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Vertical transmission of Group B *Streptococcus* in a public referral hospital

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Abstract

Background

Group B Streptococcus (GBS), a beta-hemolytic *Streptococcus*, is an important cause of neonatal and maternal morbidity and mortality in Brazil and worldwide. This study aims to evaluate vertical transmission of GBS isolated from parturients and their newborns in a municipal referral hospital in Goiânia, Goiás, Brazil.

Methods

In this cross-sectional study (August–October 2024), 206 parturients and their newborns were included. Vaginal and anorectal swabs were collected from mothers and nasal and auricular swabs from newborns. Samples underwent microbiological culture and real-time polymerase chain reaction (qPCR), with antimicrobial susceptibility testing performed according to standardized protocols.

Results

Among the 206 parturients, 26.7% were colonized with GBS, with vertical transmission observed in 64.1% of cases and an overall neonatal prevalence of 16.4%. GBS isolates showed high resistance to tetracycline (57.9%–70.9%), erythromycin (31.6%–54.6%), and clindamycin (42.1%–83.6%), particularly in vaginal and anal samples. Conversely, β-lactams (penicillin, ampicillin, ceftriaxone, and cefazolin) maintained high efficacy (≥ 86%), confirming their role as first-line agents for intrapartum prophylaxis. Resistance to macrolides and lincosamides restricts their use in penicillin-allergic pregnant women.

Conclusion

The high prevalence of maternal colonization and substantial vertical transmission highlight the urgent need to implement routine screening and intrapartum prophylaxis during prenatal care. Although culture remains the gold-standard for GBS detection, qPCR demonstrated higher sensitivity and may be a useful tool for early diagnosis of maternal colonization, especially in the absence of prenatal follow-up.

1 Introduction

Neonatal infection caused by *beta-hemolytic Group B Streptococcus (Streptococcus agalactiae, GBS)* remains an important cause of perinatal morbidity and mortality on a global scale. Recent estimates indicate that, in 2020 alone, approximately 394 thousand cases of invasive GBS disease occurred in children up to 90 days of life, resulting in about 91.900 neonatal deaths. In the same period, it is estimated that 19.7 million pregnant women presented rectovaginal colonization by GBS, associated with 231.800 cases of early-onset neonatal sepsis and 162.200 cases of late-onset neonatal sepsis, in addition to significant impacts on maternal and perinatal health, including stillbirths, preterm births and puerperal infections.[1, 2]

Vertical transmission of GBS occurs predominantly during labour or at the time of birth from maternal colonization of the gastrointestinal and genitourinary tract. Although often asymptomatic in pregnant women, this colonization represents the main risk factor for the development of early-onset neonatal disease, which usually manifests within the first 72 hours of life in the form of sepsis, pneumonia or meningitis. The incidence of this clinical form ranges from 0.7 to 3.7 per thousand live births, with an estimated case fatality rate between 6.6% and 15%, especially in preterm and low birth weight newborns. Late onset disease has an incidence between 0.5 and 1.8 per thousand live births, with a fatality rate of 2% to 6%.[3.4]

International studies show marked epidemiological heterogeneity in vertical transmission of GBS. African countries such as Ethiopia and Gambia present rates often exceeding 50%, associated with low intrapartum prophylaxis coverage and limited access to prenatal care, while Asian countries such as China, Japan and Thailand show lower prevalence, possibly related to differences in maternal and child health practices.[5–8]

In Brazil, wide regional variation in maternal GBS colonization is observed (6.9%–41.5%), with a predominance of studies in the South and Southeast. In the North and Central-West regions, data are still scarce and limited. In Goiás, few studies have evaluated maternal colonization and only one has investigated the susceptibility profile, with no data available so far on vertical transmission and neonatal colonization, which limits the formulation of public policies based on local evidence.[9, 10]

The absence of national recommendations for universal GBS screening in pregnant women reflects, in part, the lack of consistent epidemiological data. The Ministry of Health highlights the need for local studies on maternal prevalence, incidence of neonatal sepsis and cost-effectiveness of intrapartum prophylaxis before adopting systematic strategies, with underreporting and limitations of traditional diagnostic methods still contributing to underestimation of the problem in the country.

Although culture remains the gold-standard for GBS detection, its limitations, such as prolonged time to results, dependence on viable microorganisms and variable sensitivity, make molecular methods, especially real-time PCR, increasingly relevant alternatives. Recent evidence demonstrates that PCR presents high sensitivity and specificity and can optimise intrapartum antibiotic prophylaxis, reducing unnecessary antimicrobial use and the risk of vertical transmission.[11–13]

In addition, the antimicrobial susceptibility profile of GBS deserves attention. Despite maintained sensitivity to β-lactams, increased resistance to macrolides and lincosamides, especially clindamycin and erythromycin, has been observed, which limits therapeutic options in penicillin-allergic pregnant women and reinforces the importance of phenotypic characterisation of isolates to guide antibiotic prophylaxis.[14–16]

In this context, the production of local evidence integrating the evaluation of maternal colonization and vertical transmission of GBS isolates becomes essential, especially in regions with scarce data. Studies

addressing these aspects simultaneously are fundamental to improve perinatal care, support more effective prevention strategies and contribute to reducing neonatal morbidity and mortality associated with GBS.

Thus, the present study aimed to evaluate the vertical transmission of Group B Streptococcus of maternal and neonatal isolates in a municipal public referral hospital in Goiânia, Goiás.

2 Methodology

This is a cross-sectional study conducted at Hospital e Maternidade Dona Íris in Goiânia (GO) between August and October 2024, approved by the Research Ethics Committee (Opinion No. 3.361.799; CAAE n. 13320819.5.0000.8058). Parturients admitted in labour and their respective newborns participated after signing the Informed Consent Form.

Pregnant women between 35 and 41 weeks of gestation were included, with single or multiple pregnancy, with or without comorbidities and with or without rupture of membranes. Pregnant women without labour in progress, unable to answer the questionnaire or who had used systemic antibiotics or vaginal creams in the seven days prior to sampling were excluded.

Sample size was calculated considering an expected colonization prevalence between 15% and 30%, a finite population (430 deliveries in the period), 5% error and 95% confidence level, resulting in a minimum sample of 203 parturients. In total, 206 women were included.

Participants answered a structured questionnaire containing sociodemographic and clinical obstetric data. Subsequently, vaginal and anorectal swabs were collected from pregnant women and nasal and auricular swabs were collected from newborns immediately after birth. Samples were placed in Stuart transport medium and sent to the Applied Bacteriology Laboratory of IPTSP/UFG within 12 hours or kept refrigerated between 2–8°C for a maximum of 24 hours.

For GBS isolation, swabs were inoculated into Todd Hewitt broth (Newprov) supplemented with gentamicin (15 µg/mL) and nalidixic acid (8 µg/mL) and incubated at 36°C for 18–24 hours. Subsequently, cultures were plated on 5% sheep blood agar and incubated at 36°C for 24 hours under microaerophilic conditions. Suggestive colonies were subjected to Gram staining and catalase testing. Catalase negative colonies were tested by the CAMP method and plated on chromogenic agar, with those showing positive CAMP and blue coloration on chromogenic medium being considered Group B Streptococcus. Strains were stored in BHI broth with 30% glycerol at − 70°C.

The antimicrobial susceptibility profile was determined by the disk diffusion method on Mueller Hinton agar supplemented with 5% defibrinated horse blood and 20 mg/L of β-NAD according to BrCAST/EUCAST (2024) recommendations, with incubation at 35 ± 1°C in a 5% CO_2 atmosphere for 18 ± 2 hours. Inhibition zone diameters were interpreted according to current breakpoints. For some antimicrobials, the minimum inhibitory concentration was determined by broth microdilution.

Positive or inconclusive samples were submitted to real-time PCR (qPCR). For DNA extraction, bacterial lysis was performed with lysozyme (5 mg/mL) at 37°C for 1 hour, followed by extraction with T1 and S buffers (Biopur) according to the manufacturer's instructions. Amplification was performed using the GoTaq® Probe qPCR Master Mix (Promega®) system in a final volume of 20 µL, with reading on the QuantStudio 5 Real-Time PCR System (Applied Biosystems, Thermo Fisher Scientific). Positive and negative controls were included in all assays.

Statistical analysis was performed using SPSS® v.21.0. Categorical variables were expressed as absolute and percentage frequencies and continuous variables as mean and standard deviation. Prevalence ratio was used to evaluate factors associated with vertical transmission, with a significance level of 5%.

3 Results

A total of 206 parturients participated in the study, with a mean age of 24.9 ± 5.7 years. GBS colonization was identified in 53 women (26.7%). Vertical transmission occurred in 34 newborns from colonized mothers, corresponding to a rate of 64.1% (95% CI: 51.2%–77.1%). Overall, the population showed a predominantly young profile and the age distribution, municipality and area of residence of colonized pregnant women were similar to those observed in the total sample, with no relevant sociodemographic differences between groups (Table 1).

Table 1
Distribution of patients investigated for GBS colonization by sociodemographic characteristics, Goiânia – GO, 2025

Variable	Total (n = 206)	% Total	EGB positive (n = 53)	% EGB
Age				
14–22 years old	75	36.4%	18	34.0%
23–30 years old	98	47.6%	23	43.4%
31–38 years old	29	14.1%	10	20.8%
≥ 39 years old	4	1.9%	1	1.8%
City				
Goiânia	98	47.5%	26	49.1%
Aparecida de Goiânia	67	32.5%	20	37.7%
Others	41	19.9%	7	13.2%
Living zone				
Urban	200	97.1%	51	96.2%
Rural	6	2.9%	2	3.8%
Education level				
5th grade of elementary school	1	0.5	–	0.0
6th grade of elementary school	2	1.0	1	1.9
7th grade of elementary school	8	3.9	–	0.0
8th grade of elementary school	5	2.5	3	5.7
9th grade of elementary school	14	8.7	4	7.5
1st year of high school	29	14.1	8	15.1
2nd year of high school	11	5.3	2	3.8
3rd year of high school	131	63.6	32	60.4
Higher education	5	2.4	3	5.7
Occupation				
Homemaker	99	48.1	21	39.6
Unemployed	28	13.6	9	17.0
Source: The authors (2025)				

Variable	Total (n = 206)	% Total	EGB positive (n = 53)	% EGB
Formal job	61	29.6	18	34.0
Informal job	8	3.9	5	9.5
Not reported	10	4.9	–	–
Marital status				
Single	117	56.8%	33	62.3%
Married/stable union	89	43.2%	20	37.7%
Race/ethnicity				
White	28	13.6%	6	11.3%
Black	28	13.6%	7	13.2%
Brown	142	68.9%	39	73.6%
Asian	8	3.9%	1	1.9%
Family income/month				
R$ 1.000.00 a R$ 1.999,00	70	34.0%	12	22.6%
R$ 2.000.00 a R$ 2.999,00	70	34.0%	23	43.4%
R$ 3.000.00 a R$ 3.999,00	40	19.4%	13	24.5%
≥ R$ 4.000.00	12	5.8%	4	7.5%
Not reported	14	6.8%	1	1.9%
Source: The authors (2025)				

The social and educational characteristics of colonized pregnant women were similar to those of the overall sample, with no marked differences between groups. A predominance of single women and those self-declared as brown was observed, with a low proportion of higher education in both populations. Regarding occupation, although the homemaker category predominated in the total sample, colonized pregnant women showed greater participation in external activities, with a relatively higher proportion of formal and informal work.

With regard to the current pregnancy, most participants were at term gestational age and showed high adherence to prenatal care, a pattern that was also maintained among colonized pregnant women. Almost all had a single pregnancy (Table 2).

Table 2
Distribution of patients investigated for GBS colonization according to current pregnancy, Goiânia – GO, 2025

Variable	Total (n = 206)	% Total	EGB positive (n = 53)	% EGB
Gestational age				
25 to 29 weeks	4	2.0	1	1.9
30 to 34 weeks	7	3.4	4	7.6
35 to 39 weeks	136	66.0	44	83.0
40 to 41 weeks	59	28.6	4	7.6
Number of prenatal visits				
None	3	1.5	0	0.0
1 to 3 visits	16	7.8	4	7.6
≥ 4 visits	187	90.8	49	92.5
Current pregnancy				
Single fetus	205	99.5	53	100.0
Twin pregnancy	1	0.5	0	0.0
Gestational diabetes				
Yes	29	14.1	5	9.4
No	173	84.0	48	90.6
Not reported	4	1.9	0	0.0
Obesity (WHO)				
Underweight	2	1.0	1	1.9
Normal weight	45	21.8	12	22.6
Overweight	81	39.3	17	32.1
Obesity grade I	49	23.8	21	39.6
Obesity grade II	12	5.8	2	3.8
Obesity grade III	17	8.3	0	0.0
Obesity (BMI)				
Yes	21	10.2	3	5.7
Source: The authors (2025)				

Variable	Total (n = 206)	% Total	EGB positive (n = 53)	% EGB
No	181	87.9	49	92.5
Not reported	4	1.9	1	1.9
Medication use in the last 7 days				
Yes	59	28.6	15	28.3
No	147	71.4	38	71.7
Previous chorioamnionitis				
Yes	7	3.4	1	1.9
No	166	80.6	41	77.4
Not reported	33	16.0	11	20.8
Placental complications				
Yes	7	3.4	3	5.7
No	184	89.3	42	79.2
Not reported	15	7.3	8	15.1
Preeclampsia				
Yes	8	3.9	2	3.8
No	189	91.7	48	90.6
Not reported	9	4.4	3	5.7
Duration of labour				
4 to 12 hours	97	47.1	21	39.6
13 to 24 hours	108	52.4	31	58.5
Not reported	1	0.5	1	1.9
Source: The authors (2025)				

Clinical and obstetric conditions showed an overall similar distribution between colonized and non-colonized pregnant women (Table 3).

Table 3
Distribution of patients investigated for GBS colonization according to obstetric history, Goiânia – GO, 2025

Variable	Total (n = 206)	% Total	EGB positive (n = 53)	% EGB
N. of previous pregnancies				
None	16	7.8	7	13.2
1 pregnancy	82	39.8	15	28.3
2 pregnancies	61	29.6	15	28.3
3 pregnancies	21	10.2	7	13.2
4 pregnancies	15	7.3	6	11.3
5 to 7 pregnancies	11	5.3	3	5.7
History of miscarriage				
No	158	76.7	37	69.8
Yes	44	21.4	13	24.5
Not reported	4	1.9	3	5.7
No. of sexual partners in the last year				
1	149	72.3	38	71.7
2	26	12.6	5	9.4
3	2	1.0	2	3.8
Not reported	29	14.1	8	15.1
Diabetes before pregnancy				
Yes	7	3.4	1	1.9
No	177	85.9	45	84.9
Does not know	22	10.7	7	13.2
Arterial hypertension				
Yes	11	5.3	4	7.5
No	185	89.8	46	86.8
Does not know	10	4.9	3	5.7
HIV testing				

Source: The authors (2025)

Variable	Total (n = 206)	% Total	EGB positive (n = 53)	% EGB
No	3	1.5	1	1.9
Yes, result unknown	19	9.2	6	11.3
Yes, positive	1	0.5	0	0.0
Yes, negative	107	51.9	33	62.3
Not reported	76	36.9	13	24.5
History of sexually transmitted infection				
No	115	55.8	34	64.2
Yes	10	4.9	1	1.9
Not reported	81	39.4	18	34.0
Urinary tract infection during current pregnancy				
No	66	32.0	16	30.2
Yes	131	63.6	33	62.3
Not reported	9	4.3	4	7.5
Previous pregnancy with preterm birth				
Yes	13	6.3	3	5.7
No	190	92.2	50	94.3
Not reported	3	1.5	-	-
Previous pregnancy with membrane rupture				
Yes	3	1.5	2	3.8
No	191	92.7	46	86.8
Not reported	12	5.8	5	9.4
Previous pregnancy with fever during labour				
Yes	5	2.4	3	5.7
No	192	93.2	45	84.9
Not reported	9	4.4	5	9.4

Source: The authors (2025)

Variable	Total (n = 206)	% Total	EGB positive (n = 53)	% EGB
Previous pregnancy resulted in stillbirth				
Yes	5	2.4	2	1.9
No	187	90.8	46	86.8
Not reported	14	6.8	5	9.4
Had a child who died before 3 months of age				
Yes	30	14.6	11	20.8
No	130	63.1	36	67.9
Did not wish to report	46	22.4	6	11.3
Source: The authors (2025)				

A lower frequency of gestational diabetes was observed among colonized women, while grade I obesity was relatively more common in this group, with no predominance of severe obesity.

Recent medication use and the occurrence of obstetric complications (chorioamnionitis, placental complications and preeclampsia) were infrequent and did not differ between groups. Only a trend towards longer duration of labour was noted among colonized pregnant women.

Most participants reported absence of risk habits during pregnancy. Regarding obstetric history, a predominance of up to two previous pregnancies was observed, with a slight increase in the proportion of primigravidae among colonized women and a higher frequency of previous miscarriage. Urinary tract infection was frequent in both groups. Events such as preterm birth, rupture of membranes, intrapartum fever and stillbirth were rare, although a higher proportion of early neonatal death was observed among children of colonized mothers.

The results showed that neonatal characteristics were overall similar between groups (Table 4).

Table 4
Distribution of patients investigated for GBS colonization according to fetal characteristics, Goiânia – GO, 2025

Variable	Total (n = 206)	% Total	EGB positive (n = 53)	% EGB
Sex				
Masculine	108	52.9	30	56.6
Feminine	96	46.6	22	41.5
Not reported	1	0.5	1	1.9
Birth weight				
Less than 1.5 kg	5	2.4	-	0.0
Between 1.5–2.5 kg	32	15.5	6	11.3
Between 2.5–4.0 kg	167	81.1	47	88.7
Above 4.0 kg	2	1.0	-	0.0
Apgar score at 1 minute				
0 to 3	-	0.0	-	0.0
4 to 7	20	9.7	8	15.1
8 to 10	186	90.3	45	84.9
Apgar score at 5 minutes				
0 to 3	-	0.0	-	0.0
4 to 7	11	5.3	2	3.8
8 to 10	195	94.7	51	96.2
Multiple pregnancy				
Yes	1	0.5	-	0.0
No	203	98.5	53	100.0
Not reported	2	1.0	-	-
NICU admission				
Yes	9	4.4	4	7.5
No	197	95.6	49	92.5
Need for resuscitation				
Source: The authors (2025)				

Variable	Total (n = 206)	% Total	EGB positive (n = 53)	% EGB
Yes	10	4.9	3	5.7
No	196	95.1	50	94.3
Respiratory support				
Yes	18	8.7	4	7.5
No	187	90.8	48	90.6
Not reported	1	0.5	1	1.9
Infection				
Yes	1	0.5	-	0.0
No	-	0.0	-	-
Not reported	205	99.5	53	100.0
Close contact of the newborn with the mother				
Yes	200	97.1	49	92.5
No	6	2.9	4	7.5
Source: The authors (2025)				

A slight predominance of male sex and a predominance of newborns with adequate birth weight were observed. Apgar scores were mostly favourable, although children of colonized mothers more frequently showed intermediate values in the first minute of life. Admission to the neonatal ICU, the need for resuscitation and the use of respiratory support were slightly more common in this group, with no clinically relevant differences. Most newborns maintained close contact with the mother after birth, although this contact was somewhat less frequent among those exposed to GBS.

In the analysis of possible factors associated with vertical transmission of GBS, none of the evaluated variables showed a statistically significant association. Transmission occurred in 64.3% of mothers aged 15 to 25 years and in 60.0% of those aged 26 years or older (PR = 1.07; 95% CI: 0.70–1.63; p = 0.748). No significant associations were observed in relation to marital status, gestational age, duration of labour, premature rupture of membranes, occurrence of stillbirth or Apgar score at 5 minutes. Urinary tract infection during pregnancy showed a higher frequency of vertical transmission (66.7% vs. 45.5%), suggesting a trend towards increased risk, although without statistical significance (PR = 0.68; 95% CI: 0.34–1.35; p = 0.201).

3.1 Results of laboratory tests for identification of Group B Streptococcus

Analysis of laboratory tests showed relevant differences between the methods used for detection of GBS in pregnant women and newborns. Among the 206 pregnant women included in the study, microbiological culture identified 42 colonized women, corresponding to a maternal colonization prevalence of 20.6%. Among these cases, 14 showed concomitant colonization of mothers and newborns, 17 pregnant women were colonized without detection of the pathogen in their children and 11 newborns had a positive culture despite their mothers having negative results, characterizing maternal false negative results. In addition, 19 samples were classified as inconclusive due to lack of agreement between the microbiological tests employed.

Considering only culture results, the vertical transmission rate was 59.5%. All culture positive samples as well as those classified as inconclusive were subsequently submitted to real-time PCR (qPCR), totalling 108 samples analysed by the molecular method.

qPCR confirmed the presence of GBS in all samples previously positive by culture and also clarified the inconclusive cases, identifying maternal colonization in 53 pregnant women. Thus, the actual prevalence of maternal colonization was 26.7%. Among newborns, qPCR detected colonization in 34 cases, corresponding to a neonatal prevalence of 16.4% and a vertical transmission rate of 64.1% (95% CI: 51.2%–77.1%).

Overall, the results showed that qPCR had greater sensitivity compared with microbiological culture, allowing identification of cases of maternal colonization not detected by the conventional method and revealing higher rates of colonization and vertical transmission of GBS.

3.2 Antimicrobial susceptibility profile

Analysis of the susceptibility profile of maternal GBS isolates showed a high frequency of antimicrobial resistance, with all isolates showing non-susceptibility to at least one tested antibiotic (Table 5).

Table 5
Antibiotic susceptibility profiles of streptococci from pregnant women

Antibiotic tested	Susceptible (%)	Resistant (%)
Ceftriaxone	53 (96.4)	2 (3.6)
Ampicillin	51 (92.8)	4 (7.2)
Cefazolin	45 (81.8)	10 (18.2)
Penicillin	47(85.5)	8 (14.5)
Erythromycin	25 (45.4)	30 (54.6)
Tetracycline	16 (29.1)	39 (70.9)
Clindamycin	9 (16.4)	46 (83.6)
Source: The authors (2025)		

High resistance to tetracyclines, macrolides and lincosamides was observed, which limits the use of erythromycin and clindamycin as therapeutic alternatives in penicillin-allergic pregnant women. In contrast, β-lactams maintained high in vitro activity, confirming their role as the first choice for intrapartum prophylaxis.

In isolates from newborns, a similar pattern to that observed in pregnant women was found (Table 6).

Table 6
Antibiotic susceptibility profiles of streptococci from newborn

Antibiotic tested	Susceptible n (%)	Resistant n (%)
Ceftriaxone	51 (96.2)	2 (3.8)
Cefazolin	51 (96.2)	2 (3.8)
Ampicillin	50 (94.3)	3 (5.7)
Penicillin	49 (92.5)	4 (7.5)
Clindamycin	27 (50.9)	26 (49.1)
Erythromycin	28 (52.8)	25 (47.2)
Tetracycline	14 (26.4)	39 (73.6)
Source: The authors (2025)		

Analysis of these results shows agreement between the susceptibility profiles observed in maternal and neonatal isolates, characterized by high resistance to tetracyclines, macrolides and lincosamides, together with preserved efficacy of β-lactams. The findings reinforce the recommendation of penicillin

and other β-lactams as first-line therapy for intrapartum prophylaxis and neonatal treatment, while also highlighting the need for caution in empirical prescription of clindamycin and erythromycin without prior susceptibility testing.

4 Discussion

4.1 Principal Findings

Vertical transmission of GBS represents a relevant global public health problem, since infection by this pathogen is associated with adverse maternal and neonatal outcomes, including preterm birth, early-onset neonatal sepsis, meningitis, stillbirth, infant death and impairment of neurodevelopment. The vulnerability of newborns derives largely from the immaturity of the immune system, which makes early and accurate identification of maternal and neonatal colonization a central element for prevention of severe complications and for improvement of neonatal prognosis.

In the present study, bacterial culture, considered the gold-standard for GBS detection, identified a maternal colonization prevalence of 20.6%. However, application of the molecular methodology by qPCR allowed detection of a higher prevalence of 26.7%, demonstrating underestimation of colonization when culture alone is used.

With regard to neonatal colonization, culture identified positivity in 12% of newborns, with a vertical transmission rate of 59.5%. qPCR, in turn, increased these values to 16.4% of neonatal colonization and 64.1% of vertical transmission, confirming that the molecular methodology is more sensitive for detecting the presence of GBS in neonates. The predominance of the auricular site as the location of pathogen isolation, observed by both culture and qPCR, is consistent with studies that indicate this site as an important reservoir for detection of neonatal colonization.

Finally, analysis of the phenotypic antimicrobial susceptibility profile revealed high resistance to tetracycline, macrolides and lincosamides, confirming patterns already described in the literature. In contrast, β-lactams maintained high efficacy, supporting their indication as first choice for intrapartum prophylaxis and neonatal treatment.

4.2 Results in the context of what is known

These findings are consistent with recent data from the international literature, such as those reported in Vietnam by Ha et al.[17], who observed a prevalence of 25.5%, and by Nguyen et al.[18], with a slightly lower rate (19.52%). In general, the observed values fall within the global estimated range of maternal GBS colonization, which varies between 10% and 40%, as described in different epidemiological contexts.

The wide variability of prevalences described in the literature, from low values such as 4.8% in India to high rates such as 32.0% in Turkey and intermediate percentages in African countries, especially in Ethiopia, reinforces that GBS colonization is strongly influenced by geographic, sociodemographic and

methodological factors and by the organization of health services. In this sense, the results of this investigation reflect an epidemiological pattern compatible with other studies conducted in similar contexts, supporting the external validity of the findings.

The vertical transmission rates observed are close to those described in African studies, which reported rates above 59%, and fall within the high range reported in recent publications. On the other hand, significantly lower values were described in Asian countries such as China and Tanzania. These differences reinforce the influence of contextual factors such as access to prenatal care, adoption of intrapartum prophylaxis, diagnostic techniques employed and population characteristics on the dynamics of vertical GBS transmission.

In the present study, the sociodemographic profile of colonized pregnant women was characterized predominantly by young women, similar to that described in national and international studies. Although the vertical transmission rate was numerically higher among younger women, this difference did not reach statistical significance, indicating that maternal age alone did not constitute a robust predictor of transmission.

Likewise, variables such as marital status, race or ethnicity, education level, place of residence and occupation did not show statistically significant association with maternal colonization or with vertical transmission. These findings contrast with some studies that identified associations between GBS colonization and specific social determinants, suggesting that these relationships may be strongly dependent on local context and sample composition.

In the clinical and obstetric domain, none of the evaluated factors showed significant association with vertical transmission, including gestational age, duration of labour, premature rupture of membranes, parity and adverse obstetric history. These results corroborate some international findings but contrast with studies that identified associations between vertical transmission and prematurity, prolonged rupture of membranes and urinary tract infection.

Comparison between culture and qPCR consistently demonstrated the superiority of the molecular technique for detection of colonization, a finding widely described in national and international literature.

4.3 Clinical Implications

Regarding diagnostic methods, the results confirm that combined collection of vaginal and anal swabs significantly increases sensitivity for GBS detection, as recommended by the CDC and described in previous studies. In the present study, this combination of sites allowed detection of colonization in 66% of positive pregnant women, reinforcing the importance of this strategy both in epidemiological research and in clinical practice.

qPCR showed greater sensitivity, ability to detect additional cases and rapidity in obtaining results, characteristics that are fundamental for clinical decision making in the intrapartum context. Thus,

association of lower cost methods such as the CAMP test with molecular techniques may represent a viable and efficient alternative for health services with limited resources.

The high resistance to erythromycin and clindamycin, which is especially relevant in penicillin-allergic pregnant women, represents an important clinical challenge and reinforces the need for routine susceptibility testing and the D test for detection of inducible resistance.

These results support the need for more sensitive screening strategies and maintenance of intrapartum prophylaxis as an essential measure for reducing neonatal morbidity and mortality associated with GBS, especially in contexts where maternal colonization is highly prevalent.

4.4 Research Implications

It should be noted that for methodological reasons PCR was not applied to all 206 pregnant women included in the study, which made it impossible to calculate classical diagnostic accuracy parameters such as sensitivity, specificity and predictive values. Even so, in the subset of culture positive or inconclusive samples, qPCR showed superior performance.

Although longer labour and urinary tract infection showed a trend towards higher transmission rates, these associations were not statistically confirmed, possibly due to sample size and the low frequency of some events.

4.5 Strengths and Limitations

The results of this investigation reflect an epidemiological pattern compatible with other studies conducted in similar contexts, supporting the external validity of the findings.

However, the fact that PCR was not applied to all participants limited the ability to calculate diagnostic accuracy parameters. Additionally, some clinical variables had low frequency, which may have reduced statistical power to detect associations.

5 Conclusions

The present study showed a high prevalence of maternal colonization by Group B Streptococcus (26.7%) and a substantial rate of vertical transmission (64.1%) in a public referral hospital, reinforcing the relevance of GBS as an important maternal and child health problem.

Analysis of the phenotypic antimicrobial susceptibility profile revealed high resistance to tetracycline and concerning rates of resistance to erythromycin and clindamycin. In contrast, high sensitivity to β-lactam antibiotics was observed, consolidating these drugs as the gold-standard for intrapartum prophylaxis and treatment of neonatal GBS infections.

Although culture remains the gold-standard method for GBS detection, qPCR showed greater sensitivity, representing a promising tool for early diagnosis of maternal and neonatal colonization, especially in

situations of absence or inadequacy of prenatal care

Abbreviations

BMI
Body Mass Index
CAAE
Certificate of Presentation for Ethical Consideration (Certificado de Apresentação para Apreciação Ética)
CAMP
Christie–Atkins–Munch–Petersen test
GBS
Group B Streptococcus
GO
Goiás State, Brazil
ICU
Intensive Care Unit
IPTSP/UFG
Institute of Tropical Pathology and Public Health, Federal University of Goiás
NICU
Neonatal Intensive Care Unit
PR
Prevalence Ratio
qPCR
Quantitative Real–Time Polymerase Chain Reaction
SPSS
Statistical Package for the Social Sciences
WHO
World Health Organization

Declarations

Ethics approval and consent to participate

This study was approved by the Research Ethics Committee of Hospital e Maternidade Dona Íris, Goiânia, Goiás, Brazil (Approval No. 3.361.799; CAAE No. 13320819.5.0000.8058). All procedures were conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. Written informed consent was obtained from all participating women prior to enrollment in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Authors' information

Not applicable.

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Author Contribution

TSP conceived and designed the study, coordinated data collection, analyzed and interpreted the data, and drafted the manuscript. WNA contributed to study design, supervision, data interpretation, and critical revision of the manuscript. JLC contributed to laboratory procedures, data interpretation, and manuscript revision. WJGM participated in data collection, laboratory analyses, and manuscript revision. BSR contributed to laboratory analyses, data interpretation, and manuscript revision. HVM participated in laboratory procedures, data analysis, and manuscript revision. All authors read and approved the final manuscript.

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Data Availability

All data supporting the findings of this study are available within the paper and its Supplementary Information.

References

1. Armistead B, Quach P, Snyder JM, Santana-Ufret V, Furuta A, Brokaw A, et al. Hemolytic Membrane Vesicles of Group B Streptococcus Promote Infection. J Infect Dis. 2021;223:1488–96.

https://doi.org/10.1093/infdis/jiaa548.

2. Gonçalves BP, Procter SR, Paul P, Chandna J, Lewin A, Seedat F, et al. Group B streptococcus infection during pregnancy and infancy: estimates of regional and global burden. Lancet Glob Health. 2022;10:e807–19. https://doi.org/10.1016/S2214-109X(22)00093-6.
3. Baker CJ, Morven E. Group B streptococcal infections. In: Remington JS, Klein JO, editors. Infectious disease of the fetus and newborn infant. Philadelphia: WB Saunders; 1995. pp. 980–1054.
4. Yadeta T, Worku A, Egata G, Seyoum B, Marami D, Berhane Y. Vertical transmission of group B < em>Streptococcus and associated factors among pregnant women: a cross-sectional study, Eastern Ethiopia. Infect Drug Resist 2018;Volume 11:397–404. https://doi.org/10.2147/IDR.S150029
5. Le Doare K, Heath PT, Plumb J, Owen NA, Brocklehurst P, Chappell LC. Uncertainties in Screening and Prevention of Group B Streptococcus Disease. Clin Infect Dis. 2019;69:720–5. https://doi.org/10.1093/cid/ciy1069.
6. Gizachew M, Tiruneh M, Moges F, Adefris M, Tigabu Z, Tessema B. Proportion of Streptococcus agalactiae vertical transmission and associated risk factors among Ethiopian mother-newborn dyads, Northwest Ethiopia. Sci Rep. 2020;10:3477. https://doi.org/10.1038/s41598-020-60447-y.
7. Chen J, Fu J, Du W, Liu X, Rongkavilit C, Huang X, et al. Group B streptococcal colonization in mothers and infants in western China: prevalences and risk factors. BMC Infect Dis. 2018;18:291. https://doi.org/10.1186/s12879-018-3216-4.
8. Takahashi K, Sato Y, Ikeda K. Group B streptococcus neonatal umbilical colonization managed by dry cord care in nurseries: A retrospective cohort study. Pediatr Neonatol. 2021;62:506–11. https://doi.org/10.1016/j.pedneo.2021.05.003.
9. Pires TS. Colonização pelo Streptococcus do grupo B: prevalência, fatores de risco, características fenotípicas e genotípicas, em mulheres no terceiro trimestre de gestação, atendidas por serviço de referência materno infantil de Goiânia-Goiás. Dissertação. Universidade Federal de Goiás; 2009.
10. Gomes JB, Morais AV, Gomes A, de O, Soares JM, de Costa P, de Oliveira MAR et al. Prevalência da colonização materna por streptococcus β-hemolítico do grupo b em gestantes no 3º trimestre: rastreamento pré-natal do streptococcus agalactiae em um hospital de Anápolis. Caderno Pedagógico. 2024;21:e12814. https://doi.org/10.54033/cadpedv21n13-434
11. Yuan X-Y, Liu H-Z, Liu J-F, Sun Y, Song Y. Pathogenic Mechanism, Detection Methods and Clinical Significance of Group B *Streptococcus*. Future Microbiol. 2021;16:671–85. https://doi.org/10.2217/fmb-2020-0189.
12. Charfi R, Guyonnet C, Untrau M, Giacometti G, Paper T, Poyart C, et al. Performances of two rapid LAMP-based techniques for the intrapartum detection of Group B Streptococcus vaginal colonization. Ann Clin Microbiol Antimicrob. 2024;23:37. https://doi.org/10.1186/s12941-024-00695-2.
13. Peng J, Liu Y, Zou J, Wang J, Jorge Luis CD, Zhong H. Accuracy of real-time polymerase chain reaction test for Group B Streptococcus detection in pregnant women: A systematic review and

meta-analysis. Eur J Obstet Gynecol Reproductive Biology. 2025;304:141–51. https://doi.org/10.1016/j.ejogrb.2024.11.035.

14. Schrag S, Gorwitz R, Fultz-Butts K, Schuchat A. Prevention of perinatal group B streptococcal disease. Revised guidelines from CDC. MMWR Recomm Rep. 2002;51:1–22.
15. Santana FAF, de Oliveira TVL, Filho MB, de Silva S, da LSC, de Brito BB, de Melo FF, et al. *Streptococcus agalactiae*: Identification methods, antimicrobial susceptibility, and resistance genes in pregnant women. World J Clin Cases. 2020;8:3988–98. https://doi.org/10.12998/wjcc.v8.i18.3988.
16. Kamińska D, Ratajczak M, Nowak-Malczewska DM, Karolak JA, Kwaśniewski M, Szumala-Kakol A, et al. Macrolide and lincosamide resistance of Streptococcus agalactiae in pregnant women in Poland. Sci Rep. 2024;14:3877. https://doi.org/10.1038/s41598-024-54521-y.
17. Ha M-T, Tran-Thi-Bich H, Bui-Thi-Kim T, Nguyen-Thi M-L, Vu-Tri T, Ho-Huynh T-D, et al. Comparison of qPCR and chromogenic culture methods for rapid detection of group B streptococcus colonization in Vietnamese pregnant women. Pract Lab Med. 2024;42:e00435. https://doi.org/10.1016/j.plabm.2024.e00435.
18. Nguyen V, Le, Dao HN, Le VTH, Nguyen A, Van, Ha VTT, Nguyen QTN, et al. Prevalence, risk factors, and serotypes of group B *Streptococcus* rectovaginal colonization among pregnant women: a cross-sectional study at three hospitals in Hanoi, Vietnam. Ther Adv Infect Dis. 2025;12. https://doi.org/10.1177/20499361251365028.