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Original Research Article

Seroprevalence of rubella antibodies among adolescent girls of Mysore district, Karnataka, India

Anitha C[1], Srineha Prudhvi[1], Santhosh Kumar M[1,*]

[1] *Dept. of Pediatrics, JSS Medical College, JSS Academy of Higher Education & Research (JSS AHER), Mysore, Karnataka, India*

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ABSTRACT

Introduction: Rubella disease, or German measles, is a viral infection caused by the rubella virus. Human is the only known host. Therefore, the rubella virus is a candidate for global eradication because humans are the only known host. In addition, the vaccine against rubella is safe and is highly effective (≥95%) following a single dose.

Objectives: The current study was conducted to estimate the seroprevalence of rubella in healthy adolescent school girls. The adolescent girls were screened for preventing rubella during pregnancy.

Materials and Methods: A cross-sectional study was conducted between October 2016 and March 2018 for 1.8 years among the Healthy adolescent girls aged 13-16yrs Mysore District. Estimation of serum IgG levels was done by Enzyme immunoassay. There are reports of seronegativity. Therefore, we counselled them, and they were motivated to undergo active immunization. In addition, we elicited a history of MMR or rubella vaccine.

Results: A total of 160 people were studied. Among them152 (95%) participants had a positive outcome for the IgG antibodies. However, only 8(5%) of the participants were tested seronegative for IgG antibodies.

Conclusion: The universal immunization programme encourages the public to take vaccines, but only the serosurveillance studies can help to know the vaccine immunization coverage. This study reflected the epidemiology of rubella seropositivity in the Mysore district between October 2016 and March 2018.

1. Introduction

Rubella disease, or German measles, is an acute, highly contagious viral infection caused by the rubella virus. Rubella virus contains a single-stranded positive-sense RNA genome.[1,2] Humans are the only known host. It occurs most often in children and young adults and is transmitted by airborne droplets when infected people sneeze or cough.[3]

While rubella virus infection usually causes a mild fever (<39°C) and rash illness with nausea and mild conjunctivitis in children and adults. In the first trimester of pregnancy, the disease may result in a lot of complications, including miscarriage, stillbirth, fetal death and infants are born with congenital malformations, known as congenital rubella syndrome (CRS).[4]

The classical feature of rubella is the swollen lymph glands behind the ears and the neck. As a result, the rash almost occurs in 50 – 80% of the cases. The rash starts on the face and neck and progresses down the body. The rash will last for about one to three days duration. The period of infectivity is usually from first day of the rash till the fifth day after the appearance of the rash.[3]

There is a high risk (90%) of vertical transmission when a pregnant female gets a rubella infection. Deafness in the

* *Corresponding author.*
E-mail address: santhosh.kumar94@yahoo.com (Santhosh Kumar M).

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child is the most common defect seen, followed by defects in the eyes, heart, and brain.

To ensure protection against vaccine-preventable diseases, the Health Ministry of India has initiated a Measles-Rubella (MR) vaccination campaign. The campaign's main aim is to give one shot of the MR Vaccine to all children aged nine months to 15 years. The Government of India planned to reach more than 400 children in India. The MR vaccination was given irrespective of the earlier vaccine or disease status.

The live attenuated rubella vaccine has been used in immunizing children. There was substantial medical evidence that the vaccine could prevent infection and prevent pregnancy complications, including congenital rubella syndrome(CRS).[4] Following a single dose of the rubella vaccine, there is 95% long-lasting immunity, similar to immunity induced by natural infection.[3]

The population-level immunity is assessed by doing serological surveillance (serosurveillance). These studies are done as cross-sectional studies to know the antibody prevalence.[5]

Most adolescents and women of childbearing age show high rubella seropositivity rates due to childhood exposure. Several seroepidemiological surveys from India have reported that many women reach childbearing age without acquiring natural immunity to rubella, making them more susceptible to infection.[6] So far, only a few studies have been documented on the seroprevalence of healthy adolescent school girls, especially from India. The studies that have been conducted showed variable results. Hence, the current study was conducted to estimate the seroprevalence of rubella in healthy adolescent school girls. It may also enhance our understanding of the vaccination status and guide policy for clinical practice on MR, rubella vaccination.

2. Materials and Methods

The current study was done among healthy adolescent girls in the age group around 13-16yrs. The school is located in a rural area of the Mysore District. The sample size was calculated assuming the proportion of positive cases for IgM antibodies to rubella virus as 15.2 % as per the study by Ballal, M. et al.[7] The other parameters considered for sample size calculation were 6% absolute precision and 95% confidence level. In addition, an infinite population correction was applied.

The following formula was used for sample size calculation.[8] Where n = Sample size Z= Z statistic for a level of confidence, P = Expected prevalence of proportion.(If the expected prevalence is 15.2%, then P= 0.152), and d = Precision (If the precision is 5%, then d=0.06).

The required number of subjects per the calculation mentioned above was 138. Therefore, with a non-participation rate of about 15% (22 subjects), it was decided to include 160 subjects in the study.

2.1. Sampling method

All the eligible subjects were recruited for the study. Consecutively, by purposive sampling till the sample size was reached. The Study duration of this research was around 1year and 6months. The data collection for the study was done between October 2016 and March 2018.

2.2. Inclusion criteria

Healthy adolescent girls between 13-16yrs studying in rural Mysore were included after the written consent of parents and the adolescent girls to participate in the study. Exclusion criteria: Those who have received/received immunosuppressive therapy or corticosteroids for a long time were excluded.

2.3. Ethical considerations

The study was approved by the institutional human ethics committee. Informed written consent was obtained from all the study participants' parents, and only those willing to sign the informed consent were included in the study. The principal investigator explained the risks and benefits involved in the research and the voluntary nature of participation to the participants before obtaining consent. The confidentiality of the study participants was maintained.

2.4. Methodology

160 adolescent girls in the age group of 13-16yrs were included in this study. Informed consent for serum testing was taken from the parents of the adolescent girls. Estimation of serum IgG levels was done by Enzyme immunoassay. Those found seronegative were counselled for active immunization. In addition, a history of MMR or rubella vaccine was elicited.

2.5. Tests

The samples collected were transported in a vaccine container to the laboratory.Serum IgG level: 5ml of venous blood was taken by aseptic venepuncture. The serum was separated by centrifugation and then submitted to Enzyme immunoassay.

2.6. Statistical methods

The data was collected in a semi-structured proforma. Descriptive analysis: Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. For customarily distributed Quantitative parameters, the mean values were compared between study groups using an

independent sample t-test (2 groups). Categorical outcomes were compared between study groups using the Chi-square test. P-value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.[9]

3. Results

A total of 160 people were included in the analysis. The mean age of the study population was 14.79 ± 0.86 years. The minimum age was 13 years, and the maximum age was 16 years for the study population.(Table 1)

Table 1: Descriptive analysis of age group in the study population (N=160).

Age group	Frequency	Percentage
13-14 years	20	12.50%
14-15 years	20	12.50%
15 -16years	94	58.80%
16-17 years	26	16.30%

Among the study population, 20 (12.50%) participants were aged 13-14 years, 20 (12.50%) participants were aged 14-15 years, 94 (58.80%) participants were aged 15-16 years, 26 (16.30%) participants were aged 16-17 years. (Table 2)

Table 2: Descriptive analysis of Rubella antibody result in the study population (N=160).

Rubella antibody Result	Frequency	Percentages
Positive	152	95.00%
Negative	8	5.00%

152 (95%) participants had positive IgG antibodies in the study population. Only 8(5%) participants were tested seronegative for IgG antibodies. (Table 3)

Table 3: Descriptive analysis of IgG titre value in study population (N=160).

Parameter	Mean ± SD	Median	Min	Max	95% C.I Lower	95% C.I Upper
IGG titer Value	181.46 ± 120.98	178.00	5.00	624.00	162.57	200.35

The mean value of IgG titre was 181.46 ± 120.98 in the study population. The range was 5 to 624 (95% CI 162.57 to 200.35). (Table 4) Reference value of IgG taken is <10IU/ml for seronegativity, >10 IU/ml is taken as seropositive.

Among the study population, 69 (43.10%) of the participants belonged to the lower middle class, 77 (48.10%) participants were in the upper-lower class of Modified Kuppuswamy socioeconomic status, and 14 (8.80%) participants belonged to the lower class, and no one belonged to upper socioeconomic status. (Table 4)

Table 4: Descriptive analysis of socioeconomic status in the study population (N=160).

Socio economic status	Frequency	Percentages
Lower middle	69	43.10%
Upper lower class	77	48.10%
Lower class	14	8.80%

Table 5: Comparison of age groups betweenRubella antibody results (N=160).

Age group	Rubella antibody Result	
	Positive (N=152)	Negative (N=8)
13-14 years	20 (13.2%)	0 (0%)
14-15 years	18 (11.8%)	2 (25%)
15-16 years	88 (57.9%)	6 (75%)
16-17 years	26 (17.1%)	0 (0%)

*No statistical test was applied- due to 0 subjects in the cells.

25% of seronegativity is seen in the 14 to 15yrs age group, and 75% of seronegativity is seen in the 15 to 16yrs age group. (Table 6)

Table 6: Comparison of mean value between study groups (N=160).

Parameter	Rubella antibody Result		P-value
	Positive	Negative	
Value Mean ± SD	190.69 ± 117.04	6.18 ± 2.18	<0.001

The mean value was 190.69 ± 117.04 in positive Rubella antibody and 6.18 ± 2.18 in negative Rubella antibody results. The difference between the two groups was statistically significant (P-value <0.001). This indicates that most values were positive and significantly more than the negative results (Table 7)

Table 7: Comparison of socioeconomic status betweenRubella antibody results (N=160).

Socio economic status	Rubella antibody Result	
	Positive (N=152)	Negative (N=8)
Lower middle	61 (40.1%)	8 (100%)
Upper lower class	77 (50.7%)	0 (0%)
Lower class	14 (9.2%)	0 (0%)

*No statistical test was applied- due to 0 subjects in the cells.

Among the people with positive Rubella antibody results, 61 (40.1%) participants belonged to the lower middle class, 77 (50.7%) participants belonged to the upper-lower class, and 14 (9.2%) participants belonged to the lower class. Most of the study participants in the current study belonged to the lower types of Kuppuswamy's SES. All the seronegative belonged to the lower middle class (Table 7)

4. Discussion

There are only a few vaccine-preventable diseases. Rubella, even though it is a highly contagious disease effective vaccine is available. According to sustainable development goals across developing and developed nations, a few goals are directly and indirectly related to health. Sustainable development goals like alleviating poverty and hunger is linked with the burden of disease among the people in a nation. So, economically, moving a country from developing to developed depends on how effectively primary prevention is implemented, irrespective of the class of people benefiting. Zero surveillance studies play a vital role in knowing the effectiveness and coverage of an immunization programme. Surveillance means continuous scrutiny of factors that will help monitor the community's health status. At the same time, there is a need for considerable resources to be allotted in terms of workforce, technology, time and people. The developing nations in the present situation may go through an economic dilemma regarding where the resources have to be allotted. The resources available in poor and developing countries are so limited. Even the vaccination programmes under the universal health coverage theme may not be feasible in such a situation; zero surveillance studies may be restricted. The authorities in such countries involved in policymaking may not find zero surveillance studies convincing. The roadmap to eliminate rubella is not complete without zero surveillance studies, even though the prevalence of rubella disease has decreased due to effective vaccination. Elimination and zero surveillance are synonymous.

5. Conclusion

The introduction of a countrywide immunization programme began with the essential need to control vaccine-preventable diseases. The effective immunization programme had significantly decreased the morbidity and mortality related to vaccine-preventable diseases. However, there is no mandatory reason to take vaccines for the public. Only health education regarding the disease spectrum and the history of infectious disease control through effective vaccines can change people's attitudes regarding vaccination. Nowadays, we can see a surge in spreading propaganda against vaccination through various social media platforms, which can also adversely affect immunization coverage. The propaganda against vaccination is baseless, and science has consistently produced evidence for universal immunization coverage.

6. Recommendations

1. Evidence-based, scientifically driven public health leadership has to be given importance.
2. The data obtained from serosurveillace studies should end up in an actionable task that makes it meaningful.
3. As there is a lot of labour-intensive scientific effort involved, there is a need for proper planning before implementing measures.

7. Conflict of Interest

The authors declare no relevant conflicts of interest.

8. Source of Funding

None.

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Author biography

Anitha C, Professor

Srineha Prudhvi, Post Graduate

Santhosh Kumar M, Associate Professor https://orcid.org/0000-0002-5562-8810

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