Original Article

A Cross-Sectional Study on Recent Trends in Seroprevalence of Rubella Virus Infection among Antenatal Women

Dr. Jyothi Pendyala[1], Dr. Nazia Begum Mohammed[2], Dr. Butchi Babu Nutakki[3], Jakka Gnana Venkata Bhaskar[4]

[1]Associate Professor, Department of Microbiology, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India
[2]Assistant Professor, Department of Microbiology, Guntur Medical College, Guntur, Andhra Pradesh, India
[3]Assistant Professor, Department of Obstetrics and Gynaecology, Guntur Medical College, Guntur, Andhra Pradesh, India
[4]Phase III MBBS Student, Guntur Medical College, Guntur, Andhra Pradesh, India

🔓 OPEN ACCESS

Corresponding Author:

Dr. Jyothi Pendyala
Associate Professor, Department of Microbiology, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India

A B S T R A C T

Background: Rubella is a vaccine-preventable viral infection of significant concern in pregnancy due to its teratogenic potential and risk of congenital rubella syndrome (CRS). Despite ongoing immunization programs, rubella susceptibility among pregnant women remains a public health issue in several developing regions.
Aim: To determine the seroprevalence of rubella virus infection among antenatal women and evaluate its association with demographic and obstetric variables.
Methods: This cross-sectional study was conducted among 78 antenatal women attending the antenatal outpatient department at Guntur Medical College and Government General Hospital, Guntur, over two months (November–December 2023). Serum samples were analyzed for rubella-specific IgM antibodies using the NovaLisa μ-capture ELISA technique. Data on age, residence, trimester, and gravidity were collected and correlated with serological findings.
Results: The mean age of participants was 22.96 ± 4.38 years, with the majority in the 15–25-year age range. Overall rubella IgM seropositivity was 11.53%, indicating recent infection. Higher seroprevalence was observed among women aged 26–30 years (23.07%), those residing in urban areas (16.27%), and multigravidas (13.95%). Seropositivity was highest during the first trimester (16.66%), underscoring increased vulnerability in early pregnancy.
Conclusion: The study reveals that a notable proportion of antenatal women remain susceptible to rubella infection, highlighting the need for routine pre-conceptional and antenatal screening along with strengthened immunization coverage to prevent CRS and associated adverse pregnancy outcomes.

Keywords: Rubella virus, Antenatal women, Seroprevalence, IgM antibodies, Congenital rubella syndrome, ELISA, Maternal screening.

INTRODUCTION

Rubella, or German measles, is an acute contagious viral illness caused by the *Rubella virus*, a single-stranded RNA virus of the *Togaviridae* family, *genus Rubivirus* [1]. While typically mild or asymptomatic in children and adults, infection during pregnancy particularly in the first trimester poses a grave threat due to its teratogenic potential, leading to congenital rubella syndrome (CRS)**.** CRS is characterized by a constellation of anomalies, including congenital heart disease, cataracts, deafness, and neurological impairment, and may result in miscarriage or stillbirth [2,3]. The risk of fetal damage following maternal infection is estimated to reach 80–90% in early gestation**,** declining as pregnancy advances [4].

Transmission occurs through respiratory droplets from infected individuals, who remain contagious from seven days before to seven days after rash onset [1]. The virus initially replicates in the nasopharynx, followed by viremia and transplacental transmission to the fetus, resulting in intrauterine infection and developmental defects [2]. Despite the

Dr. Jyothi Pendyala, *et al.* A Cross-Sectional Study on Recent Trends in Seroprevalence of Rubella Virus Infection among Antenatal Women. *Int. J Med. Pharm. Res., 7(1): 679-684, 2026*

679

availability of safe and effective vaccines, rubella continues to be a public health concern in low- and middle-income countries, where gaps in immunization coverage and inadequate antenatal screening persist [3,5].

Globally, rubella and CRS remain preventable yet under-controlled conditions. The World Health Organization (WHO) estimates nearly 100,000 infants are born annually with CRS, with India contributing a major share of this burden [4,5]. Recent multicentric data from India have shown that, despite expanded measles–rubella vaccination, pockets of susceptibility persist among women of reproductive age, especially in rural and underserved regions [1,2]. Studies from Ethiopia and other developing nations have reported similar seroprevalence trends, underscoring the need for regular surveillance and vaccination reinforcement [6].

This study was therefore undertaken to evaluate the recent trends in rubella seroprevalence among antenatal women attending a tertiary care hospital in Andhra Pradesh, with the goal of contributing to rubella elimination efforts and improving maternal–fetal outcomes.

METHODOLOGY
Study Design and Setting:
A hospital-based cross-sectional study was conducted in the Department of Microbiology, Guntur Medical College and Government General Hospital, Guntur, Andhra Pradesh, over a two-month period from November to December 2023. The study aimed to determine the seroprevalence of Rubella virus infection among antenatal women attending the antenatal outpatient department (OPD).

Study Population and Sample Size:
A total of 78 antenatal women of varying gestational ages were enrolled after obtaining informed written consent. Sampling was done by convenient non-random selection.

Inclusion Criteria:
Pregnant women attending the antenatal OPD and willing to participate in the study, irrespective of gestational age.

Exclusion Criteria:
Women unwilling to give consent or those with other concurrent viral infections were excluded.

Data Collection:
Demographic and clinical details such as age, residence (urban/rural), gravida status, and trimester were recorded using a structured proforma. Detailed obstetric and medical histories were also documented.

Sample Collection and Processing:
Approximately 3 mL of venous blood was collected aseptically from each participant. The serum was separated by centrifugation and stored at –20°C until analysis.

Serological Testing:
All samples were tested for Rubella virus-specific IgM antibodies using the NovaLisa Rubella Virus IgM μ-capture ELISA kit (Gold Standard Diagnostics, USA). The test is based on the enzyme-linked immunosorbent assay principle, where anti-human IgM coated wells capture specific antibodies in the sample. The presence of bound antigen–antibody complexes was visualized by the colorimetric reaction with tetramethylbenzidine (TMB) substrate, and absorbance was measured at 450/620 nm using a microplate reader.

Interpretation of Results:
Results were expressed in **NovaTec Units (NTU)** calculated as:
NTU = Sample Absorbance×10/Cut-off Absorbance
Samples were classified as:
Positive: >11 NTU
Equivocal: 9–11 NTU
Negative: <9 NTU

Statistical Analysis:
Data were compiled and analyzed using Microsoft Excel. Results were expressed as frequencies and percentages. Associations between seroprevalence and demographic/obstetric variables were compared descriptively.

Ethical Considerations
The study protocol received prior approval from the Institutional Ethics Committee of Guntur Medical College (IEC No: GMC/IEC/11/2023, dated 21 November 2023). The research was conducted at Guntur Medical College and the

associated Government General Hospital, Guntur, Andhra Pradesh, in accordance with the ethical principles outlined in the Declaration of Helsinki.

RESULTS

A total of 78 antenatal women were enrolled in this cross-sectional study conducted at the Department of Microbiology, Guntur Medical College, Guntur, during November–December 2023. All participants were screened for Rubella virus IgM antibodies using the NovaLisa Rubella Virus IgM μ-capture ELISA method.

The mean age of participants was 22.96 ± 4.38 years, with a predominant representation in the 15–20 years (38.46%) and 21–25 years (37.17%) groups. Only one woman (1.28%) belonged to the 36–40 years age group. More than half of the participants were from urban areas (55.12%), and the remaining were from rural settings (44.88%). The majority of women were in their third trimester (46.15%), followed by the second (30.76%) and first (23.07%) trimesters. With regard to obstetric history, multigravidas accounted for 55.13% of the total cohort, while primigravidas constituted 44.87% (Table 1).

Table 1. Demographic Distribution of Study Participants (n = 78)

Variable	Category	No. of Cases	Percentage (%)
Age (years)	15–20	30	38.46
	21–25	29	37.17
	26–30	13	16.66
	31–35	5	6.41
	36–40	1	1.28
Residence	Urban	43	55.12
	Rural	35	44.88
Trimester	First	18	23.07
	Second	24	30.76
	Third	36	46.15
Gravida	Primigravida	35	44.87
	Multigravida	43	55.13

Serological testing revealed that 9 women (11.53%) were seropositive for Rubella IgM antibodies, indicating recent infection, while 69 women (88.47%) were seronegative, suggestive of susceptibility to primary infection (Table 2).

Table 2. Rubella IgM Seropositivity in the Study Group (n = 78)

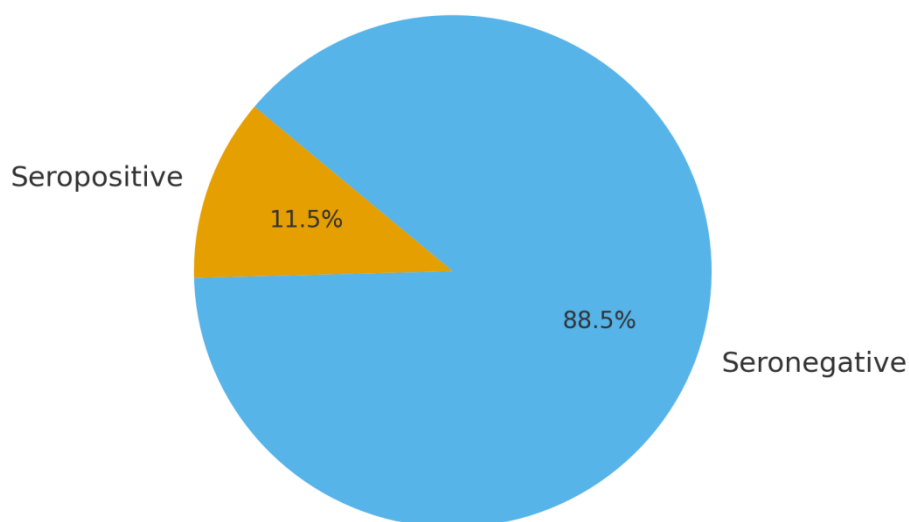| Rubella IgM Status	No. of Cases	Percentage (%)
Seropositive	9	11.53
Seronegative	69	88.47
Total	**78**	**100.0**

Figure 1.Rubella IgM Seropositivity

Analysis of seroprevalence across age categories showed the highest IgM positivity in the 26–30 years group (23.07%), followed by 21–25 years (10.34%) and 15–20 years (10.0%). No seropositivity was observed in women aged above 30

years. When stratified by residence, urban women exhibited a higher seroprevalence (16.27%) compared to their rural counterparts (5.71%) (Table 3).

Table 3. Seroprevalence of Rubella IgM Antibodies by Age and Residence (n = 78)

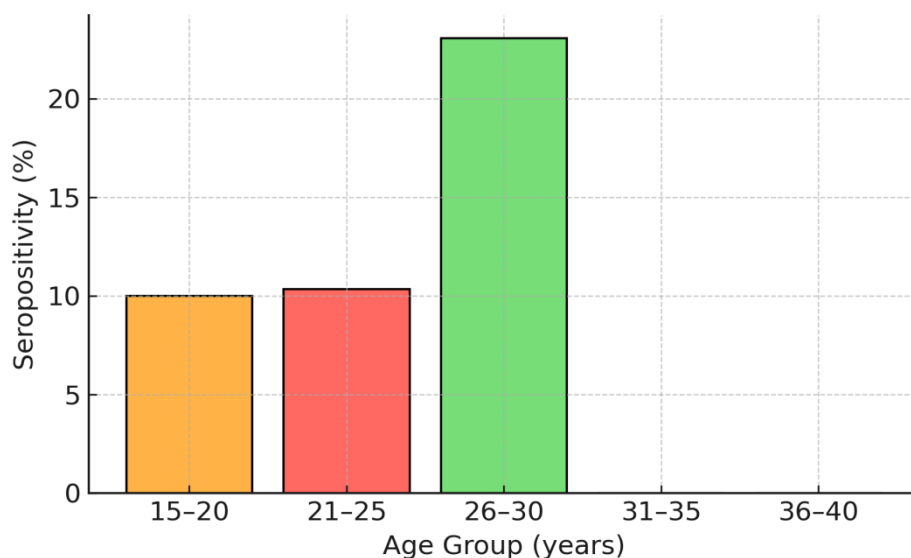| Variable	Category	Rubella IgM Positive (n)	Seropositivity (%)
Age (years)	15–20	3	10.0
	21–25	3	10.34
	26–30	3	23.07
	31–35	0	0.0
	36–40	0	0.0
Residence	Urban	7	16.27
	Rural	2	5.71

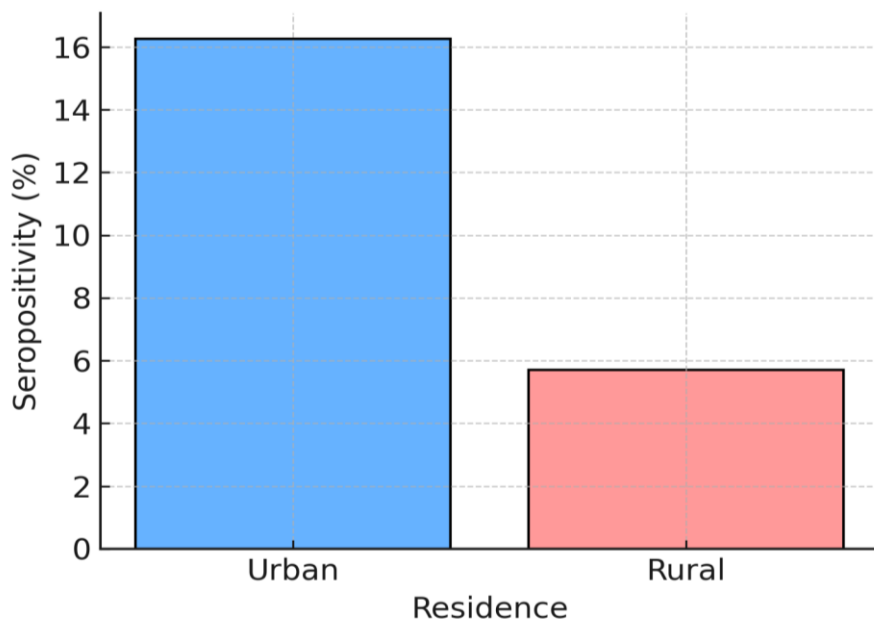**Figure 2: Seroprevalence of Rubella IgM by Age Group**

Figure 2: Seroprevalence of Rubella IgM by Residence

Trimester-wise analysis demonstrated that Rubella IgM seropositivity was highest during the first trimester (16.66%), decreased during the third trimester (13.88%), and was least in the second trimester (4.16%). Among gravidity groups, multigravidas showed a higher rate (13.95%) of seropositivity compared to primigravidas (8.57%) (Table 4).

Table 4. Seroprevalence of Rubella IgM Antibodies by Trimester and Gravida Status (n = 78)

Variable	Category	Rubella IgM Positive (n)	Seropositivity (%)
Trimester	First	3	16.66
	Second	1	4.16
	Third	5	13.88
Gravida	Primigravida	3	8.57
	Multigravida	6	13.95

DISCUSSION

The present study assessed the seroprevalence of rubella virus infection among antenatal women and explored its association with demographic and obstetric parameters. Among 78 participants, 11.53% were seropositive for rubella-specific IgM antibodies, indicating recent exposure and highlighting the continued circulation of the virus despite the availability of effective vaccination programs. This finding aligns with previous regional and global observations showing persistent susceptibility among women of reproductive age [7,8].

The mean age of participants (22.96 ± 4.38 years) reflects a predominance of younger women, a group particularly vulnerable to rubella infection due to incomplete immunization or waning immunity. The highest IgM positivity (23.07%) occurred in the 26–30 years age group, similar to the findings reported by Deka et al. (2022) from northern India, who documented higher rubella seroprevalence among women aged 25–30 years [7]. The absence of seropositivity in women over 30 years in our study may indicate past infection or sustained vaccine-induced immunity, consistent with observations from Perfetto et al. (2024) among trainee obstetric populations in Italy, where older women showed stronger rubella IgG positivity [12].

Urban participants exhibited higher rubella IgM seroprevalence (16.27%) compared to rural women (5.71%). This mirrors trends reported in Saudi Arabia by AlShamlan et al. (2021), where urban residents had greater exposure, likely due to higher population density and mobility [8]. However, a contrasting pattern was reported in Ethiopia, where rural women demonstrated relatively higher seropositivity due to limited vaccination access [6]. Such geographic variation underscores the importance of targeted immunization strategies tailored to local epidemiology.

When stratified by gestational age, first-trimester women showed the highest seropositivity (16.66%), comparable to the early-pregnancy risk patterns observed in the Chinese surveillance by Gong et al. (2024) [11]. Infection during early gestation remains clinically significant because it carries the highest risk of congenital rubella syndrome (CRS), resulting in fetal malformations, miscarriage, or stillbirth [9]. The increased seropositivity among multigravidas (13.95%) relative to primigravidas (8.57%) may reflect cumulative exposure, a finding consistent with Manjunathachar et al. (2020), who observed higher ToRCH pathogen positivity among multiparous women [9].

The global rubella IgM seropositivity among pregnant women ranges between 3% and 25%, depending on vaccination coverage, laboratory methodology, and population immunity [10,11]. Our observed rate (11.53%) falls within this range and is similar to data from other endemic countries such as Tunisia [14] and parts of Asia [11,13]. Although India has made substantial progress in rubella elimination, continued detection of IgM-positive cases suggests ongoing transmission and incomplete herd immunity.

Overall, the persistence of rubella susceptibility among antenatal women highlights the need for preconceptional screening, robust MR immunization campaigns, and periodic serosurveillance. As recommended by global rubella elimination initiatives, integrating antenatal rubella testing into routine obstetric care can identify high-risk women and prevent congenital infections [13,14]. Strengthening vaccine uptake and public awareness will be pivotal in achieving the WHO target of eliminating rubella and CRS worldwide.

Limitations

The present study, though informative, has certain limitations that warrant consideration. First, the sample size was relatively small (n = 78) and restricted to antenatal women attending a single tertiary care center in Andhra Pradesh, which may limit the generalizability of the findings to the wider population. Second, only rubella-specific IgM antibodies were assessed; inclusion of IgG titers would have provided a clearer distinction between past immunity and recent infection. Third, vaccination history and prior exposure details were not available for many participants, which could influence interpretation of seroprevalence patterns. Additionally, longitudinal follow-up and molecular confirmation were not performed to verify acute infection. Future multicentric, large-scale studies incorporating both serological and molecular assays are recommended to obtain a more comprehensive understanding of rubella immunity and transmission trends in pregnant women.

CONCLUSION

This study revealed an overall Rubella IgM seropositivity of 11.53% among antenatal women, indicating ongoing viral transmission and recent infections in the community. The highest seropositivity was observed in the 26–30 years age group, among urban residents, and during the first trimester of pregnancy. Multigravidas exhibited a slightly higher prevalence than primigravidas. These findings underscore the continued vulnerability of women of reproductive age to rubella infection, emphasizing the importance of preconceptional and antenatal screening. Strengthening Measles–Rubella (MR) immunization coverage, particularly among adolescent girls and unvaccinated women, is crucial for achieving rubella elimination and preventing congenital rubella syndrome and associated fetal complications.

REFERENCES

1. Shanmugasundaram D, Viswanathan R, Winter AK, Agarwal A, Roychowdhury B, Muliyil D,et al. Rubella immunity among pregnant women and the burden of congenital rubella syndrome (CRS) in India, 2022. Vaccine. 2024 Oct 24;42(24):126077. doi: 10.1016/j.vaccine.2024.06.044. Epub 2024 Jul 2. PMID: 38960788.

2. Shanmugasundaram D, Awasthi S, Dwibedi B, Geetha S, Jain M, Malik S, et al. Burden of congenital rubella syndrome (CRS) in India based on data from cross-sectional serosurveys, 2017 and 2019-20. PLoS Negl Trop Dis. 2021 Jul 23;15(7):e0009608. doi: 10.1371/journal.pntd.0009608. PMID: 34297716; PMCID: PMC8376255.

3. Brady AM, El-Badry E, Padron-Regalado E, Escudero González NA, Joo DL, Rota PA, et al. Serosurveillance for Measles and Rubella. Vaccines (Basel). 2024 Jul 22;12(7):816. doi: 10.3390/vaccines12070816. PMID: 39066453; PMCID: PMC11281569.

4. Ou AC, Zimmerman LA, Alexander JP Jr, Crowcroft NS, O'Connor PM, Knapp JK. Progress Toward Rubella and Congenital Rubella Syndrome Elimination - Worldwide, 2012-2022. MMWR Morb Mortal Wkly Rep. 2024 Feb 29;73(8):162-167. doi: 10.15585/mmwr.mm7308a2. PMID: 38421933; PMCID: PMC10907039.

5. Kar A. Birth defects reporting and surveillance in India: a narrative review. J Community Genet. 2025 Feb;16(1):5-14. doi: 10.1007/s12687-024-00760-5. Epub 2024 Dec 9. PMID: 39652147; PMCID: PMC11950570.

6. Asrat B, Shimelis T, Assefa AA, Hussen S. Seroprevalence of rubella virus infection among antenatal care clients of Halaba Town public health facilities, southern Ethiopia. Sci Rep. 2023 May 3;13(1):7220. doi: 10.1038/s41598-023-34444-w. PMID: 37137969; PMCID: PMC10156672.

7. Deka S, Kalita D, Paul M, Badoni G, Mathuria YP. Seroprevalence and Determinants of ToRCH Pathogens in Pregnant Women in the Sub-Himalayan Region. Cureus. 2022 Feb 5;14(2):e21946. doi: 10.7759/cureus.21946. PMID: 35273887; PMCID: PMC8902136.

8. AlShamlan NA, AlOmar RS, AlOtaibi AS, Almukhadhib OY, AlShamlan AA, Alreedy AH, et al. Seroprevalence of rubella virus among pregnant women: A 4-year registered-based study from family medicine and obstetric clinics in Saudi Arabia. Int J Clin Pract. 2021 Jun;75(6):e14156. doi: 10.1111/ijcp.14156. Epub 2021 Mar 26. PMID: 33743553.

9. Manjunathachar HV, Singh KN, Chouksey V, Kumar R, Sharma RK, Barde PV. Prevalence of torch infections and its associated poor outcome in high-risk pregnant women of Central India: Time to think for prevention strategies. Indian J Med Microbiol. 2020 Jul-Dec;38(3 & 4):379-384. doi: 10.4103/ijmm.IJMM_20_136. PMID: 33154250.

10. Shahapur PR, Kandi V. Seroprevalence of Rubella Virus-specific Antibodies in Women and the Diagnostic Efficacy of Enzyme-linked Immunoassay and Rapid Immunochromatographic Tests. Cureus. 2020 Mar 12;12(3):e7246. doi: 10.7759/cureus.7246. PMID: 32292661; PMCID: PMC7152573.

11. Gong X, Zheng C, Fang Q, Xu W, Yin Z. A case of congenital rubella syndrome and epidemiology of related cases in China, 2014-2023. Hum Vaccin Immunother. 2024 Dec 31;20(1):2334917. doi: 10.1080/21645515.2024.2334917. Epub 2024 Apr 7. PMID: 38584121; PMCID: PMC11000605.

12. Perfetto B, Paduano G, Grimaldi E, Sansone V, Donnarumma G, Di Giuseppe G. Seroprevalence for Measles, Varicella, Mumps and Rubella in the Trainee Obstetric Population: A Survey in Southern Italy. Vaccines (Basel). 2024 Mar 20;12(3):335. doi: 10.3390/vaccines12030335. PMID: 38543969; PMCID: PMC10974553.

13. Xu X, Liu S, Wang X, Huang A, Li J, Zhou Y, et al. Acceptance of Rubella-Containing Vaccine and Factors Associated with Acceptance among Women of Reproductive Age in China: A Cross-Sectional Study. Vaccines (Basel). 2024 Oct 8;12(10):1153. doi: 10.3390/vaccines12101153. PMID: 39460320; PMCID: PMC11511206.

14. Ben Moussa ML, Hamdoun M, Cherni H, Bahri O. Rubella seroprevalence among women of childbearing age in Tunis, Tunisia. BMC Infect Dis. 2025 Apr 7;25(1):470. doi: 10.1186/s12879-025-10843-4. PMID: 40197150; PMCID: PMC11974024.