***Streptococcus agalactiae*: vaginal carriage, associated risk factors and antibiotic susceptibility in pregnant women received *at Ouakam Military Hospital laboratory***

**Abstract**

**Introduction:** *Streptococcus agalactiae* or Group B Streptococcus (GBS) is a commensal bacterium of the female reproductive tract that can be pathogenic in newborns. The objectives of this present study were: to determine the rate of vaginal carriage of GBS in pregnant women, the associated risk factors and to evaluate antibiotic resistance.

**Methodology:** We conducted a prospective, descriptive, analytical study in the medical biology laboratory of Ouakam Military Hospital from July 1, 2022 to June 30, 2023. Identification and antibiotic susceptibility testing were performed using the Vitek 2 COMPACT automated system (bioMérieux). Statistical analysis was performed with RStudio software (version 4.3.2) and differences were considered significant if p<0.05.

**Results:** We received 327 pregnant women with a mean age of 31.8 ± 5.4 years. Vaginal GBS carriage was 17.74% (58/327), higher in women aged 26-35 years (70.69%), in the third trimester of pregnancy (46.6%), primiparous (46.6%), university-educated (44.8%) and having used contraception at least once (67.2%). It was higher in those with non-fetid leucorrhoea (53.4%), local inflammation (53.4%), local symptoms (67.2%), balanced vaginal flora (75.9%), use of a disposable pad (61.5%), and no previous abortion (58.6%). However, none of these factors was significantly associated with vaginal GBS carriage (p>0.05). There was no resistance to vancomycin, tigecycline, teicoplanin, linezolid and daptomycin, while tetracycline was the least active molecule.

**Conclusion:** The rate of vaginal carriage of GBS in the pregnant women in our study was relatively high, with no significantly associated risk factors. Non-negligible resistance to penicillin G was noted. However, vancomycin, tigecycline, teicoplanin, linezolid and daptomycin could be therapeutic alternatives.

**Keywords:** *Streptococcus agalactiae*, vaginal carriage, risk factors, antibiotic resistance

**1. INTRODUCTION**

*Streptococcus agalactiae* or Group B Streptococcus (GBS) is an encapsulated Gram-positive bacterium, commensal of the lower gastrointestinal tract of humans and the lower reproductive tract of women (Doran & Nizet, 2004). It is a facultative anaerobic bacterium, showing complete hemolysis (type ß) on blood agar, demanding for its culture and possessing neither catalase nor mannitol salts. It aggregates into chains, hydrolyzes sodium hippurate and is characterized by resistance to bacitracin‑ (Sambola et al., 2002).

Although commensal*, S. agalactiae* can become an invasive pathogen in immunocompromised individuals, such as neonates, pregnant women and the elderly, and be responsible for a variety of infections including pneumonia, septicemia and meningitis (Maisey et al., 2008). Thus, it remains the leading cause of chorioamniotitis and post-partum endometritis (Yancey et al., 1994) , and the leading source of early neonatal bacterial infections (Schrag et al., 2000). Newborns of mothers colonized with GBS may become infected in utero, or during delivery when they swallow or aspirate the bacteria as they pass through the vaginal canal (Schuchat, 1998)

Over twenty different virulence factors contribute to GBS pathogenesis. These include adhesins, enzymes, carbohydrates and other proteins. Most adhesins promote GBS colonization in the epithelium of the vaginal tract, enabling transmission to newborns as they pass through the vaginal tract at birth. Adhesins have also been associated with late-onset diseases, such as early-onset sepsis (Seo et al., 2013). Other virulence factors, such as HvgA, hemolytic pigment and alpha C protein, can facilitate GBS invasion of various tissues, such as the brain, placenta and cervix, leading to deterioration in physical status (Pietrocola et al., 2018). By gaining access to the bloodstream, GBS can invade the cerebral epithelium, causing meningitis, one of the late-onset diseases in newborns (Nanduri et al., 2019). This infection is responsible for a high mortality rate, estimated at less than 10% in industrialized countries and up to 30-40% in resource-limited countries (CDC, 2010).

In view of the seriousness of GBS infections, particularly in newborns, since 2002 the Centers for Disease Control and Prevention (CDC) have recommended systematic screening of all pregnant women for GBS carriage. Screening is recommended between 35 and 37 weeks of amenorrhea. The protocol, unchanged in the 2011 updated guidelines, also recommends antibiotic prophylaxis, with penicillin G as the antibiotic of first choice. This is aimed at reducing or eliminating vaginal colonization in order to limit the transmission of GBS from mother to newborn. According to CDC recommendations, this antibiotic treatment should be administered intravenously during labor and ideally at least 4 hours before birth. This is particularly true for women who have had a positive prenatal screening for GBS or for women with risk factors, but also for pregnant women who are at risk but whose GBS carriage status is unknown (CDC, 2010).

In developed countries, prenatal screening of pregnant women for vaginal GBS carriage and intrapartum antibiotic prophylaxis have been widely established and have reduced the incidence of GBS-related neonatal morbidity and mortality (CDC, 2010). In 21 African countries, a meta-analysis­­ (Gizachew et al., 2019) including studies carried out between 1989 and 2019 and involving 22206 pregnant women found an overall estimate of GBS colonization of 19.3%. In Senegal, systematic GBS screening of pregnant women is not yet performed in routine practice, and epidemiological, clinical and microbiological data on the subject currently remain scarce despite the high mortality associated with this infection in a global context of increasing antimicrobial resistance. It was against this backdrop that we carried out the present study, which set out determine the rate of vaginal carriage GBS in pregnant women, the factors associated with this colonization and the sensitivity profile of this bacterium in relation to the various antibiotics used in our region.

**2. METHODOLOGY**

**2.1. Type, location and duration of study**

We conducted a prospective, descriptive, analytical study in the medical biology laboratory of Ouakam Military Hospital (Dakar, Senegal) from July 1, 2022 to June 30, 2023. Our study population consisted of all pregnant women referred to the laboratory for genital sampling (vaginal and endocervical).

**2.2. Sampling procedure**

Sampling was carried out in a dedicated room. Prior to sampling, a questionnaire was sent to pregnant women to gather socio-demographic information, after obtaining their informed consent to participate in the study. They were then placed in the gynaecological position and a sterile vaginal speculum was inserted to visualize the cervix. The physical examination recorded the appearance of the vulva, perineum, vagina, endocervix and ectocervix. Samples were then taken from two sites (vaginal and endocervical). Vaginal sampling was carried out in the posterior vaginal cul-de-sac, using a sterile swab and gentle rotation. Endocervical sampling was carried out after introduction of the swab into the endocervix and rigorous asepsis of the ectocervix to avoid contamination by commensal vaginal flora. After collection, the color and odor of the secretions were noted.

**2.3 Microscopic examination**

It comprises two stages: fresh direct examination and examination after Gram staining.

**2.3.1. Direct examination in the fresh state**

On a slide, the swab was discharged onto a drop of saline, then the preparation was covered with a coverslip. The preparation was examined under a light microscope at x40 magnification. This step revealed the presence of leukocytes, red blood cells, epithelial cells, yeasts, mycelial filaments and the protozoan *Trichomonas vaginalis*. The smear was considered inflammatory if leukocytes exceeded 10 per microscopic field.

**2.3.2. Examination after Gram staining**

Gram staining was used to classify the vaginal flora, and also to note the presence of *Gardnerella vaginalis*, clue-cells, *Mobilluncus spp*, Gram-negative diplococci, yeasts, mycelial filaments and *Neisseria gonorrhoeae*. Four types of vaginal flora were obtained: type I: exclusive presence of lactobacilli, type II: predominance of lactobacilli > 50%, type III: presence of other flora more important than lactobacilli, and type IV: total absence of lactobacilli. Types I and II were considered balanced vaginal flora, while types III and IV were considered unbalanced vaginal flora.

**2.4. Bacterial culture**

The endocervical swab was inoculated on chocolate agar with VCNT (Vancomycin, Colistin, Nystatin, Trimethoprim) and placed in a jar with a candle to test for *Neisseria gonorrhoeae*, while the exocervical swab was inoculated on Sabouraud Chloramphenicol and ANC (Fresh Blood Agar + Nalidixic Acid and Colistin) media. In addition to these culture media, a specific agar called Granada (bioMérieux) was inoculated to test for GBS. These culture media were then incubated in an oven at 37°C for 24 hours. The next day, those showing significant bacterial growth were processed. Bacterial identification and antibiotic susceptibility testing were carried out using the Vitek 2 COMPACT automated system (bioMérieux).

**2.5. Statistical analyses**

Data collected with the questionnaire were recorded in Excel (version 2013) and analyzed using RStudio software (version 4.3.2). Categorical variables were expressed as percentages and continuous variables as averages. The Chi2 test was used to compare percentages, and Student's t-test was used to compare means. Differences were considered statistically significant for values of p<0.05.

**2.6. Ethical considerations**

Informed consent was obtained from all pregnant women participating in the study prior to inclusion. We kept all data collected anonymous; participants' identities were replaced by codes.

**3. RESULTS**

**3.1. Vaginal carriage of GBS according to socio-demographic characteristics**

During the study period, we received 327 pregnant women. The mean age was 31.8 ± 5.4 years, with lower and upper extremes of 16 and 45 years respectively. The presence of local symptoms prompted examination in 231 women (70.6%), and the remaining 96 (29.4%) were seen as part of a prenatal visit. Just over half the pregnant women (50.5%) were in the 3rd trimester of gestation. Among the 327 vaginal swabs analyzed, 58 GBS strains producing orange colonies on Granada medium (bioMérieux) (figure 1) were isolated, corresponding to a vaginal carriage rate of 17.74%.



Figure 1: *Streptococcus agalactiae* colonies on Granada agar (bioMérieux)

The socio-demographic characteristics of the study population are shown in Table I. The latter shows that among women colonized or not by GBS, those aged between 26-35 years were the most represented, with 41/58 (70.7%) and 196/269 (72.86%) respectively. Statistical analysis of the data shows that there was no statistically significant link between the age of pregnant women and GBS colonization (p=0.265). This table also shows the absence of correlation between vaginal GBS carriage and each of the socio-demographic characteristics studied (p>0.05).

Table I: Vaginal carriage of *Streptococcus agalactiae* according to socio-demographic characteristics

|  |  |  |  |
| --- | --- | --- | --- |
|  | | | |
| **Features** | **Vaginal carriage of GBS** | | ***p-value*** |
|  | **GBS Negative** | **GBS Positive** |  |
|  | **N=269** | **N=58** |  |
| **Age range (years)** |  |  |  |
| [16-25] | 31 (11.52%) | 6 (10.34%) | 0.265 |
| [26-35] | 196 (72.86%) | 41 (70.7%) |  |
| [36-45] | 42 (15.61%) | 11 (18.9%) |  |
| **Gestational age** |  |  |  |
| 1st quarter | 48 (17.8%) | 11 (19.0%) | 0.800 |
| 2th quarter | 83 (30.9%) | 20 (34.5%) |  |
| 3th quarter | 138 (51.3%) | 27 (46.6%) |  |
| **Reason for examination** |  |  |  |
| Prenatal visit | 77 (28.6%) | 19 (32.8%) | 0.640 |
| Symptoms | 192 (71.4) | 39 (67.2%) |  |
| **Marital status** |  |  |  |
| Single | 4 (1.5%) | 0 (0.0%) | 0.999 |
| Bride | 265 (98.5%) | 58 (100.0%) |  |
| **Parity** |  |  |  |
| Multipare | 66 (24.5%) | 12 (20.7%) | 0.301 |
| Primipare | 96 (35.7%) | 27 (46.6%) |  |
| nulliparous | 107 (39.8%) | 19 (32.8%) |  |
| **Study level** |  |  |  |
| Arabic | 15 ( 5.6%) | 4 (6.9%) | 0.094 |
| Illiterate | 36 (13.4%) | 3 (5.2%) |  |
| Primary | 27 (10.0%) | 8 (13.8%) |  |
| Secondary | 108 (40.1%) | 17 (29.3%) |  |
| University | 83 (30.9%) | 26 (44.8%) |  |
| **Towel type** |  |  |  |
| Cotton | 45 (22.6%) | 12 (30.8%) | 0.288 |
| Disposable towel | 145 (72.9%) | 24 (61.5%) |  |
| Sanitary tampon | 9 (4.5%) | 3 (7.7%) |  |
| **Number of abortions** |  |  |  |
| 0 | 111 (41.3%) | 34 (58.6%) | 0.206 |
| 1 | 114 (42.4%) | 18 (31.0%) |  |
| 2 | 28 (10.4%) | 4 (6.9%) |  |
| 3 | 15 (5.6%) | 2 (3.4%) |  |
| 4 | 1 (0.4%) | 0 (0.0%) |  |
| **Contraception** |  |  |  |
| No | 127 (47.2%) | 19 (32.8%) | 0.063 |
| Yes | 142 (52.8%) | 39 (67.2%) |  |
|  |  |  |  |

**3.2. Vaginal carriage of GBS according to local symptoms**

Statistical analysis of data concerning local symptoms (Table II) shows that none of these signs was significantly correlated with vaginal GBS carriage (p>0.05).

|  |  |  |  |
| --- | --- | --- | --- |
| Table II: Vaginal carriage of *Streptococcus agalactiae* according to local symptoms | | | |
| **Local symptoms** | **Vaginal carriage of GBS** | | ***p-value*** |
|  | **GBS Negative** | **GBS Positive** |  |
|  | **N=269** | **N=58** |  |
| **Dyspareunia** |  |  |  |
| Absence | 181 (67.3%) | 43 (74.1%) | 0.388 |
| Presence | 88 (32.7%) | 15 (25.9%) |  |
| **Pelvic pain** |  |  |  |
| Absence | 149 (55.4%) | 36 (62.1%) | 0.433 |
| Presence | 120 (44.6%) | 22 (37.9%) |  |
| **Pruritus** |  |  |  |
| Absence | 124 (46.1%) | 26 (44.8%) | 0.976 |
| Presence | 145 (53.9%) | 32 (55.2%) |  |

**3.3. Vaginal GBS carriage as a function of vaginal discharge characteristics**

Vaginal discharge was predominantly white; 200/269 (74.3%) in non-carriers and 44/58 (75.9%) in carriers. According to statistical analysis of vaginal discharge characteristics (Table III), there was no statistically significant variation between vaginal discharge characteristics and GBS carriage (p>0.05).

Table III: Vaginal carriage of *Streptococcus agalactiae* according to vaginal discharge characteristics

|  |  |  |  |
| --- | --- | --- | --- |
|  | | |  |
| **Characteristics of vaginal discharge** | **Vaginal carriage of GBS** | | ***p-value*** |
|  | **GBS Negative** | **GBS Positive** |  |
|  | **N=269** | **N=58** |  |
| **Color** |  |  |  |
| White | 200 (74.3%) | 44 (75.9%) | 0.273 |
| Yellow | 14 (5.2%) | 6 (10.3%) |  |
| Brown | 5 (1.9%) | 2 (3.4%) |  |
| Red | 16 (5.9%) | 1 (1.7%) |  |
| Green | 34 (12.6%) | 5 (8.6%) |  |
| **Odor** |  |  |  |
| Fetid | 152 (56.5%) | 27 (46.6%) | 0.216 |
| Non-fetid | 117 (43.5%) | 31 (53.4%) |  |
| **Type of vaginal flora** |  |  |  |
| Unbalanced | 94 (34.9%) | 14 (24.1%) | 0.152 |
| Balanced | 175 (65.1%) | 44 (75.9%) |  |
| **Local inflammatory reaction** |  |  |  |
| No | 173 (64.3%) | 31 (53.4%) | 0.162 |
| Yes | 96 (35.7%) | 27 (46.6%) |  |
|  |  |  |  |

**3.4. Vaginal carriage of GBS according to microorganisms isolated**

Isolation of GBS from the women in our study was associated or not with other micro-organisms (Table IV). Association with *Candida albicans* was most common, with 34/58 (58.6%) cases, followed by *Gardnerella vaginalis* with 12/58 (20.7%) cases. Statistical analysis of the data showed that the presence of none of the microorganisms isolated was significantly associated with vaginal GBS carriage (p>0.05).

Table IV: Vaginal carriage of *Streptococcus agalactiae* according to micro-organisms isolated

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Microorganisms** | **Vaginal carriage of GBS** | | ***p-value*** |
|  | **GBS Negative** | **GBS Positive** |  |
|  | **N=269** | **N=58** |  |
| ***Candida albicans*** |  |  |  |
| Absence | 126 (46.8%) | 24 (41.4%) | 0.541 |
| Presence | 143 (53.2%) | 34 (58.6%) |  |
| ***Gardnerella vaginalis*** |  |  |  |
| Absence | 189 (70.3%) | 46 (79.3%) | 0.219 |
| Presence | 80 (29.7%) | 12 (20.7%) |  |
| ***Mobiluncus spp*** |  |  |  |
| Absence | 243 (90.3%) | 51 (87.9%) | 0.756 |
| Presence | 26 (9.7%) | 7 (12.1%) |  |
| ***Trichomonas vaginalis*** |  |  |  |
| Absence | 266 (98.9%) | 57 (98.3%) | 0.544 |
| Presence | 3 (1.1%) | 1 (1.7%) |  |
| ***Neisseria gonorrhoeae*** |  |  |  |
| Absence | 269 (100.0%) | 58 (0.0%) | 0.999 |
| Presence | 0 (0.0%) | 0 (0.0%) |  |

**3.5. Susceptibility of GBS strains to antibiotics**

The resistance rates of GBS strains to the various antibiotics tested are shown in figure 2. The most active molecules were vancomycin, tigecycline, teicoplanin, linezolid and daptomycin, against which no GBS strains were found to be resistant. On the other hand, almost all (51/58) 87.9% of GBS strains in our series were resistant to tetracycline, which remains the least active molecule.

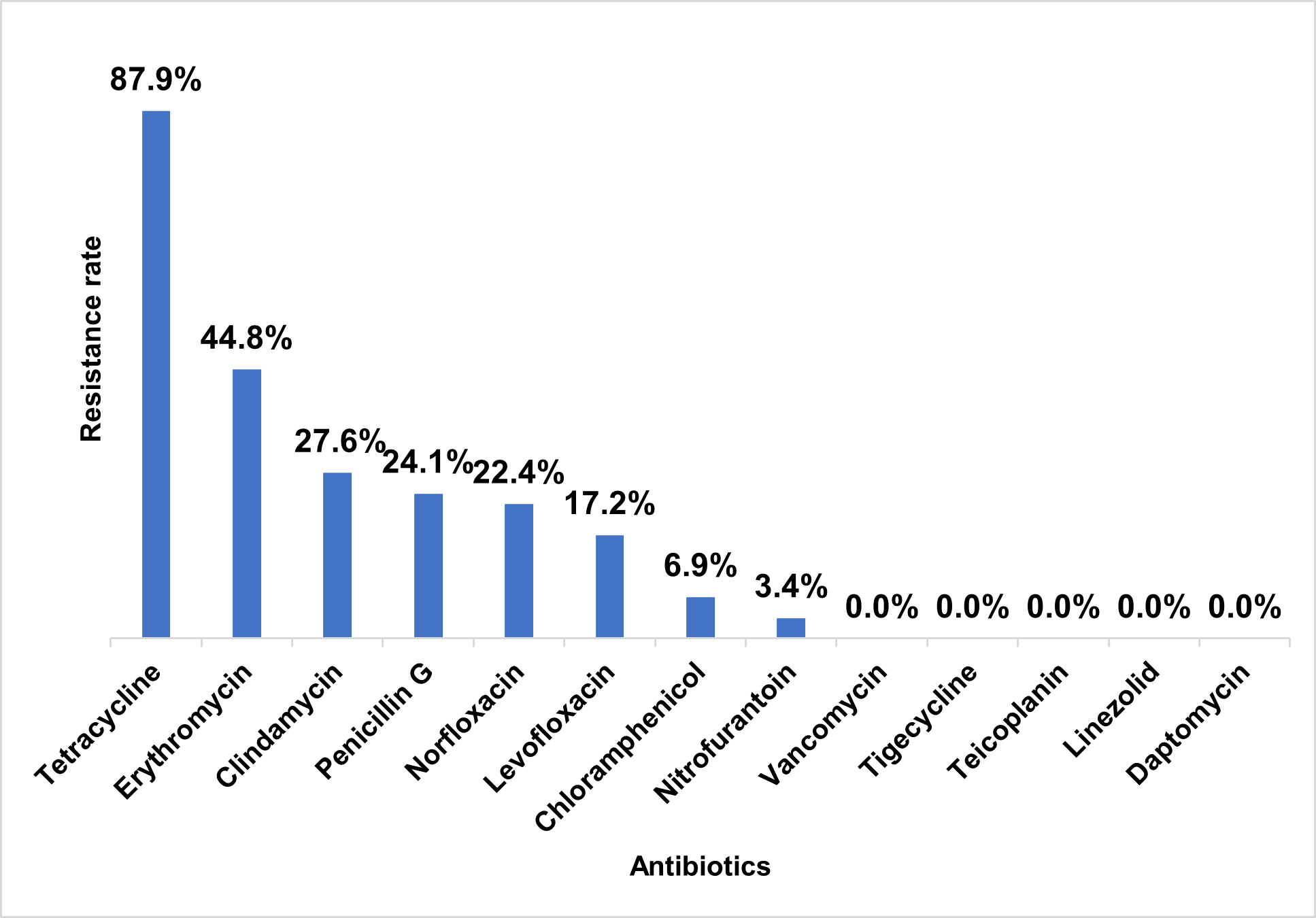
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Figure 2: Antibiotic resistance rates of *Streptococcus agalactiae* strains

**4. DISCUSSION**

In the present study, we found a vaginal GBS carriage rate of 17.74% among pregnant women. This prevalence is lower than those found in Gabon (19%) (Capan-Melser et al., 2015), Cameroon (21.3%) (Salomon et al., 2017) and Trinidad and Tobago (29%) (Akpaka et al., 2022). On the other hand, it remains higher than those found in France (Dahan-Saal et al., 2011) and Tunisia (Jerbi et al., 2007) with respective rates of 16.7% and 12.9%. In Brazil, a ten-year literature in 2019 showed GBS colonization rates in pregnant women ranging from 4.2% to 28.4% (do Nascimento et al., 2019). These results show a clear heterogeneity of GBS vaginal carriage rates in pregnant women reported in the literature. This finding was also noted in a meta-analysis including 21 African countries­­ (Gizachew et al., 2019) which found an estimated global rate of 19.3%, with inequities according to region. According to this study, the highest rates were observed in Southern Africa with 23.8%, followed North Africa with 22.7%, while the lowest were recorded in East Africa with 15.4%­­ (Gizachew et al., 2019). These variations could be due to a lack of harmonization in screening methods, bacterial identification and sampling sites. Indeed, some authors (Elikwu et al., 2016) report having used a molecular method such as polymerase chain reaction (PCR) for bacterial identification, while others (Khan et al., 2015) have used a microbiological method (bacterial culture), albeit with different culture media depending on the study. And according to some authors (Benitz et al., 1999), a sample inoculated on selective enrichment is more likely to contain GBS in pregnant animals than one inoculated on a medium without selective enrichment. With regard to sampling sites, some authors (Joachim et al., 2009) report having taken samples from the recto-vaginal area, while others (Meyn et al., 2009) have only taken samples from the vaginal area.

With regard to the risk factors studied in our series, no statistical association was found between a history of abortion and vaginal carriage of GBS. This result confirms most of the findings found in the literature (Ahmadi et al., 2018 ; Li et al., 2010) but contrasts with that obtained in Tunisia (Jerbi et al., 2007) where the authors reported that a history of spontaneous miscarriage(s) appeared to be a protective factor against vaginal carriage of this bacterium.

In our series, just over half the pregnant women (50.5%) were in the 3rd trimester of gestation. This result may be explained in part by the fact that some prescribers adhere to CDC recommendations, which recommend screening between 35th and 37th weeks of amenorrhea. This is because results obtained at this stage of pregnancy are more closely correlated with GBS colonization at full-term delivery. In this sense, several authors (Jerbi et al., 2007 ; Khan et al., 2015) have studied vaginal carriage GBS during this period of pregnancy. The results of our study are in agreement with others in the literature (Capan-Melser et al., 2015 ; Salomon et al., 2017) and show no significant association between gestational age and vaginal carriage GBS.

Depending on their level of education, university graduates were more affected than other pregnant women, although no significant association was noted between this factor and vaginal GBS carriage. On the other hand, in another study (Capan-Melser et al., 2015) , analysis of risk factors for GBS colonization showed a significant link with illiteracy. Our result could be related to the high rate of university-educated pregnant women in our series. In fact, one-third (33.33%) of the women in our cohort had a university education.

Among the colonized pregnant women in our series, women aged between 26-35 years (70.69%) were the most common, with no statistically significant association. Our finding is shared by other studies (Assefa et al., 2018) which report no significant association between GBS colonization and age group. On the other hand, contradictory results were observed in Cameroon (Salomon et al., 2017) , where GBS carriage rate was significantly associated with female age, and the 25-30 age bracket appeared to be a protective factor.

Furthermore, in Kenya (Seale et al., 2016) , the authors showed that multiparity was a factor significantly associated with GBS colonization. Indeed, in his study, this author demonstrates that parity ≥ 5 was significantly associated with vaginal carriage of GBS (Seale et al., 2016) . The same result found in Trinidad and Tobago (Akpaka et al., 2022) runs counter to ours, which shows no link between parity and this carriage.

With regard to contraception, our observations showed that vaginal colonization by GBS was higher in women who had used contraception at least once (67.2%), although there was no significant relationship. This result is in line with that obtained in the USA (Meyn et al., 2009) which showed that hormonal contraception and the use of spermicides or condoms were not associated with GBS vaginal colonization. The same author also reported in the same study that GBS colonization was not associated with abnormal vaginal odour, quantity or consistency of vaginal discharge (Meyn et al., 2009). This result corroborates our own and shows that the general characteristics of vaginal discharge are not significantly associated with vaginal GBS carriage.

In terms of GBS co-infections, the association with *Candida albicans* was the most common, accounting for 58.6% of cases, followed by *Gardnerella vaginalis* in 20.7% of cases. This finding corroborates that in Cameroon (Nkembe et al., 2018) where these two germs were the most frequently isolated in pregnant women in association with GBS. In our study, no significant link was found. contrast, other authors (Meyn et al., 2009 ; Cools et al., 2016) have reported that the presence of *Candida albicans,* intermediate vaginal flora and bacterial vaginosis were factors significantly associated with GBS vaginal colonization.

In sum, analysis of the risk factors studied in our work shows that none of these factors was significantly associated with vaginal sharing of GBS. The same result was found in Iran in 2020 (Dashtizade et al., 2020). Furthermore, a study including pregnant women in Senegal and Madagascar (Jung et al., 2021) concluded that in Senegal, none of the factors studied was associated with a significant risk of maternal GBS colonization. On the other hand, other risk factors have been found to be significantly associated with GBS carriage. This is the case, for example, of the Nigerian study (Elikwu et al., 2016) which found a significant association between a frequency of sexual intercourse greater than 2 per week and GBS carriage. On the other hand, in Kenya (Seale et al., 2016) the authors demonstrated that GBS colonization was significantly associated with Mijikenda ethnicity (indigenous population) and higher socio-economic status. However, in the same study, HIV-infected women, particularly those taking cotrimoxazole prophylaxis, less well-nourished women and those with obstetric emergencies had reduced GBS colonization rates (Seale et al., 2016). In another study (Akpaka et al., 2022) , gestational diabetes was a pathology associated with vaginal GBS carriage.

With regard to antibiotic resistance, the GBS strains in our series showed a resistance rate of 24.14% to penicillin G. This rate is higher than those reported in Ethiopia (Assefa et al., 2018), Tanzania (Joachim et al., 2009), which were 19.5% and 9.4% respectively. In Gabon (Belard et al., 2015), and Saudi Arabia (Khan et al., 2015), the authors report a perfect 100% sensitivity of GBS strains in their studies to Penicillin G. Our results show a non-negligible rate of GBS resistance to Penicillin G, demonstrating the need for alternative antibiotic therapy with molecules that are more active against this bacterium. In this respect, our study highlighted the efficacy of vancomycin, tigecycline, teicoplanin, linezolid and daptomycin, against which no resistance was noted. In Gabon, (Belard et al., 2015), the authors found a similar result with all GBS isolates sensitive to linezolid and vancomycin. An almost identical result was reported in India (Dashtizade et al., 2020) where no GBS strains isolated from genital swabs of pregnant women showed resistance to these two antibiotics. On the other hand, authors have described the emergence of GBS strains resistant to vancomycin. For example, a vancomycin resistance rate of 17% has been documented in Ethiopia (Assefa et al., 2018). The emergence of vancomycin-resistant GBS in these countries should prompt the strengthening of surveillance to avoid this phenomenon in our region. Indeed, vancomycin is a powerful last-resort antibiotic whose resistance in GBS strains could lead to a therapeutic impasse.

During our study, of all the antibiotics tested, tetracycline was the least active molecule on GBS strains with a resistance rate of 87.93%. This finding confirms data from the global literature with resistance rates close to 90% (Bertholom, 2015 ; Eren et al., 2005 ; Assefa et al., 2018) . This situation is justified by the widespread, uncontrolled use of this molecule for many years. GBS strains isolated in our study showed resistance rates of 44.83% to erythromycin. Authors (Assefa et al., 2018 ; Belard et al., 2015 ; Akpaka et al., 2022) have reported lower rates of 7.5%, 12.8% and 30.6% respectively. Our result is rather similar to that found in France (Ben Hamida Nouaili et al., 2011) where GBS resistance to erythromycin has been noted in 40% of cases. In our series, the relatively high erythromycin resistance rate may be explained by the routine use of this molecule in pregnant women with penicillin G allergy.

**5. CONCLUSION**

The rate of vaginal carriage of GBS among pregnant women in our study was relatively high, and we found no factor significantly associated with this carriage. This bacterium showed a non-negligible rate of resistance to Penicillin G. However, no resistance was noted to vancomycin, tigecycline, teicoplanin, linezolid and daptomycin, which could be therapeutic alternatives.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Authors hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**CONSENT AND ETHICAL APPROVAL**

Free and informed consent was obtained from participants in this study. All patient information was coded using anonymous numbers to maintain confidentiality, and all patients were informed of their test results.

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