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Original Article **Open Access**

Vaginal carriage of *Streptococcus agalactiae* among pregnant women in Ouagadougou, Burkina Faso

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Abstract:

Background: Group B *Streptococcus* (GBS) is one of the main bacteria responsible of serious neonatal infections. Neonatal transmission is very high at the end of pregnancy between the 34th and 38th week of gestation, and the systematic screening of GBS is strongly recommended in Burkina Faso. The objective of this study was to assess the prevalence of GBS carriage among pregnant women in Ouagadougou, Burkina Faso.
Methodology: This was a cross-sectional study of 300 pregnant women in their third trimester of pregnancy, conducted between July and November 2020. Vaginal sample was collected from each of the pregnant women during prenatal consultations. The samples were cultured on blood agar and the isolated pathogens were identified using the BD Phoenix M50 automated system. Antibiotic sensitivity test was performed on each isolate according to the recommendations of the CA-SFM-EUCAST 2020.
Results: Of the 300 women, 12 samples were positive for GBS, giving a carriage rate of 4.0%. All the GBS isolates were susceptible to ampicillin, cefotaxime, vancomycin and nitrofurantoin. On the other hand, resistance was encountered against penicillin G, erythromycin and trimethoprim-sulfamethoxazole. None of the risk factors assessed was statistically predictive of vaginal carriage of GBS in the pregnant women.
Conclusion: Vaginal carriage of GBS remains relevant. Pending the introduction of an effective vaccine in Burkina Faso, a systematic screening policy for GBS in pregnant women would help reduce perinatal infections from GBS, and the attendant neonatal and infant mortality.

Keywords: *Streptococcus agalactiae*, Group B streptococcus, vaginal carriage, risk factors, pregnancy

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Portage vaginal de *Streptococcus agalactiae* chez les femmes enceintes à Ouagadougou, Burkina Faso

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Résumé:

Contexte: Le streptocoque du groupe B (SGB) est l'une des principales bactéries responsables d'infections néonatales graves. La transmission néonatale est très élevée en fin de grossesse entre la 34ème et la 38ème semaine de gestation, et le dépistage systématique du SGB est fortement recommandé au Burkina Faso. L'objectif de cette étude était d'évaluer la prévalence du portage du SGB chez les femmes enceintes à Ouagadougou, au Burkina Faso.
Méthodologie: Il s'agit d'une étude transversale portant sur 300 femmes enceintes dans leur troisième trimestre de grossesse, réalisée entre juillet et novembre 2020. Un échantillon vaginal a été prélevé sur chacune des femmes enceintes lors de consultations prénatales. Les échantillons ont été cultivés sur gélose au sang et les pathogènes isolés ont été identifiés à l'aide du système automatisé BD Phoenix M50. Un test de sensibilité aux antibiotiques a été réalisé sur chaque isolat selon les recommandations du CA-SFM-EUCAST 2020.
Résultats: Sur les 300 femmes, 12 échantillons étaient positifs au SGB, soit un taux de portage de 4,0%. Tous

les isolats de GBS étaient sensibles à l'ampicilline, au céfotaxime, à la vancomycine et à la nitrofurantoïne. En revanche, une résistance a été rencontrée contre la pénicilline G, l'érythromycine et le triméthoprime-sulfaméthoxazole. Aucun des facteurs de risque évalués n'était statistiquement prédictif du portage vaginal du SGB chez les femmes enceintes.
Conclusion: Le portage vaginal du SGB reste d'actualité. En attendant l'introduction d'un vaccin efficace au Burkina Faso, une politique de dépistage systématique du SGB chez les femmes enceintes contribuerait à réduire les infections périnatales dues au SGB et la mortalité néonatale et infantile qui en découle.

Mots-clés: *Streptococcus agalactiae,* streptococcus du groupe B, portage vaginal, facteurs de risque, grossesse

Introduction:

Pregnancy-related illnesses and deaths remain very high. In 2015, it was estimated worldwide that 303,000 women died from pregnancy-related causes; 2.7 million children died during their first 28 days of life and 2.6 million children were stillborn (1,2). Among the causes of maternal and child mortality and morbidity, infections held an important place. Indeed, bacterial, viral or parasitic infections are common during pregnancy (3). *Streptococcus agalactiae* or Lancefield group B streptococcus (GBS), is an encapsulated Gram-positive commensal bacteria of the digestive and vaginal tract found in 20 to 30% of healthy adults (30). Group B streptococcus is considered the main agent involved in maternal-fetal infections, in utero fetal death, septicemia and meningitis in full-term newborns in industrialized countries (1,4,5).

In general, the prevalence of GBS colonization varies between countries and with figures ranging from 1.8% to 81.09% (1,6-7). Carriage rates are 10% in France (8), 26.5% in the United States of America (9), 18.12% in Thailand (10) and 23.7% in Belgium (11). In West Africa, the carriage rate was 12.7% in the city of Abidjan (Ivory Coast) (12), and 18% in Nigeria (13). It is very likely that GBS colonizes virtually all women at some point, intermittently or transiently (1), with carriage increasing with the age of pregnancy (7). Invasive infection occurs after vertical transmission from the rectovaginal sphere of the mother and 1 to 2% of newborns of colonized mothers develop neonatal infections in the first seven days after birth (14,15). In a study in Tunisia, a history of spontaneous miscarriages was associated with carriage of group B streptococcus, with newborns whose mothers who had positive samples having a significantly lower birth weight than those who did not (5).

Prevention of neonatal infection is based on GBS screening in pregnant women and the administration of antibiotics intrapartum (5). Since the Millennium Development Goals (MDGs) for maternal and child health were not achieved in 2015, those for sustainable development (SDGs) were set to, among other things, offer new opportunities for improving maternal and child health by 2030 (16, 17). Given the absence of a real GBS infection prevention in children guidelines in the health system of Burkina Faso, the present study on the vaginal carriage of GBS in women in the third trimester of pregnancy in the health district of Bogodogo, which objective was to assess the prevalence of GBS carriage among these women in Ouagadougou, with the aim of contributing to the improvement of maternal and child health indicators.

Materials and method:

Study setting:

The study was conducted in the health facilities (Medical Center of Saaba, CSPS of Wemtenga, Dassagho, and sector 30) of the health district of Bogodogo, in the city of Ouagadougou (where vaginal samples were collected) and bacteriological analysis of samples at the biomedical analysis laboratory of the University Teaching Hospital of Bogodogo (CHUB).

Study design period of study:

This was a descriptive cross-sectional study that determined the prevalence of vaginal carriage of group B streptococcus in pregnant women. The study took place from July 2020 to November 2020.

Ethical consideration:

Written authorization from the Regional Director of Health of the Centre Region as well as the agreements of principle from the managers of the health centers were obtained beforehand. In addition, informed consent of the women was a prerequisite for their inclusion in the study. The anonymity of the women and confidentiality were preserved.

Study population and participants:

The study population were pregnant women receiving prenatal consultation in different health facilities in Ouagadougou. The inclusion criteria were pregnant women in the 3rd trimester of pregnancy seen in prenatal consultation and women who voluntarily agreed to participate in the study. Exclusion criteria were women under antibiotic therapy within 72 hours preceding collection, and women with a contraindication to vaginal sampling or who have not given consent to participate in the study.

Study sample size calculation:

The sample size was calculated using the formula; $n=t^2P(1-P)/e^2$ for *S. agalactiae*

carriage prevalence of 22.0% (p=0.22), the highest carriage rate in Africa (18). For a confidence level of 95%, t=1.96 and e=5% precision, giving the calculated minimum sample size of 264, but 300 women were subsequently enrolled into the study.

Data collection:

Data collection from each pregnant women was done using a designed data collection form to obtain information on sociodemographic characteristics, obstetric history, and current pregnancy parameters.

Biological samples collection and laboratory analyses:

Each woman had a vaginal sample taken using a sterile cotton swab from the distal third of the vagina. The swabs were immediately introduced into tubes containing Todd-Hewitt with Colistin and Nalidixic Acid (CNA) broth, and transported to the laboratory for incubation at 37°C for 18-24 hours.

Subculture of the incubated broth was done on agar supplemented with 5% defibrinated sheep blood containing CNA, and incubated at 37°C for 24 hours in the presence of 10% CO_2. GBS colonies on fresh sheep blood agar appeared as small (1 to 2 mm in diameter), rounded, and present a zone of β haemolysis resulting in a perfectly transparent clear halo around the colony which corresponds to total lysis of red blood cells. Preliminary identification of GBS was by Gram stain microscopy of the colonies which showed Gram-positive cocci in chains of varying length and negative catalase test. Confirmatory phenotypic identification of GBS species was carried out using the automated BD Phoenix M50 instrument.

Antibiotic susceptibility of the GBS isolates was done by the disc diffusion technique on Muller-Hinton agar medium supplemented with 5% fresh defibrinated sheep blood, and results interpreted according to the recommendations of the 2020 Antibiogram Committee of the French Society of Microbiology - European Committee on Antimicrobial Susceptibility Testing (CA-SFM-EUCAST 2020) (18).

Data analysis:

Data were entered into Excel and Microsoft Word, and statistical analysis was done using EPI-INFO software version 7.2.3.1. Pearson's Chi-square test was used to compare data with $p<0.05$ considered as statistical significance.

Results:

A total of 300 pregnant women were enrolled into the study. The mean age of the women was 25.2±5.5 years with range of 15-42 years. A total of 36 (12.0%) cultures were positive for microbial pathogens but 12 were positive for GBS isolates, giving vaginal carriage rate in the study to be 4.0%. The mean age of women with vaginal GBS is 25.1±5.5 years with range of 19-38 years (Table 1).

The antibiotic susceptibility of the GBS isolates showed 100% sensitivity to ampicillin, cefotaxime, amoxicillin-clavulanic acid, vancomycin and nitrofurantoin but 23.0% of the isolates were resistant to penicillin G. Resistance rate to macrolides was 23.0% to erythromycin and 25.0% to lincomycin), 75.0% to quinolone (ciprofloxacin), 92.0% to tetracycline and 100.0% to trimethoprim-sulfamethoxazole (Fig 1).

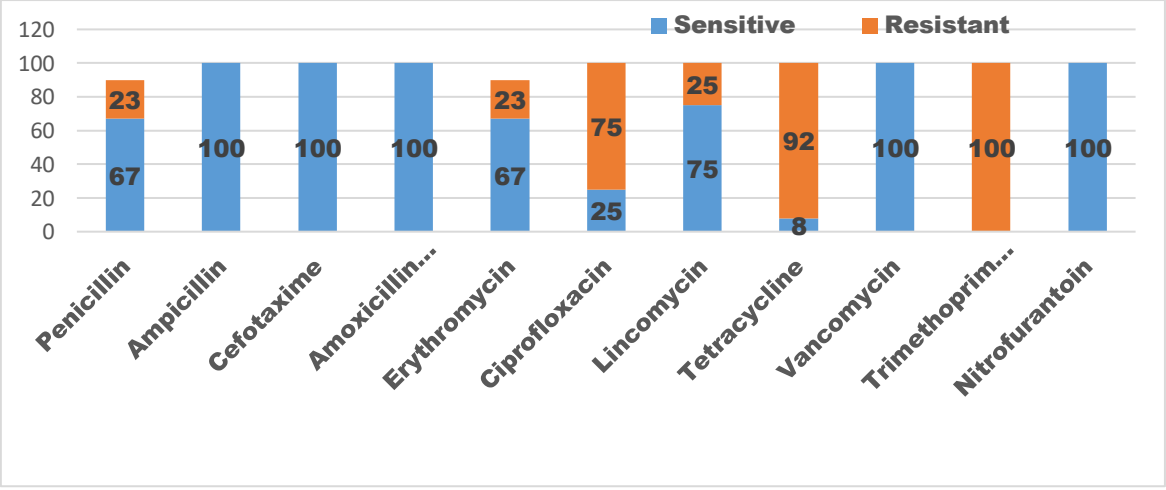

Fig 1: Susceptibility of Group B streptococcus (GBS) isolates to selected antibiotics

Table 1: Prevalence of GBS with respect to sociodemographic and obstetric characteristics of the women

Variables	Number of women (n=300)	Number of GBS isolated	Percentage (%)	*p* value
Age group (years)				
15-19	48	1	2.1	
20-34	238	8	3.4	0.054
≥ 35	14	3	21.4	
Educational level				
Not educated	156	05	3.2	
Primary	85	05	5.9	0.77
Secondary	44	01	2.3	
Tertiary	15	01	6.7	
Marital status				
Married	279	11	3.9	0.77
Single	21	1	4.8	
Occupation				
Housewife	232	8	3.4	
Employed (informal sector)	68	4	5.9	0.454
Number of gestation				
1-2	195	6	3.1	
3-4	81	3	3.7	0.09
≥ 5	24	3	12.5	
Parity				
<4	284	2	0.7	
≥ 4	16	10	62.5	0.16

Discussion:

In the present study, 300 pregnant women were enrolled, the minimum age was 15 years with an average of 25.19 years. The age group of 20 to 34 was the most represented, with 238 women or 79.33%. Among these enrolled women, 279 (93%) lived as a couple. These findings are observed in other studies in Africa, notably that carried out in Ethiopia in 2016 by Mengist et al., who found an average age of 26 years (19), as well as that carried out by Salou et al., (20) in Togo. In the African context, the early age of marriage of the girl could explain this significant frequency of young people and young adults among the participants in the present study. It appears from this study that most of these parturient women (77.33%) had no income and more than 94% of them were out of school or limited to a primary or secondary level.

Group B streptococcus was isolated from vaginal samples of the 300 participants, representing a vaginal colonization rate of 4.0%. These results are close (4.7%) to those of Nyampa, (21) in 2018 who also conducted his study on pregnant women in the city of Ouagadougou. It is the same as that led by Zaïdi, in Fez (Morocco), who also found in 2018 a GBS carriage rate (4.69%) comparable to ours (22). The Ouédraogo team, in their work in 2017 on pregnant women at all ages of pregnancy in Bobo Dioulasso, reported 6.05% (23). In addition, Mounerou et al., reported vaginal carriage rate that is a little lower than ours (2.5%) in 2015 in Togo (20).

Generally speaking, the vaginal carriage rate of GBS has been reported to vary from continent to continent, country to country, and sometimes within the same country. Thus, on the African continent, several recent studies conducted by different authors have given percentages higher than ours; Gbonon et al. reported carriage rate of 12.7% in the city of Abidjan (Ivory Coast) (12). In 2016, Bassir et al., (24) in Marrakech Morocco, reported a rate of 20.5%, Mahmoud (25) in Fez, Morocco in 2010 reported a rate of 23.0%, Mengist et al., (19) in Ethiopia reported a rate of 19% and Ezeonu in 2014 in Nigeria reported a rate of 18.0% (13). Carriage frequencies range from 10.0% in France (8), 18.12% in Thailand (10), 23.7% in Belgium (11) to 26.5% in the United States of America (9).

The variation in rates could be attributed to a number of factors including maternal hygiene and the choice of sampling site. Some researchers collected anal and/or rectal samples with vaginal samples such as in the studies carried out in Morocco and Cameroon (25,26) where high rates of GBS carriage of 23.3% and 14.0% respectively were reported. The laboratory techniques used to detect the pathogens are also factors in the variability of results between studies. Thus, researchers who used PCR reported very high prevalence of 43.8% (27).

Regarding the parameters studied in the present study which included age, level of education, marital status, profession, weight, number of gestures, parity, gestational age, high blood pressure, diabetes and anaemia, none was significantly associated with maternal carriage of GBS. Gbonon et al., (12) in Abi-

djan in 2006 and other researchers (28,29) likewise did not find statistically significant association between socio-demographic and obstetric factors, and the carriage of GBS by pregnant women. On the other hand, Joachim et al., (30) in Tanzania reported an increase in carriage when the age of pregnancy was advanced, finding 46.7% in women with gestational age of 41 to 42 weeks.

Concerning the sensitivity profile to antibiotics such as ampicillin, cefotaxime, amoxicillin-clavulanic acid, vancomycin and nitrofurantoin had very good activity on the GBS strains isolated in this study. Similar results were reported by Ferjani et al., (7). Numerous studies have reported a lack of resistance of GBS to penicillin G (7,31,20,32,33). In our series, 23.0% of the isolated strains were resistant to penicillin G. The research teams of Agricola (30) and those of Ouedraogo (23) also reported resistance of GBS to penicillin G of 9.4% and 10.8% respectively. High rates of GBS resistance were observed against macrolides (erythromycin 23%, lincomycin 25%) as well as quinolones (ciprofloxacin 75%), cyclins (92.0%), and trimethoprim-sulfamethoxazole (100.0%). This high level of GBS resistance could be a consequence of the inappropriate use of these antibiotics which are relatively easy to access for the population in Burkina Faso. Added to this is an inadequacy of regulations regarding the prescription, distribution and consumption of antibiotics in the context of Burkina Faso.

Conclusion:

Group B streptococcus can be transmitted from mother to child during or before delivery and is responsible for fetal or neonatal infection. Vaginal GBS carriage was high among women in the 3rd trimester of pregnancy in the Bogodogo health district, with no predictive factors. The most commonly used antibiotics are increasingly ineffective against these bacteria. Given the non-negligible prevalence of maternal GBS carriage in our conditions and the absence of real predictive factors for vaginal carriage, it seems desirable in the context of the prevention of maternal-fetal GBS infections to establish a policy of systematic screening near the end of pregnancy for all pregnant women in order to reduce neonatal mortality.

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Contributions of authors:

KBA, OA conceived the study idea, led the conduct of the study and editing of the manuscript. KBA, TI and KC were responsible for carrying out the bacteriological diagnostic activities. KAB and KAY were responsible for English translation activities. KAB, OA, TI, KC, KAY, SM, and SI were responsible for the final editing of the manuscript. All authors approved the final manuscript submitted.

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Conflict of interest:

No conflict of interest is declared.

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