Seroprevalence of Anti-Rubella IgG Antibodies Among Women of Chilbearing Age: A Croos-Sectional Study

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ABSTRACT

Rubella infection, while typically mild and self-limiting in adults, poses significant teratogenic risks during pregnancy, potentially leading to Congenital Rubella Syndrome (CRS) with a 75-100% transmission rate during the first trimester. This study aimed to assess the need for adult vaccination by detecting anti-rubella IgG titers in women of childbearing age and examining the correlation between vaccination history and seroprevalence. A total of 130 women, including 35 pregnant women, were tested for anti-rubella IgG antibodies using Enzyme-Linked Immunosorbent Assay. Results showed that 102 women (78.47%) were seropositive while 28 (21.53%) were seronegative. Among those with complete vaccination history, 60 women (46.15%) were seropositive, while 6 were seronegative. Of those with unknown vaccination status, 42 women (32.30%) were seropositive and 7 were seronegative. All unvaccinated women were seronegative. In the pregnant women subgroup, 32 were seropositive while 3 showed seronegativity. The finding that 21.53% of women were seronegative, including some with vaccination history, highlights a significant population at risk for rubella infection during pregnancy. This study underscores the importance of evaluating rubella susceptibility in women of reproductive age and suggests the need for considering adult and adolescent vaccination strategies to prevent CRS, even in regions where rubella vaccination is included in the national immunization schedule.

INTRODUCTION

Rubella is a mild self-limiting exanthem that causes an acute febrile infection among susceptible cohorts (children and young adults) worldwide. The infection is trivial, but during early pregnancy, it results in serious abnormalities in the fetus. It is of consequential significance in public health predominantly due to the teratogenic possibilities of the rubella virus, resulting in congenital abnormalities and congenital rubella syndrome (CRS)[1]. Three to five days after the appearance of clinical symptoms is considered a period of contagiosity[2].

The virus is pleomorphic with a single-stranded positive-sense RNA genome. It belongs to the genus Rubivirus. Unlike other togaviruses, human beings are only known natural host for the rubella virus. The viral transmission occur from person to person via respiratory route (aerosols). After inhalation of the infected droplets, the virus replication in the mucosal membranes of the upper respiratory tract, later advancing to regional lymph nodes. Placenta and the developing fetus are affected in pregnant women [3,7].

Congenital rubella syndrome: Congenital rubella syndrome (CRS) is due to infection of mother with the rubella virus during the first trimester of pregnancy. Congenital Rubella Infection (CRI) encompasses all outcomes of intrauterine rubella infection including abortion, stillbirth, congenital defects noticed soon after birth, or that which develops as a late manifestation referred to as Congenital Rubella Syndrome (CRS). Maternal viremia results in infection of the placenta and fetus. It leads to spontaneous abortion or fetal infection leading to fetal birth defects. Neonates have the risk of serious developmental disabilities like autism [4]**.** 90% of the newborns with rubella infection shows complications of CRS [3,4]. The extent of teratogenicity is determined by the timing of fetal infection. There is a decreasing trend in the seroprevalence of anti-rubella IgG antibodies and protective anti-rubella IgG in adolescent population[31].

Global scenario: Rubella has a worldwide distribution. There is a decline (97%) in rubella cases from 2000-2018. The WHO fact sheets of 2019 show that 168 out of 194 countries acquired 68% coverage by the introduction of rubella vaccines [9].

Indian scenario. Sentinel surveillance for CRS was implemented in 2016 for the first time in India. The sentinel surveillance from 2016 to 2018 (India), one-fifth of CRS patients were confirmed in the laboratory, stating the significance of rubella as a prevailing health problem in India [6]. Although the national estimates show no risk of rubella for women of childbearing age, various serosurveys have shown that there is a noticeable decrease of seropositivity in women, hence they are susceptible to rubella in significant proportions.

METHODOLOGY

Participant Characteristics And Research Design

The selected cohort only includes women of reproductive age group between18 to 30 (pregnant and Non pregnant). All the women were from southern India. Children (below 18) and women (above 30) are excluded.

Sampling Procedures

A total of 130 blood samples were collected from the females by venipuncture taking aseptic precautions. The venipuncture site was prepared as follows, First 70% ethanol was used to clean the area and allowed to air dry. Then 2% tincture of iodine was used and the area was disinfected in circular action. Iodine was allowed to dry on the skin for at least one minute. Using a sterile needle nearly 5 ml of blood was collected into a noncoagulant vacutainer (red-coloured). The sample was transported to the microbiology lab in JSS hospital. The blood samples were subjected to centrifugation at 3000 RPM for 3 minutes. The separated serum samples were stored at -20°C until further analysis for the detection of anti-rubella antibodies. Detection of IgG antibodies was done using a kit procured from DIA.PRO, an Italian manufacturer of biological products. The sample analysis was done as per the manufacturer's recommendations.

Data Analysis

The statistical data analysis for chi-squared values for history of vaccination were analysed using SPSS software. A value of $P < 0.05$ was considered statistically significant.

RESULT

This study was conducted in the Department of Microbiology, JSS Hospital, Mysuru, from January 2019 to December 2020.A total of 130 women of childbearing age including pregnant women who had consented for the study were included and the following observations were made.

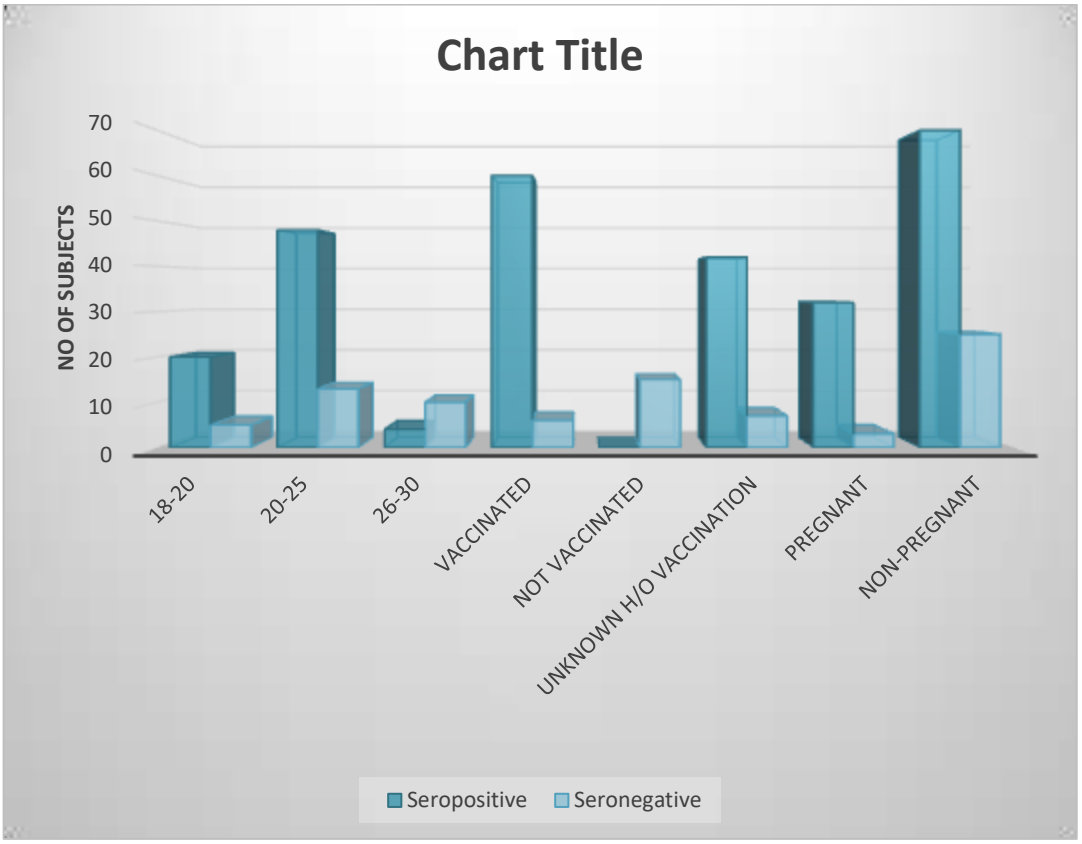
The findings revealed that 78.46% (102 women) were seropositive, while 21.53% (28 women) were seronegative for anti-rubella antibodies. Age distribution analysis showed that most participants (46.92%) were in the 21-25 age group, followed by 33.84% in the 26-30 age group, and 19.23% in the 18-20 age group. Among the participants, 50.76% reported having received rubella vaccination, 11.53% had no vaccination history, and 37.69% were unsure of their vaccination status. Of the 35 pregnant women in the study, 32 (91.4%) were seropositive, and 3 (8.6%) were seronegative. Among women with complete vaccination history, 60 (46.15%) were seropositive, while 6 (4.61%) were seronegative. Notably, all 15 women who reported no vaccination history were seronegative. Among those with unknown vaccination status, 42 (32.30%) were seropositive, and 7 (5.38%) were seronegative.

Statistical analysis: The history of vaccination among female subjects were analyzed using SPSS software in which p value was found to be 0.001 which is less than 0.005 and is considered significant.

Table 1 Distribution of Anti-Rubella IgG Antibodies Among Women of Childbearing Age (18-30 years) Based on Age, Vaccination Status and Pregnancy Status (N=130)

Characteristics	Category	Seropositive	Seronegative	Total
Age Group				
	18-20	20 (15.38%)	5 (3.84%)	25 (19.23%)
	20-25	48 (36.92%)	13 (10%)	61 (46.92%)
	26-30	4 (26.15%)	10 (7.69%)	44 (33.84%)
Vaccination History				
	Vaccinated	60 (46.15%)	6 (4.61%)	66 (50.76%)
	Not vaccinated	0 (0%)	15 (11.53%)	15 (11.53%)
	Unknown h/o vaccination	42 (32.30%)	7 (5.38%)	49 (37.69%)
Pregnancy status				
	Pregnant	32 (24.61%)	3 (2.30%)	35 (26.92%)
	Non-pregnant	70 (53.84%)	25 (19.23%)	95 (73.07%)
		102 (78.46%)	28 (21.53%)	130 (100%)

Note: All percentages are calculated from the total study population (N=130)



DISCUSSION

Rubella is an acute febrile contagious viral infection most commonly seen in young adults and children under the age of 15 years. It is characterized by rash and lymphadenopathy and is a self-limiting disease, but when infected in early pregnancy, it may lead to abortions, stillbirth, or congenital malformations in the fetus. Currently there is no treatment protocol for rubella infection and the only measure to contain the spread of infection is through vaccination.

The present study attempted to detect IgG antirubella antibodies in women of childbearing age between 18- 30 years, and the seroprevalence was found to be 78.46%, our result was consistent with aserosurvey conducted, by Gohil DJ to detect the seroprevalence of rubella,who reported that the seroprevalence among college students in mumbai was 77.8% [22] and whereas a lower seroprevalence of 66% was reported by Phalgune in a Sero-surveillance to assess rubella susceptibility and to detect efficiency o rubella vaccine in girls aged 18-24 years in Pune [23]. A study conducted among medical, nursing, and dental students of the Manipal University, India by Arunkumar G. showed a seroprevalence of 81% [24], this result is also by our study.

21.3% of females in our study were found to be susceptible to rubella by a study conducted by Thayyil Jto detecPrevalence of anti-rubella antibodies in the non-vaccinated female population,in Kerala, the prevalence of Rubella-specific IgG antibodies was found to be 68.3 % and the seronegative rate was 68.5%. It is also reported in the study that seropositive girls had an unprotective level of titre for the anti-rubella antibody [1].

In our study, seropositivity among vaccinated females was found to be 91%, and 96% prevalence of Rubella-specific protective IgG antibodies has been shown by a post-Vaccination study in Iran for investigating seroprevalence of anti-rubella in pregnant women between the ages of 12 and 42 years by Honarvar B[26].

In a recently published report by Koshy AK to examine seroprevalance of rubella inKerala, among 1671 unimmunized girls between 13-15 years of age showed 50% seroprevalence [27]. The study

also indicated that 50% of seropositive girls had protective antibodies which is somewhat correlating with our study showing 46.15% previously vaccinated among 130 females have protective antibodies.

In the present study participants with unknown history of vaccination were found to be 85.7% seropositive (total n = 49, positive = 42). A very similar result was shown in a recent study by Kandasamy to detect seroprevalence of IgG Antibody from January to February 2017, indicating 85.5%Seroprevalence of Rubella Immunity (IgG Antibody) and participants were with unknown vaccination history [28]. However, there is a higher seroprevalence rate in the above mentioned study comparison with the overall seroprevalence rate of our study that is 78.46%.

A recent meta-analysis in five different WHO regions to study the global prevalence of Rubella-specific IgG antibodies revealed a seroprevalence of 91.4% [31] and analysis from Turkey by Karakoc GB find prevalence of rubella in pregnant women and school girls, which tested school-going girls within the age group of 12-18 years and pregnant women in the age group of 26-35 years noted a seroprevalence of 92.5 %, and 100 percent [32], respectively for Rubella-specific IgG antibodies and 83% seroprevalence was reported in a study from china by Meng Q[33].A recent research from Cameroon by Taku NA among pregnant women found 94.4 percent seroprevalence in pregnant women for rubella-specific IgG antibodies [34], which correlates with our study A seroprevalence of 91.4 % was observed among pregnant women in our study and is correlating with the above mentioned studies.

Singla N conducted an epidemiological study titled The seroepidemiology of rubella in Amritsar (Punjab) and reported an overall 68% seropositivity [25] and Seroprevalence rates among girls of 11-18 age group were 67.3 % as reported in North India [29] showing lower prevalence rate in accordance with our study. A seroprevalence of 16% for Rubella specific IgG antibodies was confirmed in a recent study conducted in Pakistan by Khan A[35], shows a much difference with our study. Whereas the seroprevalence of rubella specific IgG antibody reported by the recent study from Delhi with 90% seroprevalence [30], which is higher than the seroprevalence reported in our study.

It was observed that there was a substantial variation in the prevalence of rubella IgG antibodies among women of reproductive age group in various continents, in European women, it was observed that they have a relatively higher prevalence of rubella immunity (93.2%) as compared to women of African (86.7%) and Asian origin (78.4%) [38]. In India the sero-prevalence has found to range between 53% - 94.1% [39].

The current study is in accordance with earlier studies and emphasizes the importance of rubella vaccination in older children and adolescents so that CRS can be controlled by preventing pregnant women from acquiring infection and to eradicate rubella infection in the long run.

CONCLUSION

Vaccination/immunization is considered to be the key to avoid rubella infection, especially among pregnant women. The reason behind including rubella vaccination (MR) to the national immunization schedule by the government of India is because of the low vaccination coverage of MMR vaccine which was below 50%. The incidences of rubella among children have been quite low after vaccine (MR) inclusion in the national immunization schedule in 2017. The congenital rubella syndrome (CRS) is a big concern as it increases the chances of rubella infection in women of childbearing age.

The decision to give MR vaccine to all children from 9 months to 15 years of age by the Government of India will help to prevent susceptibility to rubella in adolescents and women of childbearing age. However, it was observed in the present study that 21.53 percent of women in childbearing age were found to be seronegative, thus predisposing them to rubella infection during pregnancy which may in turn result in CRS. Thus, there is a need to evaluate the number of women

prone to rubella infection in the reproductive age and also prenatally to rubella infection to formulate strategies for prevention of congenital rubella syndrome and if women were found to be susceptible to infection, a need for adult and adolescent vaccination should be considered. In addition to immunization, consistent surveillance, as well as monitoring is essential.

Recommendations for Public Health

Following are the recommendations to Prevent Rubella Infection During Pregnancy and Ultimately Congenital Rubella Syndrome (CRS) in the Community.

1. Design the most comprehensive screening protocols on rubella antibodies amongst women of childbearing age, considering the 21.53% seronegativity rate of participants in the study and thus likely to be at risk during conception.
2. Assess the practicability of rolling out adult and adolescent immunization programs while specifically targeting all women found to be seronegative before conceiving.
3. Strengthen screening at the prenatal rubella level to identify women who are pregnant and at risk and to provide appropriate follow-up and counseling.
4. Sustain and enhance the current coverage of MR (Measles-Rubella) vaccination under the National Immunization Schedule, making it available to all children aged 9 months to 15 years.
5. Institute robust surveillance and monitoring systems to monitor rubella cases with special attention to incidence of CRS.
6. Develop strategies to improve the record-keeping of vaccinations, as the study pointed out that 37.69% of the women had no knowledge about their vaccination status.
7. Continue targeting the women in the age group of 18-30 years as they appeared to be most vulnerable to rubella vaccination.
8. Conduct regular seroprevalence studies to monitor the degree of population immunity and identify lack of protection.
9. Promote public health education regarding the role of rubella vaccination, with special emphasis on the role of vaccination in preventing Congenital Rubella Syndrome.
10. Consider a standardized system for verifying immunizations at scheduled visits to healthcare providers, especially for women of childbearing age.
11. Strengthen screening at the prenatal rubella level to identify women who are pregnant and at risk and to provide appropriate follow-up and counseling.
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