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Prevalence and antimicrobial susceptibility of *Ureaplasma* spp. and *Mycoplasma hominis* isolated from cervical swabs of pregnant women: A 7-month microbiological study

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ABSTRACT

Introduction: *Ureaplasma* spp. and *Mycoplasma hominis* are among the most frequently identified microorganisms within the female urogenital tract. Although they are often detected in asymptomatic individuals, their presence during pregnancy has been associated with adverse outcomes, including preterm birth, spontaneous abortion, and intrauterine infection. However, their exact clinical significance remains incompletely defined. This study aimed to assess their prevalence, bacterial load, and antimicrobial susceptibility among pregnant women.

Methods: A retrospective analysis was performed using routinely collected laboratory data, with no additional intervention. A total of 158 cervical swab specimens collected over a 7-month period were included in the study. Identification, quantification, and susceptibility testing were carried out using the Mycoplasma IST3 system. A bacterial load threshold of $\geq 10^4$ CFU/mL was defined as clinically relevant. Statistical evaluation was conducted using the Chi-square test.

Results: Out of 158 samples, genital mycoplasmas were detected in 39.9% of cases. *Ureaplasma* spp. represented the most frequently isolated organism, while *M. hominis* was identified less often and predominantly in mixed infections. The majority of positive specimens demonstrated bacterial concentrations $\geq 10^4$ CFU/mL. Overall, isolates exhibited high susceptibility to most tested antimicrobial agents, with resistance observed only to levofloxacin. Post-treatment follow-up indicated that persistence of infection was relatively frequent.

Conclusion: These findings indicate that genital mycoplasmas are commonly present in pregnant women and may persist despite appropriate antimicrobial therapy. This emphasizes the importance of routine microbiological follow-up and careful selection of treatment strategies to minimize potential adverse pregnancy outcomes.

Keywords: *Ureaplasma* spp.; *Mycoplasma hominis*; pregnancy; cervical swab; antimicrobial susceptibility; bacterial load

INTRODUCTION

Genital mycoplasmas, particularly *Ureaplasma* spp. and *Mycoplasma hominis*, are members of the *Mycoplasmataceae* family and constitute a unique group of microorganisms characterized by distinctive biological properties. A key feature of these organisms is the lack of a rigid cell wall, which determines their antimicrobial susceptibility pattern and accounts for their intrinsic resistance to antibiotics targeting cell wall synthesis (1-3).

These bacteria are frequently encountered within the female urogenital tract, where they may be part of the commensal microbial community (4). Nevertheless, their detection does not always indicate a benign state, as under certain conditions they can act as opportunistic pathogens and contribute to urogenital infections, particularly when host immunity or environmental balance is disrupted. Colonization is relatively common among sexually active women, although reported prevalence differs depending on population characteristics and diagnostic approaches (5,6).

Recent molecular studies in pregnant women have further confirmed the epidemiological importance of genital mycoplasmas and other sexually transmitted pathogens during pregnancy (7-9).

During pregnancy, the presence of genital mycoplasmas becomes clinically more relevant. Previous studies have proposed associations with adverse obstetric outcomes, including preterm labor, premature rupture of membranes, spontaneous abortion, and intrauterine infection (10,11). However, published data remain inconsistent, and the precise clinical significance of these organisms is still not fully established.

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Epidemiological evidence generally shows that *Ureaplasma* spp. is detected more frequently than *M. hominis* (5,6). Similar patterns have been reported across different regions, including studies from Bosnia and Herzegovina, where relatively high prevalence has been documented. Despite these findings, locally available data remain limited, indicating the need for further investigation (12).

Another important consideration is antimicrobial susceptibility. Owing to their structural characteristics, genital mycoplasmas show intrinsic resistance to certain antibiotic classes. In addition, increasing resistance to commonly used agents such as macrolides and fluoroquinolones has been reported in recent years, raising concerns regarding therapeutic effectiveness (1,13-15).

These evolving resistance patterns may influence treatment outcomes and clinical decision-making. Given the limited regional evidence and the potential relevance of these organisms in pregnancy, further research is warranted (2,16). Accordingly, this study aimed to assess the prevalence, bacterial load, and antimicrobial susceptibility of *Ureaplasma* spp. and *M. hominis* in cervical swab samples collected from pregnant women over a 7-month period.

METHODS

This research was designed as a retrospective study conducted in the microbiology laboratory of a polyclinic, Muminović“ Bihać, Bosnia and Herzegovina. The study was based on routinely generated laboratory records, without any intervention or modification of standard clinical procedures. The observation period covered 7 months, from August 5, 2025, to March 5, 2026. A total of 158 cervical swab specimens obtained from pregnant patients were included in the analysis.

The study population consisted of women in the second trimester of pregnancy (approximately 16–28 gestational weeks) who were referred for microbiological screening within standard prenatal care. Cervical samples were obtained by trained medical personnel using sterile endocervical swabs under routine aseptic conditions. Following collection, specimens were placed in transport media and delivered to the microbiology laboratory for processing according to the manufacturer's guidelines.

When detection of either *Ureaplasma* spp. or *M. hominis* was confirmed, therapeutic management was guided by current clinical recommendations and established evidence-based protocols.

For pregnant patients, macrolide antibiotics were the first-line treatment option due to their safety profile in pregnancy. The most frequently applied regimen consisted of a single 1 g oral dose of azithromycin, followed by 500 mg daily administration over the subsequent 3–4 days.

In non-pregnant individuals, doxycycline (100 mg twice daily for 7 days) may be considered as an alternative regimen. However, due to its potential teratogenic effects, tetracycline-class antibiotics are contraindicated during pregnancy.

To reduce the risk of reinfection, simultaneous treatment of sexual partners was recommended. Follow-up testing was generally performed 2–4 weeks after completion of therapy to assess eradication success and microbiological response.

Identification and quantification of genital mycoplasmas were performed using the Mycoplasma IST3 system (bioMérieux, France), which integrates organism detection, bacterial load measurement, and antimicrobial susceptibility assessment within a single platform.

The method is based on culture-dependent growth in selective media combined with biochemical reaction profiling. The system consists of multiple reaction wells containing substrates that enable differentiation through metabolic activity.

After inoculation, plates were incubated at 35–37°C under controlled conditions. Interpretation was performed at 24 and 48 h by assessing colorimetric changes indicating bacterial growth. These reactions allowed both species identification and semi-quantitative estimation of bacterial load using predefined thresholds ($\geq 10^3$, $\geq 10^4$, $\geq 10^6$ CFU/mL). A threshold of $\geq 10^4$ CFU/mL was considered clinically relevant.

Antibiotic susceptibility testing was conducted using wells containing standardized antimicrobial concentrations. For *Ureaplasma* spp., tested agents included levofloxacin, moxifloxacin, tetracycline, erythromycin, and telithromycin. For *M. hominis*, levofloxacin, moxifloxacin, tetracycline, and clindamycin were evaluated.

Growth inhibition patterns were interpreted according to manufacturer criteria and categorized as susceptible or resistant.

This study was conducted in accordance with the principles of the Declaration of Helsinki. Permission for the use of anonymized laboratory data for research purposes was obtained from the management of the private polyclinic “Muminović” Bihać, Bosnia and Herzegovina, in which the study was conducted. All data were anonymized before analysis and used exclusively for scientific purposes. As the study was based on retrospectively collected laboratory records without any patient-identifiable information or intervention in clinical procedures, informed consent was not required.

Data were analyzed using descriptive statistical methods and presented as absolute numbers and percentages. The prevalence of *Ureaplasma* spp. and *M. hominis* was calculated in relation to the total number of samples.

Differences between persistent infection and successful eradication were assessed using the χ^2 (Chi-square) test, with a significance level set at $p < 0.05$. Statistical analysis was performed using Statistical Package for the Social Sciences software (version 28, IBM, USA).

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

RESULTS

Among the 158 analyzed cervical swab samples, *Ureaplasma* spp. was detected in 63 cases, corresponding to a prevalence of 39.9%. The remaining 95 samples (60.1%) showed no evidence of these organisms.

Quantitative analysis demonstrated that most *Ureaplasma spp*. isolates were clustered at concentrations $\geq 10^4$ CFU/mL,

whereas lower and higher bacterial loads were less frequently observed. The distribution of Ureaplasma spp. concentrations is presented in Table 1.

M. hominis was identified in 3 samples (1.9%). In two cases, it was present alongside *Ureaplasma* spp., with bacterial loads ≥10^4 CFU/mL, while a single isolate represented a mono-infection with a higher concentration reaching ≥10^6 CFU/mL. The distribution of mono-infections and co-infections involving *M. hominis* is presented in Table 2.

Susceptibility testing revealed a generally high level of antimicrobial sensitivity. Resistance was detected only in relation to levofloxacin, affecting 4 of 63 isolates (6.3%). No resistance was observed for moxifloxacin, tetracycline, erythromycin, or telithromycin.

All *M. hominis* isolates demonstrated complete susceptibility to the tested antimicrobial agents.

Overall, 96.2% of isolates remained sensitive to all evaluated antibiotics, and no multidrug-resistant strains were identified. Antimicrobial susceptibility profiles of the isolates are presented in Table 3.

Follow-up testing was performed in 29 initially positive patients. Persistent colonization or infection was documented in 24 (82.8%) cases, while microbiological clearance was achieved in 5 (17.2%) cases. Statistical evaluation confirmed a significant difference between outcomes (χ^2 = 12.45; p = 0.0004). Post-treatment microbiological outcomes are summarized in Table 4.

TABLE 1. Distribution of *Ureaplasma* spp. Concentrations

Concentration (CFU/mL)	Total number	Initial results	Repeat test
≥10^3 CFU/mL	4	3	1
≥10^4 CFU/mL	45	29	16
≥10^6 CFU/mL	13	8	5
Total	62*		

*Difference due to *Mycoplasma hominis* isolates analyzed separately

TABLE 2. Distribution of mono-and co-infections involving *Mycoplasma hominis*

Type of infection	Number of samples
Ureaplasma spp. Only	61
Co-infection with *Mycoplasma hominis*	2
Mycoplasma hominis only	1

TABLE 3. Antimicrobial susceptibility profiles of isolates

Antibiotic	*Ureaplasma* spp. (n=63) (%)	*Mycoplasma hominis* (n=3) (%)
Levofloxacin	4 R (6.3); 59 S (93.7)	0 R (0); 3 S (100)
Moxifloxacin	0 R (0); 63 S (100)	0 R (0); 3 S (100)
Tetracycline	0 R (0); 63 S (100)	0 R (0); 3 S (100)
Erythromycin	0 R (0); 63 S (100)	-
Telithromycin	0 R (0); 63 S (100)	-
Clindamycin	-	0 R (0); 3 S (100)

*R (resistant); S (susceptible); Antimicrobial susceptibility was determined using the Mycoplasma IST3 test (bioMérieux, France); (—) Not applicable

TABLE 4. Post-treatment microbiological outcomes

Outcome after therapy	Number of patients	Percentage
Persistent infection	24	82.8
Negative control test	5	17.2

DISCUSSION

This study reinforces the continued clinical importance of genital mycoplasmas in pregnancy. The prevalence of *Ureaplasma* spp. observed here is consistent with previously published findings, where this organism is repeatedly reported as the most common genital mycoplasma in pregnant populations (10,11).

Across different studies, including those focusing on obstetric populations, *Ureaplasma* spp. consistently emerges as the dominant species among genital mycoplasmas (5,6). This supports its relevance in routine diagnostic screening regardless of symptom presentation.

In contrast, *M. hominis* was identified infrequently, which aligns with previously described epidemiological patterns indicating lower prevalence compared to *Ureaplasma* spp. Nonetheless, its detection, particularly in polymicrobial infections, retains clinical relevance (5).

A notable observation in this study is the tendency toward higher bacterial loads among positive samples. Although colonization does not necessarily indicate active infection, increased bacterial density may be associated with persistence and potential clinical implications. Interpretation of this parameter remains complex due to host and environmental variability (17).

The antimicrobial susceptibility pattern observed may reflect local diagnostic and therapeutic practices, including routine screening and empirical treatment strategies. Overall susceptibility remained high, with resistance limited to a small proportion of isolates.

Comparable resistance patterns have been reported in other studies, although variability between geographic regions remains well documented, highlighting the need for continuous surveillance (18,19).

The diagnostic performance and reliability of the Mycoplasma IST3 system used in this study have been previously evaluated in international multicentre investigations (20).

The absence of multidrug-resistant isolates is encouraging; however, antimicrobial susceptibility trends should still be monitored closely, as even minor shifts may influence therapeutic decisions in pregnancy (1,13,15).

A limitation of this work is its retrospective laboratory-based design, which did not allow correlation with full clinical outcomes.

CONCLUSION

The findings of this study confirm that *Ureaplasma* spp. is highly prevalent among pregnant women, with a tendency to be associated with higher levels of bacterial colonization. In comparison, *M. hominis* was detected less frequently, although its presence was still evident, particularly in polymicrobial infections.

A considerable number of cases showed persistence following antimicrobial therapy, which may indicate that current treatment approaches do not consistently result in complete microbiological clearance. This highlights the potential need for structured microbiological reassessment after treatment completion in clinical settings.

Overall, antimicrobial resistance among the investigated isolates was not commonly observed; however, isolated instances of decreased susceptibility to certain agents were identified. These observations point to the importance of continuous evaluation of antimicrobial efficacy, particularly in infections occurring during pregnancy.

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DECLARATION OF INTEREST

Authors declare no conflict of interest.

REFERENCES

1. Bébéar C, Pereyre S, Peuchant O. Current knowledge on antibiotic susceptibility of genital *Mycoplasmas*. Future Microbiol 2020;15:47-60.
2. Horner PJ, Jensen JS, Taylor-Robinson D, Waites KB, Bébéar C, Moi H, et al. 2021 European guideline on the management of *Mycoplasma* and *Ureaplasma* infections. Int J STD AIDS 2022;33(1):1-16.
3. Kavelj T, Novak A. Mikrobiološka dijagnostika infekcija uzrokovanih bakterijama *Ureaplasma urealyticum* i *Mycoplasma hominis*. Hrvat časopis Zdrav Znan 2023;3(1):41-7.
   https://doi.org/10.48188/hczz.3.1.6
4. Beeton ML, Payne MS, Jones L. The role of *Ureaplasma* spp. In the development of nongonococcal urethritis and infertility among men. Clin Microbiol Rev 2019;32(4):e00137-18.
   https://doi.org/10.1128/Cmr.00137-18
5. Leli C, Mencacci A, Latino MA, Clerici P, Rassu M, Perito S, et al. Prevalence of cervical colonization by *Ureaplasma parvum*, *Ureaplasma urealyticum*, *Mycoplasma hominis* and *Mycoplasma genitalium* in childbearing-age women by multiplex real-time PCR. J Med Microbiol. 2018;67(4):561-9.
6. Petrov AG, Nankov VM, Petrova RV, Gencheva II, Karcheva MD. Distribution of genital *mycoplasmas* in pregnant women using PCR detection methods. J IMAB 2021;27(1):3630-3.
   https://doi.org/10.5272/jimab.2021271.3630
7. Karaca C, Yildiz S, Demirci B, Kaya H, Ozkan S, Arslan H, et al. Detection of sexually transmitted infection agents in pregnant women using multiplex PCR. BMC Pregnancy Childbirth 2025;25:74.
8. Karaca C, Yildiz S, Demirci B, Kaya H, Ozkan S, Arslan H, et al. Epidemiology of sexually transmitted pathogens in pregnant women. BMC Pregnancy Childbirth 2025;25:82.
9. Marques LM, Santos F, Oliveira M, Pereira L, Da Silva R, Gomes A, et al. Prevalence of Mollicutes in pregnant women undergoing high-risk prenatal care. Epidemiol Infect 2024;152:e123.
10. Taylor-Robinson D, Lamont RF. Mycoplasmas in pregnancy. BJOG 2011;118(2):164-74.
    https://doi.org/10.1111/j.1471-0528.2010.02766.x
11. Waites KB, Katz B, Schelonka RL. Mycoplasmas and ureaplasmas as neonatal pathogens. Clin Microbiol Rev 2005;18(4):757-89.
    https://doi.org/10.1128/cmr.18.4.757-789.2005
12. Mulahuseinović N, Abduzaimović K. Prevalence of *Mycoplasma hominis* and *Ureaplasma* spp. In women undergoing routine gynecological examination in Bosnia and Herzegovina. In: Book of Abstracts. Bosnia: University of Sarajevo; 2019. p. 23-4.
13. Akinosoglou K, Tsiakalos A, Dimopoulou ID, Schinas G, Polyzou E, Kourea Kremastinou J, et al. Antimicrobial resistance rates of urogenital *Mycoplasma hominis* and *Ureaplasma* species before and during the COVID-19 pandemic: Results from a Greek survey, 2014 to 2022. J Antibiot (Tokyo) 2024;77(2):120-5.
    https://doi.org/10.1038/s41429-023-00680-5
14. Da Silva R, Da Silva D, Oliveira M, Santos F, Pereira L, Gomes A, et al. Evaluating antibiotic resistance patterns in *Mycoplasma hominis* and *Ureaplasma* spp. infections: Insights from a clinical cohort. Biol Life Sci Forum 2025;4(3):12.
15. Xiao L, Crabb DM, Duffy LB, Paralanov V, Glass JI, Waites KB. Antimicrobial resistance in *Ureaplasma* species and *Mycoplasma hominis*. Antimicrob Agents Chemother 2011;55(2):717-23.
16. Workowski KA, Bachmann LH, Chan PA, Johnston CM, Muzny CA, Park I, et al. Sexually transmitted infections treatment guidelines, 2021. MMWR Recomm Rep 2021;70(4):1-187.
    https://doi.org/10.15585/mmwr.rr7004a1
17. Kasper DC, Mechtler TP, Reischer GH, Witt A, Langgartner M, Pollak A, et al. The bacterial load of genital mycoplasmas in pregnancy and its association with preterm birth. Am J Obstet Gynecol 2010;203(3):1-6.
18. Manavi K, Wiesenfeld HC, Jensen JS, Waites KB, Taylor-Robinson D, Horner PJ, et al. Antimicrobial susceptibility patterns of *Ureaplasma* species and *Mycoplasma hominis* in pregnant women. J Antimicrob Chemother. 2014;69(12):3250-3256.
19. Redelinghuys MJ, Ehlers MM, Dreyer AW, Lombaard HA, Kock MM. Antimicrobial susceptibility patterns of *Ureaplasma* species and *Mycoplasma hominis* in pregnant women. BMC Infect Dis 2014;14:171.
    https://doi.org/10.1186/1471-2334-14-171
20. Boostrom I, Bala Y, Vasic JM, Gluvakov J, Chanard E, Barratt AH, et al. Evaluation of the MYCOPLASMA IST3 urogenital mycoplasma assay in an international multicentre trial. J Antimicrob Chemother 2021;76(12):3175-82.
    https://doi.org/10.1093/jac/dkab320