

Research Article



Serodiagnosis and Antigenic Evidence of Goat Contagious Pleuropneumonia

MAHMOOD T AL-LAHIBI, MAAB I. AL-FARWACHI*

Department of Internal and Preventive Medicine, College of Veterinary Medicine, University of Mosul, Mosul, Iraq.

Abstract | Goat contagious pleuropneumonia (GCP) is one of the most important caprine respiratory mycoplasmosis and result in considerable economic losses. Between September and December 2025, 200 sera (100 does and 100 Bucks) were collected from different ages ($< 1\text{years}=100$, $\geq 1\text{years} =100$) of unvaccinated local breed goats from 25 flocks. The animals were selected at random and categorized depending on their clinical status at the time of sampling (one hundred sera were obtained from goats without respiratory sign, while 100 sera were collected from goats with respiratory symptoms). All sera were analyzed for the presence of serum antibodies against GCP using the commercially available contagious caprine pleuropneumonia antibody (GCP-Ab ELISA) Kit and goat contagious pleuropneumonia (GCP-Ag ELISA) Kit. The GCP -Ab ELISA detected antibodies in 42 animals, yielding a total seroprevalence of 21% (95% CI: 15.9-27.2%), whereas the GCP-Ag ELISA identified antigen in 10 animals (5%, 95% CI: 2.7-9.0%). The agreement between both assays appeared slight (Cohen's $\kappa = 0.10$). Does had significantly higher seropositivity compared to bucks by using both assays. Adult goats ($>1\text{ year}$) had the highest antibody prevalence (36%, $P < 0.001$). Clinically, antibodies were found in 32.0% of goats without respiratory signs and in 10.0% of animals with respiratory signs ($P < 0.05$), while all antigen-positive goats showed respiratory symptoms. Correspondingly, Does showed a significantly higher risk of GCP compared to bucks (OR = 20.7 for GCP-Ab ELISA and OR = 23.4 for GCP-Ag ELISA; $P \leq 0.002$), and adults were more likely to be seropositive than young goats (OR = 8.8, $P = 0.001$) by using GCP-Ab ELISA. Goats with respiratory symptoms had considerably increased probabilities of testing positive for both assays ($P = 0.001$). In conclusion, GCP is present in the study area, accompanied by elevated antibody detection reflecting previous exposure or subclinical infection and antigen detection confirming acute infection. Age, gender, and clinical state all had an impact on disease identification, emphasizing the complementary roles of both ELISAs for accurate herd-level surveillance and diagnosis.

Keywords | ELISA, Contagious caprine pleuropneumonia, Goats, Respiratory infection, Iraq, serodiagnosis

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***Correspondence** | Maab I. Al-Farwachi, Department of Internal and Preventive Medicine, College of Veterinary Medicine, University of Mosul, Mosul, Iraq; Email: maabalfarwachi@yahoo.com

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INTRODUCTION

Goat contagious pleuropneumonia (GCP) is caused by the F38 biotype of *Mycoplasma*, which is currently reclassified as *M. capricolum subspecies capri pneumoniae* (Mccp), (Ahaduzzaman, 2021; Ali *et al.*, 2024). This

particular Mycoplasmal illness is exceedingly contagious in goats; morbidity is usually 100%, and mortality can range from 60% to 100% (Ahmad *et al.*, 2025; Yattoo *et al.*, 2018; 2019). The clinical signs of infection include anorexia, listlessness, pyrexia, cough, and dyspnoea, with accompanied grunting and a wide-based forelimb posture (Elhassan and

Salama, 2018; Tharwat *et al.*, 2025). On autopsy, fibrinous pleuritis and pleural effusion are frequently present, with occasionally pericarditis; the lung lobes (unilateral or bilateral) are swollen, hard, and varied with red, yellow, white, and grey foci (Yatoo *et al.*, 2019; Kabir *et al.*, 2021; Tharwat *et al.*, 2025). The diagnostic procedure requires the collection and transport of specimens specifically under sterile and standardized conditions to confirm its accuracy (WOAH, 2021). Despite isolation and identification of *Mycoplasma capricolum* subsp. *capripneumoniae* (Mccp) remain the diagnostic gold standard for GCP (WOAH, 2021), and polymerase chain reaction assays are now more frequently being used as reference procedures (Elhassan and Salama, 2018; Yatoo *et al.*, 2018; WOA, 2021). Both approaches have significant practical limitations. The isolation of Mccp is technically difficult due to its extreme fastidiousness, necessitating specialized culture media, prolonged incubation periods, and highly controlled laboratory environments (Elhassan and Salama, 2018). Similarly, while PCR has great sensitivity and specificity, its use in routine diagnosis is frequently limited in resource-constrained and field settings due to the need for specialized equipment, consistent electricity, and trained workers (Teshome *et al.*, 2019; Elhassan and Salama, 2018; WOA, 2021). Serological assays are extensively employed for herd-level surveillance of GCP; yet, their diagnostic efficacy fluctuates based on the specific antigen identified (Ali *et al.*, 2024). Antibody-based ELISA (Ab-ELISA) is effective for detecting prior exposure and subclinical infections, while antigen-based ELISA (Ag-ELISA) is more representative of current infections, but typically at lower detection rates (Hay and Westwood, 2002; March *et al.*, 2002; Wesonga *et al.*, 2004). Direct ELISA (Antigen detection) is a quick, reliable, and cost-effective diagnostic method that allows for direct detection of Mccp antigens, facilitating timely case identification (Hay and Westwood, 2002). Field-use screening for antibody response of animals to Mccp, including the latex agglutination test and complement fixation test, exhibit variable sensitivity and cross-reactivity with other *Mycoplasma* species (Peyraud *et al.*, 2014; Elhassan and Salama, 2018; Ogeto, 2022). Consequently, different types of ELISA (including blocking, competitive, and indirect) have been industrialized to improve diagnostic sensitivity and specificity, allowing for more reliable differentiation of GCP from other mycoplasmal infections (Sharew *et al.*, 2005; Peyraud *et al.*, 2014; Jean de Dieu *et al.*, 2019; Khan *et al.*, 2024).

The disease is widespread in Africa, with confirmed cases in Ethiopia, Kenya, Uganda, Tanzania, Sudan, Morocco, and Algeria, as well as in several Asian countries, including India, Pakistan, China, and multiple nations of Middle Eastern countries such as Saudi Arabia, Oman, Yemen,

Iran, the United Arab Emirates, Qatar, Turkey, and Jordan (WOAH, 2021). Recently, GCP was detected serologically from pneumonic goats in Iraq (Al-Lahibi and Al-Farwachi, 2025).

Although the disease is routinely diagnosed in Iraq based on clinical signs, post mortem findings and serology, no scientific research document the isolation or antigenic detection of the causative agent in the country till now. Therefore, the main goal of this study was to confirm the diagnosis of GCP in diseased goats using both serological and antigen detection ELISA methods. It also aimed to assess the diagnostic performance and agreement of the GCP-Ab ELISA and GCP Ag-ELISA assays. The study also looked at the relationship between GCP detection and sex, age, and clinical state in order to better understand disease epidemiology and assist efficient surveillance methods.

MATERIALS AND METHODS

AREA OF STUDY

Mosul is one of the largest cities in Iraq, situated in the northern part of the country, just about 400 km (250 miles) north of Baghdad on the Tigris. The area of the city is 32,308 km². This city has four discrete seasons with dissimilar rainfall periods in autumn, winter, and early spring that ranged between 400-860 millimeters. This zone is branded by diverse districts, such as rivers, fields pastures, and agricultural lands with biological variety.

STUDY DESIGN AND ANIMALS' POPULATION

A cross-sectional study was conducted from September to December 2025 on unvaccinated local breed goats from 25 flocks. The sample size (n = 200) was calculated using the formula for estimating a proportion with 95% confidence and 5% precision, assuming an expected prevalence of 20% based on previous studies (Charan and Biswas, 2013).

Flocks were selected randomly from the study area, and within each flock, animals were chosen using simple random sampling. To ensure balanced representation, 100 animals were under 1 year of age and 100 were ≥1 year, with equal numbers of does (n = 100) and bucks (n = 100). Animals were also categorized based on clinical status: 100 goats exhibited respiratory signs (coughing, nasal discharge, and dyspnea), while 100 goats showed no clinical signs. Blood samples were collected via jugular venipuncture, allowed to clot at room temperature, and centrifuged at 3,000 rpm for 10 minutes to separate serum, which was then stored at -20 °C until analysis.

SEROLOGICAL TESTS

GCP-Ab ELISA kit (ID SL0128Gt, Sunlong Biotech

Co., Hangzhou, China) was used to detect anti-GCP antibodies, and the assay was performed according to the manufacturer's instructions. This test was considered the reference standard for antibody detection. It has previously been validated against the latex agglutination test (Al-Lahibi and Al-Farwachi, 2025). The optical density (OD) values were calculated using an ELISA plate reader (Multiskan FC, Thermo Fisher Scientific, USA) at a wavelength of 450 nm.

The effectiveness of the assay was determined based on control values, where the mean optical density (OD) of the positive control was ≥ 1.00 and the mean OD of the negative control was ≤ 0.10 . The cut-off value was calculated as the mean OD of the negative control plus 0.15. Samples with OD values lower than the cut-off were considered GCP-Ab negative, whereas samples with OD values equal to or greater than the cut-off were classified as GCP-Ab positive.

GCP antigen was detected using a commercial sandwich ELISA kit (SL0015Gt; SunLong Biotech Co., Ltd., Hangzhou, China). The test uses a double-antibody sandwich approach and is designed for qualitative antigen detection in goat serum. In this test, samples were placed in microplate wells pre-coated with GCP-specific capture antibodies. Following incubation and washing, an HRP-labeled detection antibody specific to the GCP antigen was added. After a second washing phase, enzymatic activity was detected using the TMB substrate, and the reaction was halted with acid. Absorbance was measured at 450 nm, and the results were classed as positive or negative by comparing them to the cut-off value determined from the negative control. All step and result interpretations were performed strictly according to the manufacturer's directions.

STATISTICAL ANALYSIS

Data were input and analysed with STATA 13.0 (StataCorp, College Station, TX, USA). Descriptive statistics were used to summarize the findings, which were expressed as frequencies and percentages. Cohen's kappa coefficient (κ) was utilized to evaluate the agreement between both tests. The discrepancies between both assays were analyzed using McNemar's test to establish their statistical significance. Associations between categorical variables (gender, age, and clinical status) and ELISA results were evaluated using the Chi-square (χ^2) test, or Fisher's exact test, as appropriate (The Fisher's exact test was utilized in instances of zero cell counts, and infinite odds ratios were qualitatively determined). The strength of the link was determined by using odds ratios (ORs) with 95% confidence intervals (CIs). P-values < 0.05 were considered statistically significant.

RESULTS

Out of 200 serum samples examined, antibodies against GCP were detected in 42 goats, giving an overall seroprevalence of 21.0% (95% CI: 15.9–27.2%) as determined by the CCPP-Ab ELISA. In contrast, GCP antigen was detected in 10 animals (5.0%, 95% CI: 2.7–9.0%) using the GCP-Ag ELISA. McNemar's test revealed a significant difference between the both tests ($P < 0.0001$; Table 1).

Table 1: Results of diagnostic tests used for detection of goat contagious pleuropneumonia.

Diagnostic tests	Number of examined animals	Number of seropositive animals	95% Confidence intervals
GCP-Ab ELISA	200	42(21.0%)	15.9–27.2%
GCP-Ag ELISA	200	10(5.0%)	2.7–9.0%

McNemar's test revealed a highly significant difference between GCP-Ab ELISA and GCP-Ag ELISA results ($\chi^2 = 27.57$, $P < 0.0001$).

The agreement between the two ELISA assays was assessed using Cohen's kappa, which yielded $\kappa = 0.10$, indicating slight agreement (Table 2).

Table 2: Contingency table comparing GCP-Ag ELISA (Direct ELISA) and GCP-Ab ELISA (Indirect ELISA) results for detection of CCPP in goats (n = 200).

	Direct ELISA Positive	Direct ELISA Negative	Total
Indirect ELISA Positive	5 (True Positive)	42 (False Negative)	47
Indirect ELISA Negative	5 (False Positive)	148 (True Negative)	153
Total	10	190	200
Cohen's $\kappa = 0.10$			

Analysis according to gender revealed a significantly higher seropositivity rate among does compared to bucks. Using the GCP-Ab ELISA, 39.0% of does (39/100; 95% CI: 29.4–49.3) were seropositive, whereas only 3.0% of bucks (3/100; 95% CI: 0.6–8.5) tested positive ($P < 0.001$) (Table 3). Similarly, antigen detection by the GCP-Ag ELISA was recorded exclusively in does (10.0%, 10/100; 95% CI: 4.9–17.6), while no bucks were antigen-positive, with this difference being statistically significant (Table 4).

Antibodies responded to Mccp (using GCP-Ab ELISA) varied significantly among age groups. The highest seropositivity rate was observed in goats aged ≥ 1 years (36.0%, 95% CI: 26.7–46.2, $P < 0.001$), compared with animals aged < 1 years (6.0%, 95% CI: 2.2–12.6, 2.2–12.6), (Table 3). In contrast, GCP antigen detected by the GCP-

Ag ELISA did not differ significantly among age groups ($P=0.52$; Table 4).

According to clinical status, antibodies responded to GCP were detected in 32.0% (32/100, 95% CI: 22.9-42.2, $P < 0.001$) of animals without respiratory signs, and in 10% of goats exhibiting respiratory signs (Table 3). All animals that tested positive by the GCP-Ag ELISA were recorded in goats with respiratory signs (10.0%, 10/100, 95% CI: 4.9-17.6, $P < 0.001$; Table 4).

Correspondingly, does had significantly higher odds of

GCP seropositive than bucks, with odds ratio (OR) of 20.7 (95% CI: 6.1-70.4, $P = 0.001$) for GCP-Ab ELISA and 23.4 (95% CI: 1.3-410.2, $P = 0.002$) for GCP-Ag ELISA, indicating that does were much more likely to be infected than bucks. Adult goats (≥ 1 year) were more likely to be seropositive than young goats (< 1 year) (OR = 8.8, 95% CI: 3.5-22.2, $P = 0.001$), whereas age was not significantly associated with GCP-Ag ELISA (OR = 1.5, 95% CI: 0.4-5.5, $P = 0.52$). Goats showing respiratory signs had higher likelihood of testing positive for both assays compared to animals without respiratory signs ($P = 0.001$; Table 5).

Table 3: Distribution of results of antibody detection against goat contagious pleuropneumonia using GCP-Ab ELISA according to sex, age, and clinical statuses.

	Variables (number of examined animals)	Number of positive (%)	Number of negative (%)	95% Confidence intervals	P value
Gender	Bucks (N=100)	3(3.0)	97(97.0)	0.6-8.5	$P < 0.001$
	Does (N=100)	39(39.0)	61(61.0)	29.4-49.3	
Age (years)	< 1 (N=100)	6(6.0)	94(94.0)	2.2-12.6	$P < 0.001$
	≥ 1 (N=100)	36(36.0)	64(64.0)	26.7-46.2	
Clinical status	Goats without respiratory signs (N=100)	32(32.0)	68(68.0)	22.9-42.2	$P < 0.001$
	Goats with respiratory signs (N=100)	10(10.0)	90(90.0)	4.9-17.6	

P value calculated using Chi-square test.

Table 4: Distribution of results of antigen detection of goat contagious pleuropneumonia using GCP-Ag ELISA according to gender, age, and clinical statuses.

	Variables (number of examined animals)	Number of positive (%)	Number of negative (%)	95% Confidence intervals	P value
Gender	Bucks (N=100)	0(0.0)	100(100)	0.0-3.6	0.002*
	Does (N=100)	10(10.0)	90(90.0)	4.9-17.6	
Age (years)	< 1 (N=100)	4(4.0)	96(96.0)	1.1-9.9	0.52
	≥ 1 (N=100)	6(6.0)	94(94.0)	2.2-12.6	
Clinical status	Goats without respiratory signs (N=100)	0.0	100(100)	0.0-3.6	$P < 0.001^*$
	Goats with respiratory signs (N=100)	10(10.0)	90(90.0)	4.9-17.6	

P value calculated using Chi-square test. *Fisher's exact test was applied due to zero cell counts.

Table 5: Comparative odds ratios for GCP-related risk variables utilizing GCP-Ab ELISA and GCP-Ag ELISA.

Variables	GCP-Ab ELISA		GCP-Ag ELISA	
	Odds ratio (95% confidence intervals)	P value	Odds ratio (95% confidence intervals)	P value
Gender				
Buck (Ref.)	1.0 (Ref.)	0.001	1.0 (Ref.)	0.002
Does	20.7(6.1-70.4)		23.4(1.3-410.2)	
Age				
< 1 year	1.0 (Ref.)	0.001	1.0 (Ref.)	0.52
≥ 1 year	8.8(3.5-22.2)		1.5(0.4-5.5)	
Clinical status				
Goats without respiratory signs	1.0 (Ref.)	0.001	1.0 (Ref.)	0.001
Goats with respiratory signs	4.2(1.9-9.4)		∞ (3.2- ∞)	

Ref. = Reference category. Infinite OR (∞) indicates zero positive cases in the reference group.

The current investigation confirms the presence of Mccp for the first time in the study area, emphasizing its continued importance as a major health limitation in goats. This was confirmed by overall seropositive of 21.0% using GCP-Ab ELISA and by the detection of Mccp in the 5% of the examined animals using GCP-Ag ELISA. GCP was initially confirmed in Iraq in 2025 using serological testing (indirect ELISA) (Al-Lahibi and Al-Farwachi, 2025).

The overall seropositive of 21.0% detected by GCP-Ab ELISA is comparable to findings reported in several endemic regions (Chandio *et al.*, 2019; Hussain *et al.*, 2021). Several other studies have shown higher prevalence rates than the current finding. Kipronoh *et al.* (2016) found a prevalence of 47.2% in Kenya; Ingle *et al.* (2008) reported a prevalence of 33.67% in Pakistan; and Mbyuzi *et al.* (2014) reported a prevalence of 52.1% in Tanzania. Lower prevalences were seen in Nepal (4.71%) (Regmi *et al.*, 2023) and Ethiopia (4.7%) (Getachew *et al.*, 2025). Differences in the climate, animal husbandry, sampling approach, sample size, agricultural ecology, population density, sampling duration, laboratory test utilized, and research area may explain the discrepancy in estimated seroprevalence.

On the contrary, the lower antigen positivity rate (5.0%) observed using GCP-Ag ELISA is consistent with previous studies indicating that antigen detection assays primarily identify animals with active infection, during which the pathogen load is sufficiently high to be detected (Hay and Westwood, 2002). This disparity between antibody and antigen detection emphasizes the stage-dependent nature of GCP diagnosis and supports the two ELISA tests complimentary diagnostic roles. Higher antibody detection rates have been attributed to prior exposure, chronic infection, or subclinical infection or carriers (Liljander *et al.*, 2015). In addition, experimental studies have demonstrated that antibody responses can persist well beyond the acute phase of GCP, and that serological status does not always correlate with the presence of clinical disease. And explain why antibody-based assays generally yield higher positivity rates than direct antigen or pathogen detection methods (Hay and Westwood, 2002; March *et al.*, 2002; Wesonga *et al.*, 2004).

Mccp antigens can be detected in pulmonary tissue by indirect immunobinding assay (Guerin *et al.*, 1993), sodium dodecyl sulfate (SDS)-polyacrylamide gel electrophoresis with mycoplasmas concentrated from pleural fluid (Thiaucourt *et al.*, 1992), Immunohistochemistry (Wesonga *et al.*, 2004), immunostaining, gel immunoprecipitin tests (Manso-Silván and Thiaucourt, 2019) and sero antigen detection by latex agglutination test (March *et al.*, 2000) has been

described. The present research used the double antibody sandwich ELISA technique for qualitative detection of GCP antigen (GCP-Ag ELISA). The microplate wells are pre-coated with GCP-specific antibodies. Following incubation, the sample's corresponding antigen binds to the immobilized antibodies. Notably, this study is the first to utilize antigen-detection ELISA for GCP diagnosis in Iraq, offering an effective technique for identifying active infection and also providing necessary background information for epidemiological surveillance and disease control.

The slight agreement between GCP-Ab ELISA and GCP-Ag ELISA ($\kappa = 0.10$) observed in the present study is in line with previous reports comparing serological and antigen-based assays for GCP, where limited concordance has been attributed to differences in test sensitivity, specificity, and the temporal dynamics of infection (March *et al.*, 2000; Liljander *et al.*, 2019).

Conspicuously, all antigen-positive animals were also antibody-positive, while a considerable proportion of antibody-positive animals were antigen-negative. Similar findings have been documented in endemic settings, suggesting that antibody ELISA (Indirect) is more suitable for epidemiological surveillance, whereas antigen ELISA (direct) is more appropriate for confirming active disease (Thiaucourt *et al.*, 1996; Jean de Dieu *et al.*, 2019, 2020).

Furthermore, the highly significant result of McNemar's test ($P < 0.0001$) confirms that GCP-Ab ELISA detected significantly more positive animals than GCP-Ag ELISA. This observation concurs with previous studies reporting higher detection rates for antibody-based assays due to the persistence of antibodies after clearance or reduction of the pathogen (Peyraud *et al.*, 2014; Liljander *et al.*, 2015).

Gender has significant effects on antibody seropositivity and antigen detection of GCP in goats, with does having higher probabilities (high odds ratio) and seropositivity than bucks. This result supports previous research showing that stressors and hormonal changes associated with pregnancy, lactation, and prolonged exposure to antigen, may make does more susceptible to infection or stronger antibody responses. Bucks, on the other hand, are frequently in fewer numbers and are more likely to be marketed or replaced, reducing their chances of prolonged exposure to ill. These results are in agreement with the results of previous scientific work by Wazir *et al.* (2016) who found more positive results in does (4.01%) as compare to bucks (3.33%). Additionally, the same results were obtained by Parray *et al.* (2019), Regmi *et al.* (2023), and Ahmad *et al.* (2025). However, the current data contradict Suryawanshi *et al.* (2015), who found more cases of seropositivity in bucks compared to does. Several studies have revealed that

does and bucks are equally susceptible to GCP (Abrhaley *et al.*, 2019; Lugonzo *et al.*, 2023; Ashagrie *et al.*, 2024; Moti *et al.*, 2024; Ahmad *et al.*, 2025; Getachew *et al.*, 2025).

Goats older than one year had the highest seropositivity rate (36.0%, 95% CI: 26.7-46.2, $P < 0.001$) and higher odds of exposure compared to animals younger than one year (6.0%, 95% CI: 2.2-12.6, 2.2-12.6), because of the production of new naïve lymphocytes and the functional competency of memory cell populations decline with ageing (Zimmerman *et al.*, 2013).

Goats aged ≥ 1 years are frequently at maximum production efficiency and in close contact with the rest of the herd. This age group typically has multiple exposure opportunities, resulting in increased antibody detection (Goats are social animals and those over one year old, especially bucks and productive does, are typically kept in close, regular contact with the rest of the herd in order to manage mating and social hierarchies). Several studies were reported a higher odds ratio in old-aged goats than young-aged goats (Abrhaley *et al.*, 2019; Ashagrie *et al.*, 2024).

Young animals (<1 year) may have had shorter exposure duration or underdeveloped immune responses, leading in lower positive rates. Similarly, Selim *et al.* (2021) found the same results with high prevalence (48.7 %) in older goats relative to younger. In an Ethiopian investigation, age was related with seropositivity, with an odds ratio of 1.47, showing that older goats are more likely to test positive for GCP (Teshome *et al.*, 2019).

However, numerous studies show no significant association between age and GCP seroprevalence (Abrhaley *et al.*, 2019; Moti *et al.*, 2024; Getachew *et al.*, 2025).

In the present study, although, antibodies responded to GCP were detected in 32.0% of animals without respiratory signs, and in 10% of goats exhibiting respiratory signs. All animals that tested positive by the GCP-Ag ELISA were recorded in goats with respiratory signs, indicating a strong association between antigen detection and pneumonic cases. Goats showing respiratory signs had higher odds ratios of testing positive using both assays (GCP-Ab ELISA and GCP-Ag ELISA) compared to animals without respiratory signs.

The antibody levels were statistically greater among goats without respiratory signs, indicating the presence of subclinical or previous infections in the population. However, odds ratio calculations revealed those goats with respiratory symptoms had a significantly higher probability of seropositivity. This apparent disparity is due

to a basic difference between prevalence estimates and odds-based measures of association, which account for the distribution of both positive and negative animals within a category. These findings highlight the importance of interpreting prevalence and odds ratios as complimentary epidemiological parameters rather than contradicting ones.

Notably, antigen positivity was exclusively detected in goats with respiratory signs, yielding in an infinite odds ratio. This finding highlights the strong association between clinical manifestation and active infection and reinforces the value of antigen detection assays in identifying clinically relevant cases. The wide confidence intervals observed for antigen-based odds ratios reflect the limited number of antigen-positive animals and should therefore be interpreted cautiously, as also reported in similar field-based studies.

In summary, the present study confirms the endemicity of GCP in the study area and demonstrates the complementary diagnostic value of antibody and antigen ELISA assays. The identification of key risk factors associated with exposure and active infection provides valuable information for targeted surveillance and control strategies. Integrating serological and antigen-based diagnostics is recommended to achieve a more accurate understanding of GCP epidemiology under field condition.

CONCLUSION

GCP is present in the study area, as shown by antibody and antigen detection in goats. The GCP-Ab ELISA identified more positive animals, including subclinical cases, whereas the GCP-Ag ELISA detected only those with active respiratory disease, with fair agreement between the two assays. Antibodies respond and antigen detection were influenced by gender, age, and clinical status with higher rates in does and in adult goats with respiratory signs.

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NOVELTY STATEMENT

This study provides one of the first comprehensive investigations of goat contagious pleuropneumonia (GCP) in local goat populations of the study area using both antibody- and antigen-based ELISA assays simultaneously. Unlike previous studies that relied on a single diagnostic approach, the present work compared serological evidence of exposure with antigen detection

of active infection, allowing a more complete assessment of disease status at the herd level. Furthermore, the study evaluated the influence of major risk factors, including age, sex, and clinical status, and quantified their association with GCP occurrence through odds ratio analysis. The findings highlight the occurrence of both subclinical exposure and active infection among goats and demonstrate the complementary diagnostic value of antibody and antigen ELISAs for epidemiological surveillance and disease control programs.

AUTHOR'S CONTRIBUTION

Concept, supervision, literature search and writing manuscript: MAL-F. Design, resources, data collection and processing and analysis and, interpretation: MAL-F. and MTA. Critical review: MAL-F and MTA.

ETHICAL APPROVAL

The College of Veterinary Medicine Committee, University of Mosul provided its approval to this study (Approval number: UM.VET. 2025.038; Dated 7/8/2025).

GENERATIVE AI AND AI ASSISTED TECHNOLOGY STATEMENT

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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