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Maternal Health and Group B Streptococcus: Prevalence and Risk Factors in Senegalese Pregnant Women

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Abstract

Background: Group B Streptococcus (GBS) is a significant cause of neonatal infections, including sepsis, pneumonia, and meningitis, representing a major public health concern in sub-Saharan Africa. In Senegal, the prevalence and risk factors for GBS carriage in pregnant women are poorly understood, with limited data available on its association with vaginal infections and microbiota balance. This study aims to assess the prevalence of GBS carriage among pregnant women in Senegal and explore potential risk factors, including maternal age, parity, gestational age, vaginal infections, and vaginal flora.

Methods: A total of 407 pregnant women were enrolled in this cross-sectional study conducted in Senegal. Participants were tested for GBS carriage, and data on maternal characteristics, including age, number of pregnancies, parity, and gestational age, were collected. A detailed history of vaginal infections was obtained, and vaginal samples were analyzed to determine the flora composition, including the presence of candidiasis, bacterial vaginosis (BV), and normal flora. Statistical analyses were conducted to assess the associations between these factors and GBS carriage by using R software (version 4.4.0).

Results: Of the 407 women enrolled, 119 (29.2%) tested positive for GBS carriage. The median age of participants was 32 years, with no significant association between age and GBS carriage. There was no significant relationship between the number of pregnancies, parity, or gestational age and GBS colonization. However, women with a history of vaginal infections, particularly candidiasis, had a significantly higher odds of GBS carriage (OR: 2.72, 95% CI: 1.76–4.25). Vaginal flora analysis revealed that 60.7% of participants had normal flora, 28.0% had intermediary flora, and 11.3% had BV, with no significant associations between flora type and GBS carriage.

Conclusion: This study highlights the prevalence of GBS carriage among pregnant women in Senegal and identifies candidiasis as a significant risk factor for GBS colonization. These findings emphasize the need for targeted screening and management strategies, particularly for women with vaginal infections, to reduce the risk of GBS-related neonatal infections. Further research is necessary to better understand the molecular mechanisms underlying the association between vaginal infections and GBS carriage in the Senegalese and broader sub-Saharan African context.

Keywords: Group B Streptococcus; Pregnant women; Senegal; Risk factors

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Introduction

Group B Streptococcus (GBS) is a major cause of neonatal infections, including sepsis, pneumonia, and meningitis, posing significant risks to both maternal and neonatal health, particularly in sub-Saharan Africa. In this region, the burden of GBS-related morbidity and mortality is high, partly due to limited access to effective prenatal screening, intrapartum antibiotic prophylaxis (IAP), and healthcare infrastructure [1]. Despite its importance, the prevalence of GBS carriage and the factors contributing to its colonization in pregnant women remain poorly understood in many African countries, including Senegal. Limited data are available on the role of various maternal and vaginal health factors influencing GBS colonization, and these factors can vary widely across different populations. In Senegal, a country located in West Africa, maternal health is impacted by a complex interplay of socio-economic, cultural, and healthcare-related factors, which may contribute to the prevalence of GBS carriage. The prevalence of GBS colonization in pregnant women in Senegal has

been reported to range from 12% to 30%, with variations depending on the study population, methodology, and region [2]. Given the lack of widespread screening programs and the absence of routine GBS prophylaxis, understanding the factors associated with GBS colonization is critical for improving maternal and neonatal health outcomes. Maternal age, parity, and gestational age have all been identified as potential risk factors for GBS colonization, though results are inconsistent across different studies [3].

Vaginal infections, including bacterial vaginosis (BV) and candidiasis, have been suggested as potential contributors to GBS colonization, with studies indicating that these infections can alter the vaginal microbiota and increase susceptibility to bacterial colonization [4]. In particular, candidiasis has been linked to a higher likelihood of GBS carriage, though the underlying mechanisms remain unclear and are yet to be explored in the African context [5]. In Senegal and other sub-Saharan African countries, the prevalence of candidiasis and BV is relatively high among pregnant women, potentially influencing GBS colonization dynamics [6].

Given the limited understanding of the factors influencing GBS carriage in Senegal, this study aims to assess the prevalence of GBS colonization in a cohort of pregnant women and to identify potential risk factors, including maternal age, parity, gestational age, and a history of vaginal infections. By examining the relationship between vaginal infections, particularly candidiasis, and GBS carriage, we seek to provide insights into the role of vaginal flora composition in GBS colonization. This study is critical for developing context-specific strategies to prevent and manage GBS-related complications in Senegal and sub-Saharan Africa, ultimately improving maternal and neonatal health in the region.

Methodology

Study design

This study employed a retrospective and descriptive design to analyze vaginal swab samples from pregnant women at the Medical Biology Laboratory of the Institute Pasteur in Dakar, Senegal, collected between July 1, 2022, and June 30, 2023. The study received approval from the institutional review board, ensuring strict adherence to ethical guidelines for human research as outlined by the World Health Organization [7].

Population and sampling

The study included pregnant women who presented for bacteriological examinations of vaginal swabs at the laboratory during the study period.

Inclusion criteria

- Pregnant women aged 18 years and older.
- Undergoing routine bacteriological examination of vaginal samples.
- Complete medical records available.

Exclusion criteria

- Incomplete medical records.
- Recent antibiotic or antifungal treatment within the last two weeks prior to sampling.

Sample collection and preparation

Vaginal samples were collected by trained healthcare personnel using sterile techniques. The sample collection procedure involved the following steps:

- Swabbing: A sterile swab was inserted into the posterior fornix of the vaginal canal to collect the sample.
- Transport: Samples were immediately placed in sterile tubes containing saline solution and transported to the laboratory for analysis within two hours of collection to ensure sample integrity [8].

Laboratory analysis

The laboratory procedures for diagnosing bacterial vaginosis, candidiasis, and Group B Streptococcus (GBS) colonization were as follows:

Group B Streptococcus detection

Group B Streptococcus (GBS) was detected using Granada medium (Becton Dickinson, UK). Orange colonies formed on the medium after 18-24 hours of incubation at 37°C were indicative of GBS colonization.

Bacterial vaginosis diagnosis

BV was diagnosed using the Nugent score, which involves the microscopic examination of Gram-stained vaginal smears. The Nugent scoring system evaluates the relative abundance of vaginal bacterial flora, including *Lactobacillus spp.*, *Gardnerella vaginalis*, and *Mobiluncus spp*. Scores were categorized as follows:

- 0–3: Normal vaginal flora.
- 4–6: Intermediate flora.
- ≥7: Bacterial vaginosis [9].

Candidiasis diagnosis

Vulvovaginal candidiasis was diagnosed by culturing samples on CHROMagar Candida medium (Becton Dickinson, USA), which was incubated at 37°C for 48 hours. Cultures with at least 10 yeast colonies were considered positive. Positive cultures were further confirmed by direct microscopy for the presence of budding yeast or pseudo hyphae [8].

Data collection and analysis

Demographic and clinical data were extracted from the patients' medical records. The data collected included:

- Age.
- Gestational age at the time of sampling.
- Obstetric history (e.g., parity, history of preterm birth).
- History of infections (e.g., previous GBS or BV infections).

Data were entered into an Excel spreadsheet (Microsoft Excel version 2010) for initial management and subsequently analyzed analyses to describe the population across age, Nugent score, candidiasis, gestational age, parity, weeks of amenorrhea, history of infection and flora according to Strepto B carriage. A comparison between women who were infected and uninfected with Strepto B was made according to categorical variables of interest using Fisher's exact test and continuous variables using the analysis of variance (anova) test. Univariate and multivariate logistic regression analyses were performed to examine characteristics associated with Strepto B carriage. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. The significance level of explanatory variables was set at

5%. The parsimonious model was chosen on the basis of AIC (Akaike Information Criterion) model selection criteria. Statistical analyses were performed using R software (version 4.4.0).

Ethical considerations

This study was conducted in accordance with ethical standards for research involving human participants. Indirect consent was obtained from all participants involved in the study. Participants were informed that their data would be used for medical research purposes, and they were given the option to opt out. In our reports, we state that individuals who do not wish for their data to be utilized in medical research can contact our secretary to have their information excluded from the study. The confidentiality of all participants was maintained throughout the research process, and all data were anonymized prior to analysis.

Results

Demographic characteristics

A total of 407 pregnant women were enrolled, with 119 (29.2%) testing positive for GBS carriage. The median age was 32 years (range: 17–46). Among the participants, the majority were aged 30–39 years (56.5%), followed by those aged 00–29 years (34.9%). There was no statistically significant association between age groups and GBS carriage, although women aged 40-49 years showed a slightly higher odds ratio (OR: 1.51, 95% CI: 0.68–3.25).

Number of pregnancies and parity

The mean number of pregnancies was similar between GBS-positive (2.6 ± 1.4) and GBS-negative women (2.6 ± 1.5), with no significant association (OR: 1.00, 95% CI: 0.86–1.15). Similarly, mean parity was comparable (1.2 ± 1.2 in negatives vs. 1.3 ± 1.3 in positives), showing no significant relationship (OR: 1.00, 95% CI: 0.84–1.19).

Gestational age

The majority of participants were before 35 weeks of amenorrhea (85.3%). GBS carriage was slightly less frequent in women after 35 weeks (10.9%) compared to those before 35 weeks (89.1%), but this was not statistically significant (OR: 0.63, 95% CI: 0.31–1.18).

History of vaginal infections

A history of vaginal infections was reported by 41.5% of participants (n=169). GBS-positive women were more likely to have a history of vaginal infections (45.4%) compared to GBS-negative women (39.9%), but the association was not significant (OR: 1.25, 95% CI: 0.81–1.92).

Vaginal Flora

Normal vaginal flora was observed in 60.7% of participants (n=247), intermediary flora in 28.0% (n=114), and vaginosis in 11.3% (n=46). There were no significant associations between GBS carriage and the type of vaginal flora. Specifically, intermediary flora was associated with an OR of 1.22 (95% CI: 0.75–1.95), while BV showed an OR of 0.59 (95% CI: 0.26–1.24) compared to normal flora.

Candidiasis and GBS Carriage

Candidiasis was present in 44.0% of participants (n=179). Women with candidiasis were significantly more likely to test positive for GBS (61.3%) compared to those without candidiasis (38.7%) (OR: 2.72, 95% CI: 1.76–4.25).

Discussion

This study provides important insights into the prevalence of Group B Streptococcus (GBS) colonization and its associated factors among pregnant women, with findings that align with and expand on existing literature.

The prevalence of GBS colonization in our study was 29.2%, consistent with global estimates ranging from 10% to 40%, as reported in previous studies [10]. Women aged 30-39 years constituted the majority of both GBS-positive and GBS-negative groups, but no significant association was found between age and GBS colonization. This aligns with findings from Russell et al. (2019), who noted that maternal age in this range does not strongly predict GBS colonization risk [11]. A significant relationship was observed between GBS colonization and vulvovaginal candidiasis (VVC), with GBS-positive women being 2.72 times more likely to have concurrent candidiasis. This association supports the hypothesis of shared environmental or host factors conducive to colonization by both microorganisms [12]. However, no significant association was found between GBS colonization and Nugent scores, indicating that bacterial vaginosis (BV) may not be a major determinant of GBS presence. This contrasts with some studies that have reported an increased risk of GBS

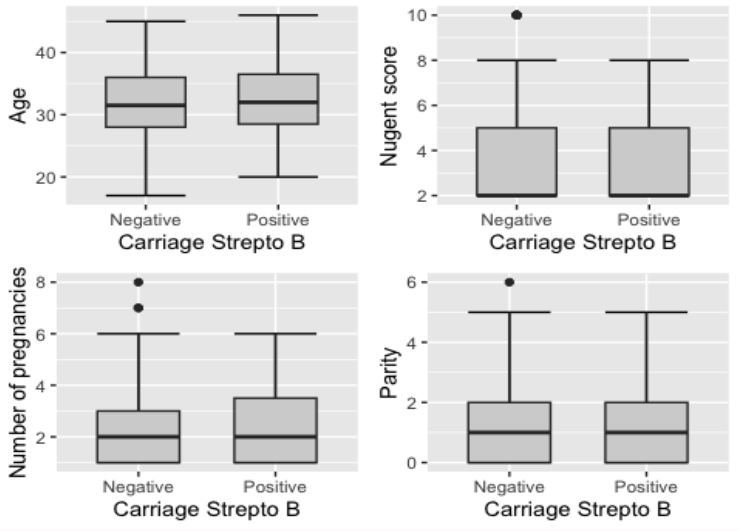

Figure 1: Box Plot of Age, Nugent Score, Number of Pregnancies, and Parity by GBS Status.

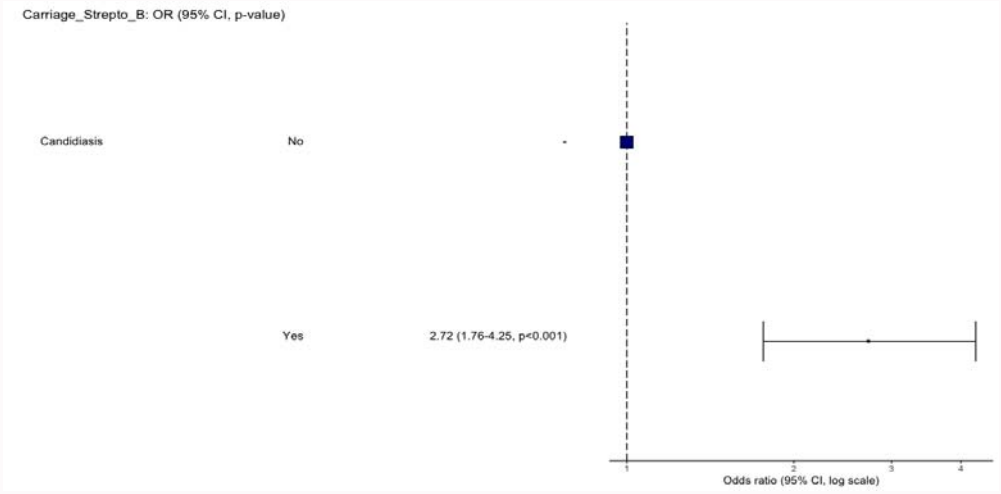

Figure 2: Relation between GBS carriage and Candidiasis infection.

Table 1: Distribution of GBS cases by risk factors.

Carriage Strepto B	Negative (N=288)	Positive (N=119)	Total (N=407)	p-value Odds Ratio (95% CI)
Age group				0.554
(17-29)	102 (35.4%)	40 (33.6%)	142 (34.9%)	-
(30-39)	164 (56.9%)	66 (55.5%)	230 (56.5%)	1.03 (0.65-1.64)
(40-49)	22 (7.6%)	13 (10.9%)	35 (8.6%)	1.51 (0.68-3.25)
Number of pregnancies				
Mean (SD)	2.6 (1.5)	2.6 (1.4)		1.00 (0.86-1.15)
Parity				0.988
Mean (SD)	1.2 (1.2)	1.3 (1.3)		1.00 (0.84-1.19)
Weeks of amenorrhea				0.218
Before 35 SA	241 (83.7%)	106 (89.1%)	347 (85.3%)	-
After 35 SA	47 (16.3%)	13 (10.9%)	60 (14.7%)	0.63 (0.31-1.18)
History of infections				0.321
No	173 (60.1%)	65 (54.6%)	238 (58.5%)	-
Yes	115 (39.9%)	54 (45.4%)	169 (41.5%)	1.25 (0.81-1.92)
Flora balance				0.224
Normal	175 (60.8%)	72 (60.5%)	247 (60.7%)	-
Intermediate	76 (26.4%)	38 (31.9%)	114 (28.0%)	1.22 (0.75-1.95)
Vaginosis	37 (12.8%)	9 (7.6%)	46 (11.3%)	0.59 (0.26-1.24)
Candidiasis				< 0.001
No	182 (63.2%)	46 (38.7%)	228 (56.0%)	-
Yes	106 (36.8%)	73 (61.3%)	179 (44.0%)	2.72 (1.76-4.25)

colonization in women with disrupted vaginal flora [13].

Neither parity nor the number of pregnancies showed significant associations with GBS colonization, consistent with prior findings by Hitti et al., which suggested that parity alone is not a reliable predictor of GBS carriage [14]. Similarly, gestational age was not significantly associated with colonization in this study, although some studies have suggested that late gestation may increase colonization risk [15]. These discrepancies highlight the need for larger, multicenter studies to clarify these relationships.

The strong association between GBS and candidiasis observed in this study underscores the importance of routine screening for both infections during pregnancy. GBS is a well-known cause of neonatal sepsis and meningitis, with vertical transmission occurring in approximately 50% of cases when untreated [16]. The co-occurrence of candidiasis further complicates the clinical picture and may necessitate broader diagnostic and therapeutic approaches. Identifying co-infections such as VVC during pregnancy could serve as a clinical marker for heightened surveillance and early intervention to mitigate adverse outcomes.

This study is limited by its cross-sectional design, which precludes the ability to determine causal relationships. Additionally, the study

was conducted at a single center, potentially limiting generalizability to other populations. Furthermore, while univariable analyses were performed, residual confounding factors may not have been fully accounted for.

Longitudinal studies are needed to investigate the temporal dynamics of GBS colonization and its interactions with other infections, particularly VVC. Future research could also explore molecular mechanisms driving the coexistence of GBS and Candida species in the vaginal microbiota. Incorporating microbiome sequencing approaches may provide deeper insights into the complex interplay of vaginal microorganisms during pregnancy [17].

Conclusion

This study provides valuable insights into the prevalence and potential risk factors associated with Group B Streptococcus (GBS) carriage among pregnant women. The overall prevalence of GBS carriage was found to be 29.2%, with no significant associations observed between age, number of pregnancies, parity, or gestational age and GBS carriage. However, a history of vaginal infections and vaginal flora composition did not show significant associations, suggesting that these factors alone may not be reliable predictors of GBS colonization in pregnancy.

Notably, the presence of candidiasis was strongly associated with an increased likelihood of GBS carriage, emphasizing the need for careful monitoring and management of vaginal infections during pregnancy. These findings underline the complexity of GBS colonization and the importance of considering a range of factors in the prevention and management strategies for GBS during pregnancy. Further research is needed to explore the molecular mechanisms underlying the association between candidiasis and GBS carriage, as well as to evaluate the effectiveness of targeted interventions in reducing GBS-related maternal and neonatal complications.

Conflict of Interests

The authors declare no conflicts of interest regarding the publication of this article. The study was conducted independently and received no external influence from any commercial or financial entities.

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