# Seroprevalence of *Chlamydia abortus* in cattle and its association with abortion

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**Abstract**

*Chlamydia abortus (C. abortus)* is a Gram-negative, obligate intracellular bacterium causing enzootic abortions, especially in small ruminants. Due to its zoonotic potential, it is an important pathogen that threatens reproductive health in both animals and humans. It has been reported that *C. abortus* can cause abortion, stillbirth and underweight offspring in ruminants and can cause infection in cattle; however, epidemiological data on this subject are limited. This study was carried out to determine the seroprevalence of *C. abortus* infection in cattle and to evaluate the relationship between infection and abortion cases. A total of 200 cattle blood samples (100 aborted and 100 healthy) collected from Central Anatolia were analysed by the ELISA method. According to ELISA results, 13% of aborted cows and 2% of healthy cows were seropositive, and the difference between the groups was statistically significant ($p < 0.01$). The total seropositivity rate was determined as 7.5%, and the antibody level was found to be mild or moderate in most of the positive samples. The findings indicate that *C. abortus* can cause infection in cattle and may be the causative agent in some abortion cases. The mostly subclinical course of the infection makes diagnosis difficult and poses a hidden threat to herd health. Therefore, identifying infected animals by serological screening is important for controlling the disease. In addition, due to its zoonotic effects, *C. abortus* should be carefully monitored in terms of both veterinary public health and human health.

***Keywords:*** *Abortion, cattle, Chlamydia abortus, one health, seroprevalence*

## *INTRODUCTION*

*Chlamydia abortus (C. abortus),* formerly known as *Chlamydophila abortus* is an obligate intracellular Gram-negative bacterium known as the causative agent of enzootic abortion, especially in small ruminants (sheep and goats), causing various infections in humans, other mammals, and birds (Ganta et al., 2022; Karagul et al., 2020; Malal et al., 2020; Turin et al., 2022). Infection usually leads to severe damage to the placenta in late pregnancy and consequently to abortions, stillbirths or weak offspring. As it is a zoonotic pathogen, it can cause serious diseases in humans, especially in close contact with infected animals (Marti and Jelocnik, 2022). In this respect, it is important for public health and causes reproductive problems in humans (Turin et al., 2022). There are 13 species belonging to the Chlamydiaceae family (Ganta, 2022).

*Chlamydia pecorum*, *C. abortus* and *Chlamydia psittaci* have been detected in cattle so far. *C. abortus* affects ruminants, causing epizootic cattle abortions and reproductive problems and causing significant economic losses (Li et al., 2016). The disease has non-specific clinical manifestations with symptoms such as pneumonia, enteritis, polyarthritis, sporadic encephalomyelitis, abortion, endometritis, perinatal mortality and reproductive disorders (Ganta et al., 2022; Ye et al., 2024). In addition to acute infections, subclinical infections have also been reported in cattle. However, subclinical infections also have significant effects on livestock productivity, such as reduced live weight gain and infertility. In infected farms, especially in small holdings, economic losses are significant due to a significant decrease in milk yield, abortions, early calving and calf mortality. Infection is transmitted from contaminated pastures. In animals, transmission occurs through direct or indirect contact with respiratory, ocular or oral routes (Maji et al., 2025; Turin et al., 2022). The interaction of factors such as nutritional deficiencies, poor management, lack of hygiene and host genetics suggests that it may play a role in multifactorial diseases (Dur-e-Najaf et al., 2023). Although *C. abortus* infection has been widely described in small ruminants, data on its prevalence and effects in cattle are very limited. The limited number of studies in the literature suggests that the infection may also be subclinical in cattle and may cause reproductive problems. However, epidemiological data on the relationship between *C. abortus* and abortions in cattle are insufficient and further studies are needed (Ye et al., 2024). In Turkey, several regional studies have reported varying prevalence rates of *C. abortus* infection in sheep and goats, ranging from 5% to over 30%, depending on geographical location and herd management practices. However, comprehensive national-level data, particularly for cattle, remain scarce. Including such prevalence data underscores the potential impact of the pathogen in both species and highlights the need for targeted surveillance efforts (Aras et al., 2017; Malal et al., 2020; Koç et al., 2024; Yildirir et al., 2023). Since clinical signs of infection are generally non-specific and pathological lesions are not pathognomonic, diagnosis is very difficult (Ganta et al., 2022; Ye et al., 2024). Therefore, the detection of infected animals relies on the use of serological methods (ELISA and CFA) and DNA-based techniques (PCR and RFLP). Therefore, serological tests, especially the ELISA method, which has high sensitivity and specificity, is preferred for its availability under field conditions. ELISA tests offer a practical and effective tool for detecting both active and previous infections (Hireche et al., 2022).

This study was carried out to determine the seroprevalence of *C. abortus* infection in cattle and to evaluate the relationship between infection and abortion.

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This study aimed to determine the antibodies against *C. abortus* in bovine blood sent to Aksaray University, Faculty of Veterinary Medicine, Department of Microbiology for diagnosis by ELISA method and to determine the seroprevalence of the infection and whether there is a difference in seropositivity between aborted cows and healthy cows.

## MATERIALS AND METHODS

### *Collection of samples*

Blood samples of 200 cattle (100 aborted and 100 healthy cattle) sent to Aksaray University Veterinary Faculty, Microbiology Department from the provinces in Central Anatolia region for diagnosis were collected. Blood samples were centrifuged at 1500 x g, and sera were stored at -20°C.

### *ELISA test*

IDEXX Chlamydiosis Total Ab commercial kit (IDEXX Switzerland AG, Liebefeld-Bern, Switzerland) was used according to the manufacturer's instructions. Samples and positive and negative controls were diluted 1:400, and 100 µL of sample and control were added to the wells of each plate and incubated at 37°C for 1 hour. 100 µL of peroxidase-labelled protein G conjugate was added, plates were covered with adhesive paper and incubated at 37°C for 1 hour. After washing the plates three times, 100 µL of TMB substrate was added and incubated for 15 min at room temperature. 100 µL of stop solution was added to each well, and finally, the optical density (OD) values of the serum samples were analysed at 450 nm on an ELISA reader (BIOTEK EL×800, USA). the commercial kit, the OD value of the sample had to be ≥30% of the OD value of the positive control serum for the serum sample to be considered positive. The cut-off value was determined as 0.39. Samples above this value were considered positive (Hireche et al., 2022; Orjuela et al., 2022). Based on their values, the positive ODs were classified into 3 categories; mild (390-500), moderate (500-600) and severe (≥600) infections. The seropositivity findings obtained were determined according to the distribution of provinces.

### *Statistical analysis*

In statistical analysis, the Chi-square test was applied to evaluate the relationship between variables and $p<0.01$ was considered significant.

## *RESULTS*

The presence of antibodies against *C. abortus* was detected in 13 of 100 serum samples obtained from aborted cows (13%). In contrast, only 2 out of 100 cows in the healthy control group were seropositive (2%). The difference in seropositivity rates between the abortion group and the healthy group was statistically significant ($\chi^2$ test, $p = 0.007$; $p < 0.01$). There is a significant relationship between *C. abortus* infection and abortion. The results indicate that exposure to *C. abortus* infection is significantly higher in aborted cows compared to healthy cows. Relative Risk (RR):

The risk of seropositivity in the abortion group was 13%, the risk of seropositivity in the healthy group was 2%, and the risk of exposure to *C. abortus* in aborted cows was 6.5 times higher than in healthy cows. The risk (positivity rate) and odds ratio (positive/negative ratio) of the aborted and healthy groups were 6.5 and 7.32, respectively, and summarised in the figure (Figure 1).

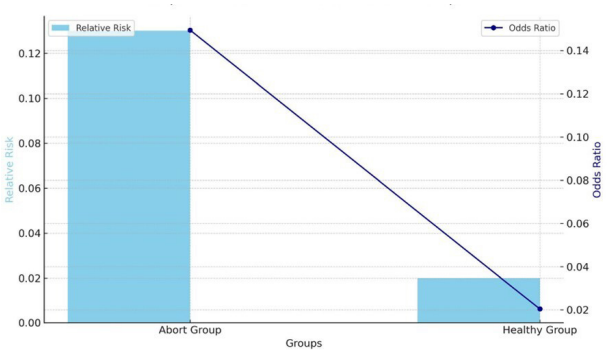


***Figure 1.*** *Comparison of relative risk and Odds ratio between groups (100 healthy, 100 aborted samples, seropositivity rates)*

According to the ELISA results, 7.5% (15/200) of the total of 200 samples were positive. Of these positive samples, 62% had mild antibodies, 30% had moderate antibodies, and 8% had high antibodies (Figure 2). In healthy animals, two seropositive samples had mild and moderate antibody positivity.

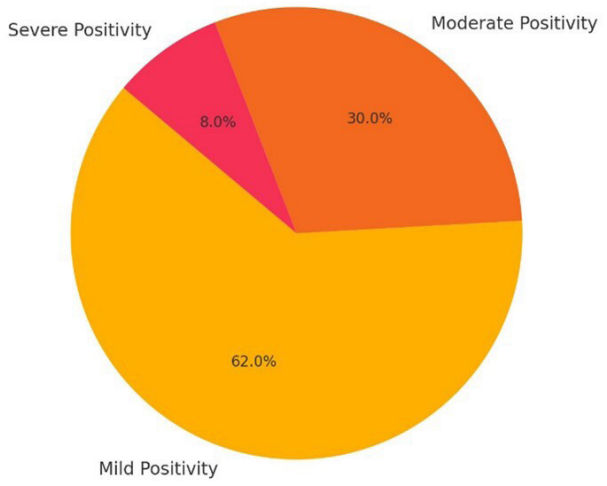


***Figure 2.*** *Antibody level distribution in positive samples*

Of the 200 samples collected within the scope of the study, 55% were from Aksaray (110 samples), 25% from Niğde (50 samples), 15% from Konya (30 samples) and 5% from Karaman (10 samples); 7.5% (15 samples) of these samples were positive; 46.7% of the positive cases were from Aksaray (7 cases, positivity rate in Aksaray was 6.36%), 40% from Niğde (6 cases, positivity rate in Niğde was 12%), 13.3% from Konya (2 cases, positivity rate in Konya was 6.67%) and no positive case was found in Karaman (0%) (Figure 3).


***Figure 3.*** *Map of Positivity Distribution by Province*

## *DISCUSSION*

*C. abortus* is an important zoonotic agent causing placentitis, abortion and neonatal losses in cattle and studies conducted in various regions in Turkey show that this agent is prevalent at certain rates. According to the ELISA results obtained in this study, 7.5% seropositivity was detected in 200 cattle samples, and antibody levels were mild (62%) and moderate (30%) in most of the positive samples. These findings indicate that most infections may be subclinical or latent. The fact that seropositivity was also observed in two healthy animals supports that the infection can spread without clinical signs.

The results obtained are like the seropositivity of 8.33% reported by Gökçe et al. (2007) in the Kars region. Lower rates have been reported in molecular-based studies supporting serological data. Karataş Yeni (2022) detected *C. abortus* DNA at a rate of 2.03% in cattle samples collected from different regions. Similarly, Aras et al. (2017) detected 3% positivity in 65 bovine fetus samples analysed by PCR in Aksaray and Konya provinces. This difference may be due to the fact that PCR shows active infections while serology shows previous infections.

The findings suggest that the prevalence of *C. abortus* in cattle may be lower compared to the 16.5% sheep foetus positivity in the study conducted by Koç Akpınar et al. (2024) in the Black Sea Region. In the aforementioned study, significantly increased oxidative stress parameters (CP, MDA, TOS, OSI) and decreased TAS level in infected foetuses revealed that infection may cause systemic effects at the tissue level and may be supported by biochemical markers.

In general, studies conducted in different regions of Turkey and the findings obtained from this study reveal that *C. abortus* is low to moderately prevalent in cattle and that the combined use of PCR and ELISA in diagnosis is valuable in identifying both active and transmitted forms of infection. In this context, integration of regular screening, isolation measures and vaccination programmes can provide more effective control in terms of both animal health and zoonotic risk.

When compared with the international literature; Wilson et al. (2012) in Ireland reported 4.75% positivity at the individual level and 57% positivity at the herd level in a study conducted in 100 herds. In Belgium, Yin et al. (2014) reported a seroprevalence of 1.69%, while positivity at herd level reached 14.7%. These rates are low compared to the 7.5% rate obtained in our study. However, in Iraq, Al-Magsoosi et al. (2022) reported a seropositivity rate of 17.03%, indicating a higher level of antibody presence. As in this study, it was observed that positivity was mostly limited to mild antibodies in our study.

In a study conducted in Colombia, Góngora Orjuela et al. (2022) reported a seroprevalence of 47.1% in a population of 514 cattle. This rate is quite high and suggests that *C. abortus* is endemic in the region. In a study conducted by Marzok et al. (2023) in Egypt, seroprevalence was found to be 20.75% and it was emphasised that risk factors such as age, herd size, disinfection practices and abortion history were significantly associated with infection. Similarly, the limited number of animals with high antibody levels in our study suggests that the infection tends to be subclinical.

The main reasons for these differences in seroprevalence rates include the test methods used, age and sex distribution of animals, herd management conditions, geographical and climatic differences and the endemic status of the infection in the region. In addition, the predominance of individuals with mild antibody levels in the classification according to antibody levels indicates that the infection is either detected at an early stage or the carrier status is common. This finding was also reported in similar studies conducted in Iraq and Belgium (Yin et al., 2014; Al-Magsoosi et al., 2022).

In this study, significant differences were observed in positivity rates between provinces. The highest seropositivity rate was found in Niğde with 12%, followed by Konya (6.67%) and Aksaray (6.36%), while no positivity was found in Karaman. The high rate in Niğde shows the effect of regional differences on the prevalence of infection. These differences may be due to local husbandry practices such as herd management, hygiene practices and animal mobility. Therefore, it is important to address the infection at the regional level and to shape control strategies according to local conditions.

## CONCLUSION

In this study, it was shown that *C. abortus* infection is a factor that should not be ignored in cattle, especially in abortion cases. Significantly high seropositivity in aborted cows indicates that this pathogen may be a contributing factor in bovine abortion cases. Although *C. abortus* does not stand out as the main cause of abortion in cattle, the findings indicate that this pathogen may contribute to the aetiology of abortion. Indeed, seropositivity in 13% of aborted cows may indicate a previous or current infection, whereas antibodies were not detected in 87% of aborted cows, suggesting that most abortion cases were due to other causes. On the other hand, 2% seropositivity in the control group of healthy cows suggests that the infection may be subclinical in some individuals.

In conclusion, it is essential to emphasize the importance of future surveillance or control programs. This situation requires consideration of the infection from both herd health and public health perspectives and contributes to the development of widespread controls and preventive strategies thanks to the applicability of serological screening methods in the field.

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**Conflict of interest**

The authors declared that there is no conflict of interest.

**Ethical statement**

This study was approved by the Aksaray University Animal Experiments Local Ethics Committee, Aksaray, Türkiye (Approval no: 2025-4-32).

**Author contributions**

GS contributed to the project idea and design. GS contributed to the execution of the study. GS contributed to the data collection. GS read and approved the final version of the manuscript.

**Availability of data and materials**

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

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