

# Group B Streptococcus Colonization among Saudi Women During Labor

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## Abstract

**Background:** The presence of group B streptococcus in the genital area during pregnancy and labor is associated with high neonatal morbidity and mortality. However, the exact prevalence of group B streptococcus among Saudi women has not yet been established.

**Objective:** The aim of this study was to determine the prevalence of group B streptococcal colonization in Saudi pregnant women as a primary end-point and neonatal complications as a secondary end-point.

**Materials and Methods:** A prospective, observational, cross-sectional study was conducted to estimate the prevalence of group B streptococcal colonization among Saudi women admitted in labor to the King Fahd Hospital of the University, Al-Khobar, Saudi Arabia. A total of 1371 maternal specimens (vaginal swabs, rectal swabs and midstream urine) were collected from 457 patients between October 2011 and September 2016. Neonatal specimens (urine, blood and cerebrospinal fluid) were collected if clinically indicated.

**Results:** Of the 457 women enrolled in this study, 87 (19%) had positive cultures for group B streptococcus either in the vaginal or rectal swab or both. Group B streptococcus was also found to be the most commonly isolated organism. In total, there were five cases of neonatal sepsis, of which one early-onset neonatal sepsis was caused by group B streptococcus.

**Conclusions:** This study found that the prevalence of group B streptococcal colonization is 19% among Saudi women admitted in labor to the King Fahd Hospital of the University.

**Keywords:** Colonization, group B streptococcus, pregnancy, prevalence, Saudi

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## INTRODUCTION

Group B streptococcus (GBS) is an encapsulated Gram-positive diplococcus bacteria that is part of the microflora of the gastrointestinal and genital tracts of pregnant women. Usually, it does not cause any clinical symptoms. However, during pregnancy, GBS multiplication in the vagina can lead to maternal morbidity as well as neonatal morbidity and mortality. In fact, during the 1970s,

GBS was the most common cause of infection that led to early neonatal morbidity and mortality in the United States. The case–fatality ratio was reported as high as 50% in one case series.<sup>[1]</sup>

There is wide geographic variation in the prevalence of maternal GBS colonization. The reported prevalence ranges from as low as 3% in countries such as Israel and, as per one study, Saudi Arabia to as high as 60.3%

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in Zimbabwe.<sup>[2-10]</sup> In the United States, GBS maternal colonization rates have stabilized around 20% to 25%.<sup>[11]</sup> In the United Kingdom, the reported prevalence rates range from 15% to 28%. In the Middle East and North Africa, the rate is estimated to be around 22%.<sup>[12]</sup>

Discrepancies in the reported prevalence of maternal GBS colonization can be attributed to geographical factors as well as to differences in the sampling and culture methods.<sup>[13-15]</sup> This is evidenced in Saudi Arabia, where there is great discrepancy in the reported rates of prevalence of GBS colonization in obstetric patients.<sup>[13-16]</sup> In one study conducted in Abha, it was reported that GBS colonization is very uncommon, with only 1 case reported from 7713 patients reviewed.<sup>[3]</sup> In contrast, maternal colonization have been reported as high as 31.6% from King Abdulaziz University Hospital, Jeddah.<sup>[17]</sup>

As stated earlier, GBS maternal colonization can result in not only maternal morbidity but also neonatal morbidity and mortality.<sup>[1]</sup> The transmission of GBS from the mother to child is vertical transmission before or during labor. Neonatal GBS infections can present as early-onset infection or late-onset infection. Early-onset infection is the most common type of neonatal GBS disease. Usually, it occurs within the 1<sup>st</sup> week of life. Late-onset infection occurs after the 1<sup>st</sup> week and up to 3 months. Invasive neonatal GBS disease is associated with the presence of GBS in the maternal genital tract.<sup>[18]</sup>

Despite the impact of maternal GBS colonization, recent data are lacking for all regions of Saudi Arabia, including the Eastern Province, to determine and develop any guidelines for GBS colonization screening in Saudi Arabia. Therefore, to fill this gap in literature as well as to help overcome discrepancies in the reported prevalence of GBS colonization, this study aims to determine the prevalence of GBS colonization in pregnant women as a primary end-point and neonatal complications as a secondary end-point in the Eastern Province of Saudi Arabia.

## MATERIALS AND METHODS

A prospective, observational, cross-sectional study was conducted to estimate the prevalence of GBS colonization among Saudi women admitted in labor to King Fahd Hospital of the University, Al-Khobar, Saudi Arabia. A total of 1371 specimens were collected from 457 patients from October 2011 to September 2016. All pregnant women who were admitted to labor and delivery department and agreed to participate as well as signed the informed consent were recruited to the study. Inclusion criteria were as follows:

gestational age  $\geq 24$  weeks, single or multiple pregnancy, intact or ruptured membranes, unknown GBS status and no history of previously affected children with GBS. Exclusion criteria included all pregnancies of  $\leq 24$  weeks, a positive GBS vaginal–rectal screening culture during the current pregnancy, GBS bacteriuria during any trimester of the current pregnancy, history of previously affected children with GBS and those scheduled for cesarean section, irrespective of it being emergency or elective and regardless of the membrane status.

Basic demographic data were collected for each patient. This included maternal age, gravidity, parity, gestational age, neonatal and maternal complications.

Three swab specimens were obtained from each parturient woman by the attending physician. Serum-coated cotton-tipped swab sticks were used to collect specimens for culture following universal precautions. Vaginal swab specimens were obtained from the vaginal introitus without a speculum. A separate swab was used for obtaining rectal specimens. The final specimens were obtained from midstream urine samples. After the specimen was received in the laboratory, it was initially incubated in either 5% sheep blood agar plate (BAP) with enrichment media or in colistin–nalidixic acid agar at 37°C for 24 h. This method cultures both Gram-positive cocci and bacilli. Further, a catalase reaction was performed for all Gram-positive cocci test to differentiate Gram-positive streptococci from Gram-positive staphylococci. The confirmatory tests for GBS were latex agglutination test, CAMP test or by automated identification machine. Bacteriuria is defined by the presence of GBS in concentrations of  $\geq 10^6$  CFU/ml.

Regarding the neonatal cultures, the urine culture was carried out similar to the method described for maternal urine culture. For the blood culture, the samples were initially incubated in BacT/ALERT VIRTUO Microbial Detection System (bioMérieux Inc., Hazelwood, MO) for 7 days at 37°C. Subsequently, the samples were first cultured in BAP (5% sheep blood) and then in MacConkey agar for 24 h each at 37°C to isolate any Gram-positive and Gram-negative bacteria, respectively. Finally, the confirmatory GBS tests, i.e., CAMP test or an automated identification, were performed. Cerebrospinal fluid was centrifuged and incubated in BAP at 37°C for up to 4 days. The culture results were followed up, after which the antibiotic sensitivities were identified using automated methods (VITEK 2) combined with a complimentary manual method (Kirby–Bauer) for complex microorganisms. Patients with GBS colonization received

intrapartum GBS prophylaxis, according to The American College of Obstetricians and Gynecologists and Centers for Disease Control and Prevention guidelines.<sup>[1]</sup> The neonates were monitored by the pediatric team to document any evidence of neonatal sepsis either by blood or cerebrospinal fluid cultures and the data were recorded accordingly.

Statistical analyses were performed using Numbers '09 (version 2.0.5) (Apple, Cupertino, CA, USA) software. The procedures involved were transcription, preliminary data inspection, content analysis and interpretation. Percentages, mean and median were used in this study to analyze epidemiological variables. Fisher's exact test and chi-square test were performed using GraphPad Prism 7 (GraphPad Software, Inc., La Jolla, CA, USA).  $P \leq 0.05$  was considered statistically significant.

This study was exempted from review by the Institutional Review Board of King Fahd Hospital of the University (Reference no.: KFHU- EXEM 0018).

## RESULTS

The mean age of the 457 patients enrolled was 29.6 years; median was 30 years (range 16–49 years). A total of 108 women were primigravida, and 349 women were multigravida. Gravidity ranged from 1 to 10 and parity ranged from 0 to 7. Gestational age ranged from 25 to 42 weeks. In total, 87 (19%) had a positive culture for GBS, either the vaginal or rectal swab or both; GBS was the most commonly isolated organism. Other organisms isolated included *Candida albicans* (1.5%), *Escherichia coli* (2%), *Klebsiella pneumoniae* (1.5%), group A streptococcus (1%), methicillin-resistant *Staphylococcus aureus* (1%) and *Enterococcus faecalis* (0.5%). These organisms were isolated from 40 women.

Culture positivity among women aged 36–45 years was lowest at a prevalence of 8.9%, with an odds ratio of 0.5 ( $P = 0.03$ ) [Table 1].

There was no difference in the prevalence of GBS colonization in relation to parity [Table 2]. History of previous abortion did not affect the prevalence of GBS colonization rate; colonization in women with a history of previous abortion was 14.3% ( $P = 1.0$ ). In addition, gestational age of <37 weeks was not associated with a higher rate of colonization, with the GBS colonization rate in these women being 27% ( $P = 0.07$ ). Further, there was no significant difference in the rate of GBS colonization among patients with preterm delivery, prelabor rupture of membranes and diabetes [Table 3].

**Table 1: Prevalence of group B streptococcal colonization in relation to age**

Age (years)	Total cases	Colonized cases	Percentage	OR	P
18-25	97	13	13.4	0.7	0.27
26-35	248	64	25.8	1.4	0.096
36-45	112	10	8.9	0.5	0.03
Total	457	87	19		

OR – Odds ratio

**Table 2: Prevalence of group B streptococcal colonization in relation to parity**

Parity	Number of cases	Number of colonized cases	Percentage	OR	P
0	132	33	25	1.3	0.23
1	118	21	17.8	0.9	0.8
2-7	207	33	15.9	0.8	0.4
Total	457	87	19		

OR – Odds ratio

**Table 3: Prevalence of group B streptococcal colonization in preterm delivery, prelabor rupture of membrane and diabetes**

Maternal condition	Number of cases	Number of colonized cases	Percentage	OR	P
Preterm delivery	87	20	23	1.21	0.49
Prelabor rupture of membrane	44	11	25	1.3	0.44
Diabetes	28	9	32	1.7	0.19

OR – Odds ratio

Bacteriuria was diagnosed in 40 women (8.8%), of which 13 women had GBS colonization; in 7 of these 13 women, GBS colonization was found in both the rectovaginal swab and in the urine.

There were five cases of neonatal sepsis (i.e. overall rate of neonatal sepsis was 10.9/1000 live births), of which one early-onset neonatal sepsis was caused by GBS; in the remaining cases, sepsis were caused by different microorganisms.

## DISCUSSION

Maternal GBS colonization is associated with neonatal morbidity and mortality.<sup>[1]</sup> However, there is lack of recent data on the prevalence of GBS colonization in Saudi Arabia, and specifically in the Eastern Province. This study found that the rate of GBS colonization among Saudi women admitted in labor to the King Fahd Hospital of the University is 19%. This is similar to rates reported in a systematic review that analyzed data from 23 developing countries and found the overall rate of maternal GBS colonization to be 12.7%.<sup>[12]</sup> The results of the current study are also similar to GBS colonization rates reported in Kuwait and Iran (14.6% and 16%, respectively).<sup>[18-20]</sup>

In the Saudi Arabian context, the prevalence of GBS colonization in this study is lower than that reported from Riyadh and Jeddah (27.6% and 31.6%, respectively),<sup>[13,17]</sup> whereas it is much higher than a study conducted in Abha, where only 1 case was reported from 7713 patients reviewed.<sup>[3]</sup> These results are not surprising because it is a well-known fact that maternal GBS colonization exhibits great geographic variation.<sup>[5]</sup> There are no recent studies in the Al-Khobar area, where the current study was conducted; however, one study conducted in 1985 had found the maternal GBS colonization rate to be 9.2%.<sup>[14]</sup> It cannot be ascertained whether the increase observed in the current study was due to an actual increase in the prevalence of GBS colonization or, as more likely, due to changes in sampling and culturing technique.

In the United States, the prevalence of maternal GBS colonization continually decreased over the years and has currently stabilized at 20–25%. The initial decrease in the prevalence was possibly due to improved access to health care for high-risk groups and improved management of urinary tract and/or other infections during pregnancy.<sup>[11]</sup> Similarly, the rates of GBS colonization in Saudi Arabia could further be reduced by increasing awareness about the importance of regular antenatal care, increasing access to health care for high-risk group and proper and timely management of infections during pregnancy.

The timing of carrying out tests in such studies is of paramount importance because the rate of colonization could falsely appear to be lower if done at 35–37 weeks of gestation. For example, in a systemic review on the timing of GBS screening in pregnancy, it was found that 6% of GBS carriers remain undetected in the antenatal stage.<sup>[21]</sup> Although the present study found no significant difference in the rate of colonization at gestational age of <37 weeks, the authors believe that screening during labor would be the most relevant time to prevent neonatal morbidity and mortality. However, it should be noted that the polymerase chain reaction (PCR) test, which could provide rapid detection of GBS, is not yet used widely.

There was no significant difference between the carrier status of term and preterm labor in our study. This result is in agreement with that of a meta-analysis conducted to determine the association of maternal GBS colonization with the onset of preterm labor. The meta-analysis included 11 cohort studies, 5 cross-sectional studies and case-control studies and found no association between preterm delivery and maternal GBS colonization.<sup>[21]</sup> However, the results of the current study contrast with that of a study conducted in India, where the rate of GBS colonization was found to be

higher among women in preterm labor.<sup>[20]</sup> Preterm labor has many possible etiologic factors including infection, uterine abnormalities and cervical incompetence. Therefore, it is possible that there were additional preterm labor-caused infections in the Indian study.

The present study found no increase in the rate of GBS colonization among women with obstetric complications such as preterm labor, prelabor rupture of membrane and diabetes mellitus. In contrast to our findings, a study conducted in Iran found that the rectal GBS carriage rate in diabetic pregnant women is higher than in nondiabetic pregnant women. The authors had concluded that diabetes is a risk factor for GBS colonization during pregnancy. Nevertheless, similar to the findings of our study, the study found vaginal colonization to be similar between pregnant diabetic and nondiabetic women.<sup>[19]</sup> However, it should be noted that the sample size of both these studies were very small, and thus statistical conclusions are limited.

The rate of neonatal sepsis in the present study was 10.9/1000 live births. Although the prevalence of maternal colonization is relatively low in this study, data on neonatal sepsis are very limited to draw any valid conclusions. Therefore, larger studies are needed to ascertain the rate of neonatal sepsis. Neonatal sepsis can be caused by several pathogens. In Saudi Arabia, Kuwait and Bahrain, *S. aureus* was found to be the predominant cause of neonatal sepsis, while in the United Arab Emirates, GBS was found to be the leading cause of neonatal sepsis.<sup>[22-24]</sup> These data again confirm the geographic variation of GBS carriage in maternal genital tract and the neonatal vertical transmission. The empirical use of antibiotics in high-risk neonates to prevent early-onset neonatal sepsis is practised to date in the absence of data on maternal colonization.<sup>[25]</sup>

In Saudi Arabia, there is no national screening program for maternal GBS carrier state screening. Because there are no defined guidelines to screen for maternal GBS colonization in Saudi Arabia, there is no standardization and screening is carried out either as per a hospital's policy and regulation or, in its absence, at the discretion of attending physicians. However, before adopting any policy regarding GBS screening, more research should be carried out to ascertain the cost-effectiveness of screening based on the prevalence of maternal GBS colonization, vertical transmission to neonates and rate of early-onset neonatal disease in different provinces of Saudi Arabia. Future research in Saudi Arabia should also include the use of PCR methods for isolating GBS during labor, as it provides results faster than conventional methods and has shown to be effective and promising when used in other settings.<sup>[26]</sup>

## CONCLUSIONS

The prevalence of GBS colonization is 19% among Saudi women presenting during labor in the Eastern Province of Saudi Arabia. Similar prevalence studies should be conducted in other regions of Saudi Arabia so that consolidated data is available for policy makers to make an informed decision regarding if all pregnant women should be screened for GBS colonization in Saudi Arabia.

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## Conflicts of interest

There are no conflicts of interest.

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