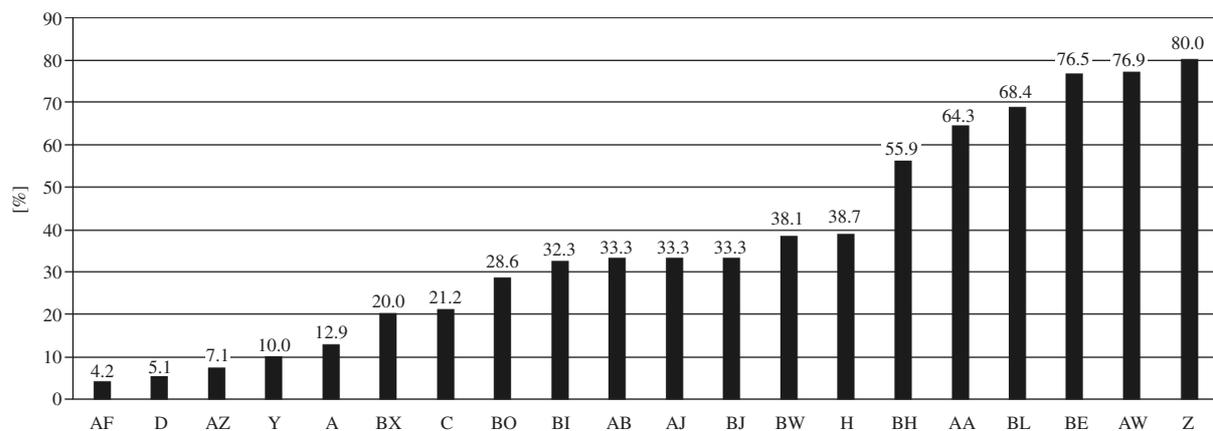


Fig. 1. Within-herd prevalence rate of CAE in seropositive goat herds

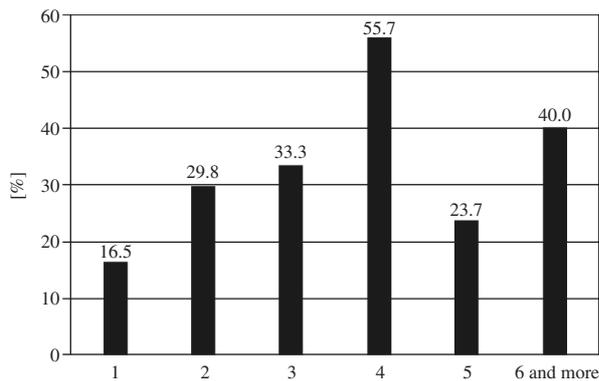


Fig. 2. Prevalence rate of CAE in age (in years) groups

Proportion of goats with antibodies is lowest in youngest animals and increases in subsequent age groups to reach the peak in four year-olds and then falls. The disease spreads mainly from infected dams to their kids by ingestion of colostrum and milk [6]. Moreover results of our study confirmed significant role of horizontal transmission in spreading the disease. The seroprevalence in one year-old goats (16.5%) is more than three times lower than in four year-olds (55.7%). This can be supported by other studies, which also show that the disease spreads slowly but continuously among animals [15, 16]. Along with the development of clinical signs more diseased than healthy goats is culled so prevalence rate in older goats declines.

The results of our investigation indicate that CAEV infection tends to spread slowly within a goat herd but eventually the seroprevalence can reach such high values that the only way to eradicate the disease is to cull the entire herd. That shows the importance of early detection of CAE in a herd which allows eradication of the disease by culling only seropositive animals.

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