Original Research Report

PROPORTIONS OF GROUP B *Streptococcus* ISOLATION FROM PREGNANT WOMEN'S VAGINAL AND RECTAL SWAB SPECIMENS AT A TERTIARY HOSPITAL IN SURABAYA, INDONESIA

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ABSTRACT

Group B *Streptococcus* is a Gram-positive bacterium found in women. It causes high-risk mortality in pregnant women, newborns, and the elderly. This study aimed to compare group B *Streptococcus* (GBS/*Streptococcus agalactiae*) proportions from different collection sites (vaginal and rectal swabs). This was an analytic observational study with a hospital-based cross-sectional design. A total of 74 swabs were taken from 37 pregnant women at 35–37 weeks of gestation. Each participant provided a vaginal swab and a rectal swab, which were cultured in Todd Hewitt broth, blood agar, and CHROMagar. The specimens were subsequently identified using the VITEK 2 system. The GBS isolation percentages from the vaginal and rectal swab specimens were determined to be 13.5% and 8.1%, respectively. The McNemar test had a result of 0.697, and the Cohen's kappa test had a result of 0.165. To conclude, there was no significant difference in GBS isolation proportions between the vaginal and rectal swab cultures. Combined vaginal and rectal swab cultures were required to increase GBS isolation from pregnant women.

Keywords: Proportion of *Streptococcus agalactiae*; vaginal swab; rectal swab; maternal health

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Highlights:

1. Rectal and vaginal swab specimens were collected from pregnant women, and there was no significant difference in the proportions of group B *Streptococcus* isolation.
2. Combined vaginal and rectal swab cultures provide higher isolation of group B *Streptococcus*.

INTRODUCTION

Group B *Streptococcus* (GBS/*Streptococcus agalactiae*) is an encapsulated, betahemolytic, catalase-negative, and facultative anaerobe coccus found in the human commensal microbiome. The source of vaginal GBS colonization in women is the gastrointestinal (GI) tract (Hanson et al. 2022, Wang et al. 2022). Group B *Streptococcus* is still a major cause of morbidity and mortality in high-risk populations, such as pregnant women, newborns, and the elderly. It can cause preterm births, fetal injury, premature membrane ruptures, fetus infection, sepsis, meningitis in infants, and fetal demise (Raabe & Shane 2019, Kurian & Modi 2022, Suwardewa et al. 2022).

GBS is a Gram-positive bacterium found in 5-30% of women's vaginal and gastrointestinal tracts (Tille 2014). Rectovaginal colonization by GBS occurs in 10 to 30% of pregnant women and is responsible for many perinatal and neonatal infections (Szymusik et al. 2014). Currently, data on GBS colonization and invasive bacterial disease in the Indonesian population are limited. A study conducted in Denpasar, Bali, Indonesia, between 2007–2008 reported that the GBS colonization rate was 31.3% among 32 pregnant women with gestational ages of 35–37 weeks (Sri-Budayanti & Hariyasa-Sanjaya 2013). In Jakarta, Indonesia, the GBS colonization

rate in pregnant women was 30% (53 out of 177). These rates were higher than the other Asian countries mean rate of 12.8% (country variation: 8%-20%) and also higher than the global rate of GBS colonization (Russell et al. 2017, Edwards et al. 2019, Safari et al. 2021).

Important knowledge to prevent diseases in high-risk pregnancies should be acquired through screenings, such as the Poedji Rochjati Score Card (Simanungkalit et al. 2021). The Centers for Disease Control and Prevention (CDC) recommended a universal antenatal culture-based screening at 35-37 weeks of gestation. Screenings are crucial for identifying bacteria with high resistance to antibiotics (Linggarjati et al. 2021, Sulikah et al. 2022), and also preventing other conditions that may pose a risk to reproductive health (Hanifah et al. 2018, Kurniawati et al. 2019). The recommendation also suggested rectovaginal specimen collection in order to obtain an adequate yield of GBS (Kwatra et al. 2013). The accuracy of colonization status can be enhanced by improving culture timing, adding more specimen collection locations, and utilizing the correct culture and detection methods (Kwatra et al. 2013).

Rectal swabs may provide a quick and convenient method for analyzing the colonic microbiome. Rectal swabs obtained from clinicians are a reliable method of analyzing the colonic microbiome. Because antibiotics influence the microbiome, obtaining specimens for microbiome analysis is often time-critical. Rectal swabs are demonstrated to be a valid and practical method for microbiome analysis (Turner et al. 2022).

Although there were numerous studies on GBS, the results of some studies concerning the site of specimen collection were inconclusive. Rosa-Fraile & Spellerberg (2017) reported that rectovaginal swabs were more likely to yield positive cultures than vaginal swabs only (100% versus 50%, respectively). Khalil et al. (2017) reported that rectovaginal specimens had a lower detection rate than vaginal and rectal specimens. Nadeau et al. (2022) reported similar results of GBS-positive rectal and vaginal swab specimen cultures. In a study conducted by Bidgani et al. (2016), rectal swabs yielded more positive cultures than vaginal swabs. Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, did not have universal culture-based screening at 35-37 weeks of gestation at the time this study was conducted. Therefore, the authors compared GBS culture detection rates in pregnant women from different sample collection sites (vaginal and rectal swabs).

MATERIALS AND METHODS

This research was an analytic observational study with a hospital-based cross-sectional design. It was conducted at the Department of Obstetrics and Gynecology and the Microbiology Laboratory of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, since February until April 2018. As previously used in a study by Bidgani et al. (2016), the sample inclusion criteria of this study were vaginal and rectal swab specimens from pregnant women between 35 and 37 weeks of gestation. The technique used for collecting the samples was consecutive sampling.

Vaginal and rectal swabs were collected from each subject, then the specimens were inoculated within 24 hours in a selective broth culture medium, i.e., Todd Hewitt broth. The broth was incubated for 18 to 24 hours at 35˚ C and subcultured on blood agar plates and CHROMagar plates for 24 hours, as suggested by Kwatra et al. (2013). The data were analyzed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, New York, USA), with a 95% confidence interval and a significance (p-value) ≤0.05. The McNemar test was used for two related measurements on the same sample or when each individual measurement in one sample could be paired with a specific measurement in the other sample. The McNemar test for paired proportions was utilized to examine the relationship between the two specimen collection methods and the test results of the specimens. Agreements between pair of cultured methods were assessed by Cohen's kappa statistic. Cohen's kappa statistic was used to assess the concordance between the two culture methods.

RESULTS

During the study period, 74 swabs (37 vaginal swabs and 37 rectal swabs) were obtained from 37 pregnant women who met the inclusion criteria. Seven of 37 pregnant women indicated GBS colonization from at least one collection site. The prevalence of intrapartum GBS colonization among pregnant women at Dr. Soetomo Hospital was 18.9%. The detection rate of GBS was higher in the vaginal swab specimen culture than the rectal swab specimen culture. The proportions of GBS collected from the vaginal and rectal swabs were 5 (13.5%) and 3 (8.1%), respectively.

Table 1. Comparison of GBS cultures from pregnant women's vaginal and rectal swab specimens.

	Vaginal culture		Total
	Positive	Negative	
Rectal culture			
Positive	1	2	3
Negative	4	30	34
McNemar p-value	0.687		
Kappa value	0.165		
Total	5	32	37

The detection rates of GBS did not differ significantly between the vaginal and rectal swab methods (Table 1). The p-value from the McNemar test was 0.687, while the Kappa value was 0.165 for GBS detection in the vaginal and rectal cultures.

DISCUSSION

Group B streptococcus is a leading cause of neonatal bacterial sepsis and meningitis. The risk of colonization in newborns rises if the mother is heavily colonized with this bacterium (Bigdani 2016). In most populations studied, 10–30% of pregnant women were colonized with GBS in the vaginal or rectal area. Similarly, this study discovered that 18.9% of pregnant women were colonized by GBS. Both anatomic site sampling and culture methods are important in maximizing GBS carriage detection rates. Rectovaginal swabs have been reported to provide high bacterial yields, as the gastrointestinal tract is a natural reservoir for GBS and a potential source of vaginal colonization (Bigdani 2016).

In this study, a non-significantly higher GBS detection rate was observed in the vaginal region than in the rectal region (13.5% vs 8.1%), with p=0.687 in the McNemar test. Other studies have also reported a slightly higher detection rate in vaginal swab specimen cultures compared to rectal swab specimen cultures (Africa & Kaambo 2018). However, in Russell et al. (2017) reported a higher GBS detection rate in rectal swab cultures than in vaginal swab cultures (18% vs 24%), as did Bidgani et al. (2016) (17.9% vs 10.2%).

The Cohen's kappa statistic coefficient shows the inter-rater agreement in a study, with K>0.75 is considered as excellent agreement, 0.4<K<0.75 as good agreement, and 0<K<0.4 as poor agreement. The kappa coefficient for the detection of GBS from vaginal and rectal swab cultures was 0.165, indicating a poor agreement. The non-significant McNemar test results for the GBS detection from vaginal versus rectal swab cultures (p=0.687) indicated that both methods produced the same discrepancy. Therefore, a combination method was required to increase the GBS detection rate.

Rectovaginal swabs are recognized as the representative sampling technique for conducting culture in detecting GBS colonization, as these bacteria are part of the normal flora of the gastrointestinal tract and may be the source of vaginal colonization. Swabbing the lower vagina and rectum (through the anal sphincter) significantly improves the culture yield compared to sampling the cervix or vagina without also swabbing the rectum (Kwatra et al. 2013, Bidgani et al.2016). Gopal Rao et al. (2017) reported that the detection rate of GBS from rectovaginal swabs was significantly higher than from vaginal swabs or rectal swabs alone. Rosa-Fraile & Spellerberg (2017) reported that rectovaginal sampling provided positive culture more frequently than vaginal sampling Nadeau et al. (2022) described that a perianal culture could replace a rectal culture because the detection rate of GBS was comparable while women were spared the discomfort of a rectal culture.

Strength and limitations

This study can contribute data for future studies, especially in the proportions of group B *Streptococcus* (*Streptococcus agalactiae*) from different collection sites (vaginal and rectal swabs). The findings of this study may provide insight into the necessity of a combination of vaginal and rectal swab cultures in indicating the isolation of GBS from pregnant women. The limitations of this study were the lack of time and the small number of samples. However, this study's findings may still be used as preliminary data for future studies using large numbers of samples.

CONCLUSION

Combined vaginal and rectal swab cultures are required to increase group B *Streptococcus* (GBS) isolation among pregnant women. It provides more accurate results and a promised reduction of neonatal infection risks.

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Conflict of interest

None.

Ethical consideration

This research was approved by the Health Research Ethics Committee of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, through the letter number 39/Pamke.KKE/I/2018 on 08/02/2018.

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None.

Author contribution

All the authors contributed to the conceptualization, research design, data analysis, and interpretation of the obtained results. IV collected the specimens and wrote the manuscript.

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