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Prevalence and Factors Influencing Colonization of Group B Streptococcus Among Expecting Mothers: A Cross-Sectional Study in Iringa, Tanzania

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Abstract:

- ***Background:***

Group B Streptococcus (GBS) is a main reason of maternal and newborn morbidity, underlying unusual pregnancy results including; sepsis, and primary-onset newborn illness. Information of delivering mother's GBS colonization, linked factors, and drug exposure patterns is vital for notifying protective approaches and managing suitable prophylactic drugs during pregnant. Nevertheless, facts on GBS epidemiology in Tanzania are inadequate known. This research intended to come up with the prevalence, influencing factors, and drug exposure patterns of GBS colonization among expecting mothers in Iringa Tanzania.

- ***Methodology:***

An analytical cross-sectional study conducted to 131 expecting mothers with gestational age ≥37 weeks who underwent spontaneous vaginal delivery at Iringa Hospital. Low vaginal swabs were collected from delivering women, and umbilical swabs were obtained in their newborns immediately after birth. Specimens were cultured for GBS using standard microbiological techniques, and drug exposure testing was done using the Kirby–Bauer disk diffusion technique. Data were analyzed using SPSS version 27. Logistic regression analysis was employed to recognize influencing factors for GBS colonization, at CI of 95% with P-value of ≤ 0.05.

- ***Findings:***

Prevalence of delivering mothers GBS colonization was 23%. High blood pressure during pregnancy was independently influencing GBS colonization (adjusted odds ratio [AOR] = 11.43; 95% confidence interval [CI]: 2.72–48.04; p = 0.001). Multigravidas were also a significant predictor, with multigravidas being 15 times likely to be colonized than Primegravida (AOR = 15.13; 95% CI: 3.92–58.35; p < 0.001). High levels of antimicrobial resistance were observed to ceftriaxone (60%), gentamicin (57%), and erythromycin (47%), while most isolates remained susceptible to penicillin, cefotaxime, chloramphenicol, and vancomycin.

- ***Conclusion:***

Maternal GBS colonization among women delivering at Iringa Hospital is high, with hypertension during pregnancy and multigravidas identified as significant influencing factors. The substantial resistance to commonly used antibiotics insists the necessity for routine GBS screening, rational antibiotic use, as well as development of evidence-based recommendations for Tanzania's prophylactic use of intrapartum antibiotic.

Keywords: *Group B Streptococcus; Maternal Colonization; Pregnancy; Prevalence; Risk Factors; Antimicrobial Susceptibility; Tanzania.*

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I. INTRODUCTION

➢ *Background*

Group B Streptococcus (GBS) (*Streptococcus agalactiae*) is a Gram-positive bacterium that commonly colonizes the gastrointestinal and genitourinary tracts of healthy adults. In expecting mothers, GBS colonization is of particular clinical importance because of its association with adverse maternal and neonatal outcomes and this has been influenced by several factors including preterm labor and parity(1). Maternal colonization serves as the primary reservoir for vertical transmission to the neonate during labor and delivery, potentially resulting in early-onset newborn sepsis, pneumonia, and meningitis, remain major contributors toward neonatal morbidity and mortality worldwide.

Globally, the prevalence of maternal GBS colonization differs extensively, ranging from 10% to 35%, depending on geographical region, inhabitants characteristics, and screening methodologies. High-income countries have implemented routine antenatal GBS screening and intrapartum antibiotic prophylaxis, leading to substantial reductions in early-onset neonatal GBS disease. A study conducted in nine countries of Middle and low income countries of South Asia and Africa found average of prevalence of twenty four while high prevalence observed in Mali hence low prevalence observed in Ethiopia and this was linkage with parallel transmission which was in Mozambique and lowest in Bangladesh(2). In contrast, many low- and middle-income countries lack standardized screening programs, contributing to persistently high rates of maternal colonization and neonatal infection.

In sub-Saharan Africa, GBS colonization amongst expecting mothers, generally reported to be higher than in high-income settings. Studies from countries such as Nigeria, Uganda, and Morocco have reported prevalence rates exceeding 20%. In Tanzania, data on maternal GBS colonization remain limited and fragmented, with few studies assessing prevalence, connected risk factors, and antimicrobial sensitivity patterns. The absence of comprehensive national guidelines for routine GBS screening further complicates effective prevention strategies.

Several maternal and obstetric factors have been linked with amplified threat of GBS colonization, including history of prematurity, and history of still birth while cefepime account as highest antibiotic resistance while vancomycin and ampicillin accounts for highest susceptibility(3). However, findings across studies are inconsistent, and the relative contribution of these factors may vary by setting. Identifying locally relevant predictors of GBS colonization is essential for developing targeted interventions in resource-constrained environments.

Antimicrobial susceptibility patterns of GBS are critical for guiding effective intrapartum antibiotic prophylaxis. Penicillin remains the drug of choice for GBS prevention; however, increasing resistance to other antibiotics such as erythromycin, tetracycline, in addition clindamycin has been reported by previous studies(4). In settings where empirical antibiotic use is common and antimicrobial stewardship is limited, resistance patterns may differ significantly, underscoring the need for local surveillance data.

Given the high burden of newborn illness and mortality in Tanzania and lack of routine GBS screening, understanding the prevalence, influencing factors and antimicrobial sensitivity of GBS colonization amongst expecting mothers is of significant public health importance. This study was therefore conducted to generate evidence on maternal GBS colonization at Iringa Hospital, with the aim of informing clinical practice, guiding antibiotic policy, and supporting the development of context-specific preventive approaches to lessen maternal and neonatal problems related with GBS.

II. METHODOLOGY

➢ *Research Design and Location*

An analytical cross-sectional study was conducted at the Antenatal Ward of Iringa Hospital in the Southern Highlands of Tanzania. The hospital serves as the main referral facility for Iringa Region, which has diverse socio-cultural characteristics that may influence maternal health outcomes.

➢ *Study Population*

The study involved pregnant women admitted to IRRH for spontaneous vaginal delivery. Eligible participants were women with a gestational age of thirty seven weeks and above, and had latent stage of labor were provided with informed consent. Women were excluded if they had used antibiotics in fourteen days prior to enrollment, had undergone vaginal investigation before sample collection, or were seriously ill (e.g., eclampsia or antepartum hemorrhage).

➢ *Sample Determination*

The sample was obtained by the Kish Leslie formula, based on a previously reported Group B Streptococcus (GBS) prevalence of 9.45% among pregnant women in Mwanza, Tanzania, at CI of 95%. The computed least sample size was 131 respondents. A purposive sampling procedure was used to consecutively to enroll qualified respondents till the required sample size achieved.

➢ *Data Gathering Process*

Data were gathered using a pre-tested structured questionnaire capturing demographic variables, past obstetric information, and relevant clinical variables, including mother age, number of birth, gestational age, HIV test results, occupation, use of family planning, and Diabetes diagnosis. Specimen collection was performed by the principal investigator and two trained intern doctors following standardized procedures.

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➢ *Sample Collection and Laboratory Investigation*

Low vaginal swabs were obtained from eligible mothers in the earl stage of labor prior to digital vaginal examination, without the use of a speculum, by inserting the swab 2–3 cm into the birth canal and spinning it gently. For neonates, ear canal and umbilical swabs were obtained immediately after delivery before cleaning or wrapping.

All specimens were collected using sterile swab kits containing Amies transport medium and taken for an investigation within six hours. Samples were augmented in Todd Hewitt Broth supplemented with nalidixic acid and gentamicin, incubated at 37°C for 18–24 hours, and subsequently sub-cultured onto sheep blood agar. Detection of GBS performed using Gram staining, assessment of beta-hemolysis, and the CAMP test.

➢ *Drug Sensitivity*

Antimicrobial susceptibility conducted using the Kirby–Bauer disk diffusion method on Mueller–Hinton agar. Results were interpreted according to Clinical and Laboratory Standards Institute (CLSI) guidelines (2012). The antibiotics checked included penicillin, ceftriaxone, erythromycin, vancomycin, chloramphenicol, and gentamicin.

➢ *Data Analysis*

Data cleaned, and analyzed using SPSS version 27. Maternal GBS colonization rates were summarized using descriptive statistics. Associations between GBS colonization and selected variables were assessed using Pearson's Chi-square test, while Fisher's exact test was applied where expected cell counts were less than five. Statistical significance was determined at a p-value ≤ 0.05.

III. RESULTS

➢ *Participants' Demographic Information*

Among 131 expecting mothers studied at Iringa Hospital majority of them 87 (66.41%) aged between 21-30 and most of them were married 117 (89.32%) , and regarding the level of education majority had secondary education 55(42.2%) while minority had no formal education 6(4.5%). Regarding the income level most of them earned less than one hundred thousand incomes per month 101 (77%). The majority the gestational age 87(66.41%) of the pregnant were between 38-40.

➢ *The Proportional of GBS Among Expecting Mothers*

Among the 131 pregnant women who provided low vaginal and perianal swabs, 30 (22.9%) tested positive for *Group B Streptococcus* colonization (Illustration 1).

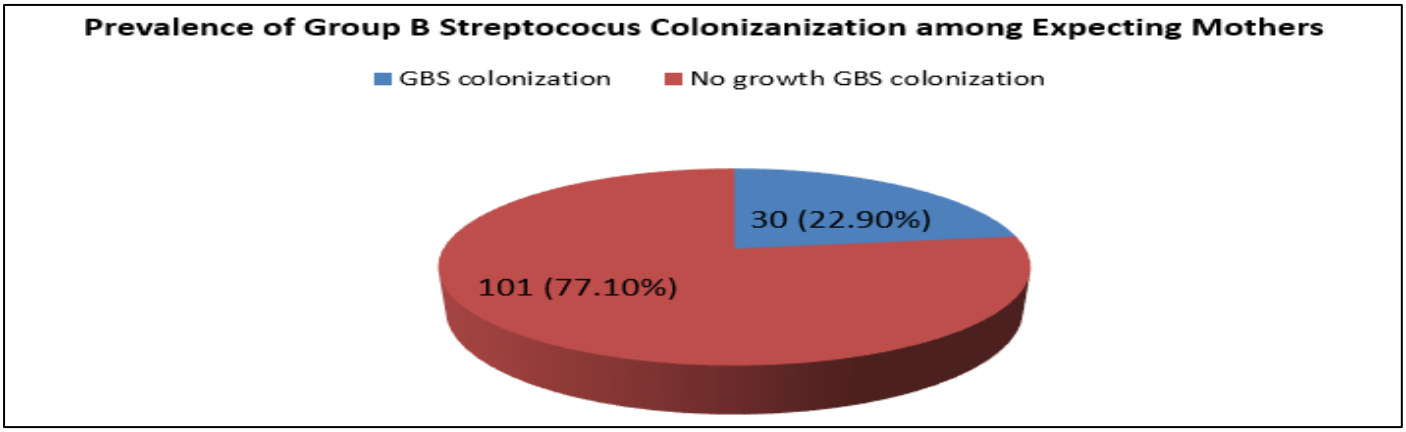

Fig 1 Illustration 1: Distribution of GBS Among Expecting Mothers (N=131)

➢ *Proportion of Newborn GBS Colonization*

Among the newborn studied, 11 (8%) were colonized with GBS, representing cases of vertical transmission from colonized mothers (Illustration 2).

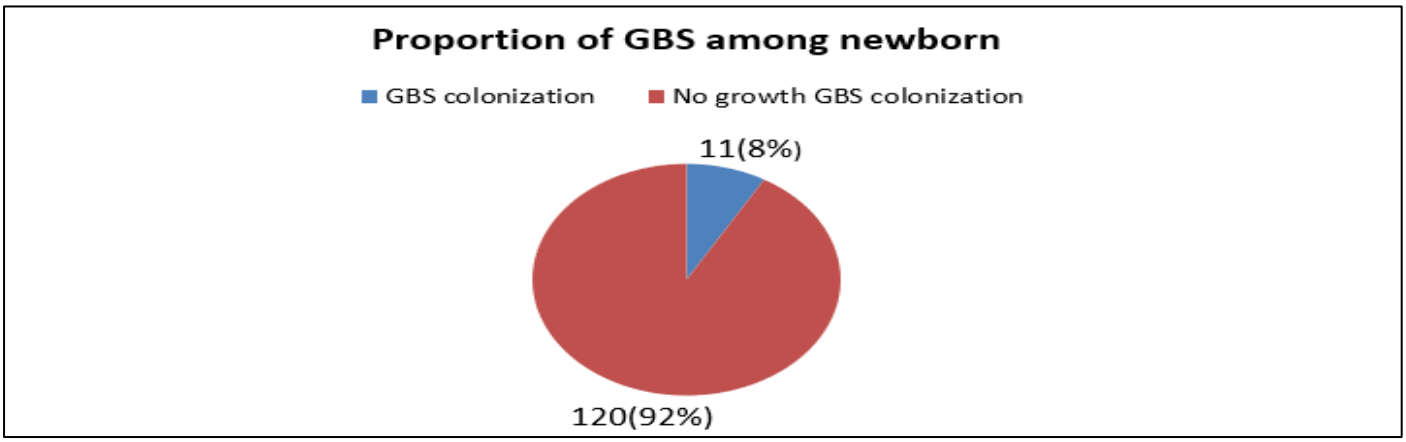

Fig 2 Illustration 2: Proportion of GBS Colonization Among Newborn (N=131)

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- *Factors Influencing GBS Colonization Among the Expecting Mothers*

Gravidity, diabetes mellitus (DM), and hypertension (HTN) were had relationship with GBS colonization ($p < 0.05$). Multigravida mothers were more colonized with GBS (40.3%) compared to primigravidae (4.7%). All women with DM were colonized (100%), and 70% of hypertensive women tested positive for GBS. (Table 1).

Table 1 Association Between Maternal Factors and GBS Colonization (n = 131)

Variable	GBS (+) n (%)	GBS (-) n (%)	P-value
Age (years)			0.557
<20	2 (18.0)	9 (82.0)	
21–30	23 (26.0)	64 (74.0)	
31–40	5 (15.0)	28 (85.0)	
Gestational Age (weeks)			0.157
37–39	25 (26.0)	71 (74.0)	
≥40	5 (14.0)	30 (86.0)	
Substance Abuse			0.190
Yes	2 (50.0)	2 (50.0)	
No	28 (22.0)	99 (78.0)	
Gravidity			**0.001***
Primigravida	3 (4.7)	61 (95.3)	
Multigravida	27 (40.3)	40 (59.7)	
Medical Conditions			
UTI			0.106
Positive	3 (50.0)	3 (50.0)	
Negative	27 (21.6)	98 (78.4)	
VDRL/RPR			0.919
Positive	1 (25.0)	3 (75.0)	
Negative	29 (22.8)	98 (77.2)	
HIV			0.349
Positive	2 (13.3)	13 (86.7)	
Negative	28 (24.1)	88 (75.9)	
DM			**0.001***
Yes	3 (100.0)	0 (0.0)	
No	27 (21.1)	101 (78.9)	
HTN			**0.001***
Yes	7 (70.0)	3 (30.0)	
No	23 (19.0)	98 (81.0)	

*Significant at $p < 0.05$

- *Predictors of GBS Amongst Expecting Mothers at Iringa Hospital*

Logistic regression analysis identified gravidity and hypertension as significant predictors of GBS colonization. Multigravida women had an adjusted odds ratio (AOR) of 15.1 (95% CI: 3.92–58.35, $p < 0.001$) compared to primigravidae. Women with hypertension had an AOR of 11.4 (95% CI: 2.72–48.04, $p = 0.001$) relative to normotensive women. Diabetes mellitus showed a high crude odds ratio (OR = 22.5), but the adjusted estimate could not be defined due to the small number of cases (Table 2).

Table 2 Predictors of GBS Colonization Among Expecting Mothers at Iringa Hospital (N=131)

Variable	OR	C.I (95%)		P-value	AOR	C.I (95%)		P-value
		Lower	Upper			Lower	Upper	
Diabetes Mellitus								
Yes	22.522			0.999			Undefined	
No	**Ref.**							
Hypertension								
Yes	2.297	2.387	41.408	0.002	**11.433**	2.721	48.038	**0.001**
No	**Ref.**							
Gravidity								
Multigravida	2.619	3.902	48.275	0.000	**15.126**	3.921	58.353	**0.000**
Primigravida	**Ref.**							

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➢ *Antimicrobial Exposure Pattern of Streptococcus agalactiae*

Among the GBS isolates tested, highest exposure was observed to chloramphenicol (83%)**,** cefotaxime (77%), and penicillin (73%). Moderate susceptibility was noted for vancomycin (63%) and erythromycin (53%). High levels of resistance were observed against ceftriaxone (60%), gentamicin (57%), and erythromycin (47%), while no intermediate susceptibility was detected for most antibiotics, except for gentamicin (7%). These results highlight the significance of performing routine antimicrobial susceptibility testing to guide effective prophylaxis and treatment of GBS infections.

Table 3 Antimicrobial Susceptibility Patterns of *Group B Streptococcus* Isolates (N = 30)

Drug	Sensitive n (%)	Intermediate n (%)	Resistant n (%)
Ceftriaxone	12 (40.0)	0 (0.0)	18 (60.0)
Penicillin	22 (73.0)	0 (0.0)	8 (27.0)
Chloramphenicol	25 (83.0)	0 (0.0)	5 (17.0)
Gentamicin	11 (36.0)	2 (7.0)	17 (57.0)
Vancomycin	19 (63.0)	0 (0.0)	11 (37.0)
Cefotaxime	23 (77.0)	0 (0.0)	7 (23.0)
Erythromycin	16 (53.0)	0 (0.0)	14 (47.0)

IV. DISCUSSION

The current research demonstrated GBS colonization prevalence of 23% amongst term expecting mothers (≥37 weeks), with an observed vertical transmission rate of 8.4% to their newborns. In a comparable study from Nigeria involving 500 expecting mothers and their neonates, had GBS colonization prevalence of 34.2%, with a vertical transmission rate of 19% to newborns(5).

Differences in sample size may have influenced the observed variation in prevalence, as the smaller sample size in the current study (131 women and their newborns) may limit precision compared to the larger Nigerian study (500 participants). In Mwanza, Tanzania, a comparable study reported a *Streptococcus agalactiae* colonization prevalence of 24.5% among pregnant women with HIV infection, closely aligning with the prevalence reported in the current study(6). Unlike the current study, which reported a highly prevalent of GBS colonization, the Cameroonian study found a comparatively low prevalence (8.69%), with colonization significantly associated with obstetric and maternal health factors such as induced abortion, spontaneous abortion, stillbirth, fever, and anemia(7).

The findings of this study indicate that hypertension and gravidity were significant predictors of GBS colonization. Hypertensive women had an eleven-fold increased odds of GBS colonization compared with normotensive women, and multiparous women were fifteen times more likely to be colonized than primigravidae. Similar studies conducted in China found that advance maternal age, ≥35years old, Early rupture of membrane, Pre term delivery were associated with GBS colonization(8). The difference in the predictors might be due to geographical, and race difference of the two countries.

Among the GBS isolates tested, chloramphenicol, cefotaxime, and penicillin demonstrated the highest susceptibility rates, while substantial resistance was observed against ceftriaxone, gentamicin, and erythromycin. Other studies reported high susceptibility to chloramphenicol; the Ethiopian study demonstrated substantially higher resistance to erythromycin and penicillin, whereas resistance to ceftriaxone was lower compared to the present study(9). Consistent with the present study, the Kenyan study identified resistance to commonly used antibiotics, including penicillin G, ampicillin, clindamycin, and vancomycin, highlighting emerging challenges in the management of GBS infections among pregnant women(10).

V. CONCLUSION AND RECOMMENDATIONS

Maternal GBS colonization at Iringa Hospital is high, with hypertension during pregnancy and multigravidas identified as significant predictors. The isolates showed substantial resistance to commonly used antibiotics, while remaining largely sensitive to penicillin, cefotaxime, chloramphenicol, and vancomycin. These conclusions emphasize the necessity for daily antenatal GBS screening, rational use of antibiotics, and targeted intrapartum prophylaxis. Educating pregnant women on risk factors and adherence to antenatal care, alongside ongoing surveillance of antimicrobial susceptibility, is essential to reduce mothers and newborns illness influenced by GBS.

VI. LIMITATIONS OF THE STUDY

The study included term pregnant women (≥37 weeks) admitted to Iringa Hospital for spontaneous vaginal delivery in the latent phase of labor. Mothers with history of using antibiotics in the past 14 days or critically ill were omitted; this may affect generalizability of the results.

➢ *Ethical Considerations*

Approvals to do the study were obtained from the relevant authority of hospital and ethical clearance was granted by the University of Dodoma. Respondents were consented and were conversant of their right to withdraw in the study without any consequences.

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- *Competing Interest*
  The authors confirmed no conflicting interests.

- *Authors' Contributions*
  FRK conducted the research, analyzed the data, and then drafted the manuscript. ALM reviewed and provides guidance throughout the research development, analysis and manuscript preparation. All authors approved the final manuscript.

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