Biomedical Communication

Sero-Prevalence of IgG Rubella Antibodies in Indian Adolescent Women from Tertiary Care Hospitals, Kanchipuram, Tamil Nadu, India

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ABSTRACT

Rubella causes a mild self-limiting illness in children with fever and rash, however in pregnant women, rubella infection causes miscarriage, fetal death, or an infant born with congenital birth defects known as congenital rubella syndrome. The present study attempts to investigate the seroprevalence of IgG rubella antibodies in Indian adolescent girls. The study being a cross -sectional hospital based, was carried at the department of Obstetrics and Gynecology OPD and ward at Meenakshi Medical College Hospital and Research Institute (MMCHRI), Enathur, Kanchipuram, Tamil Nadu, India. In all the cases the association was statistically not significant (P value>0.05) when compared with joint family. The odds of Rubella IgG positive was 0.656 times in nuclear family and the association was statistically not significant (P value>0.05) when compared with several children in three. The odds of Rubella IgG positive were 1.711 times in only 1 child, the odds of Rubella IgG positive in 2 children were 1.371 times. In the present study we conclude that the statistically no significant association between the socioeconomic status, parents' age, father's education level, father's employment status, mother's education level, mother's employment status, and Rubella IgG status.

KEY WORDS: ADOLESCENT GIRLS, CHILDREN, IGG ANTIBODY, PREGNANT WOMEN.

INTRODUCTION

In India, Congenital Rubella Syndrome (CRS) is the most common cause of non-traumatic childhood cataracts after the hereditary cataract. Cataract due to CRS accounts for about 10% of pediatric cataracts in India. India has set a goal to eliminate measles and rubella/ CRS by 2023 (Herini et al. 2021). World Health Organization (WHO) has recognized CRS which results in vision and hearing loss among babies can be prevented. Children inflicted with CRS have special needs throughout their life causing a lot of disease burden (Qin et al. 2021). Hence live Rubella vaccines (RCV) are vigorously promoted by WHO in many countries (Herini et al. 2021; Rasool et al. 2021).

Before the introduction of the Rubella vaccine in 1969, the global incidence of CRS was 0.8-4/1000 live births during epidemics and the endemic periods from 0.1-0.2/1000 live births during endemics (Gubio et al. 2019). Since 2010 the "trivalent Measles-Mumps-Rubella vaccine" is available in India but it was not included in the regular immunization schedule of a newborn. The same was the case with the Rubella vaccine, but it was included in the National Immunization Schedule (India) recently (Shanmugasundaram et al. 2021). Immunization studies reported that less than 50% of the children are covered with MMR vaccine. This forced the Indian government to take stringent measures thereby it was decided in 2017 to include the Rubella vaccine in the National Immunization Program. Each country adopted its strategy as per their requirements and implementation feasibility. Covering all adolescent girls and susceptible women of reproductive age is one such strategy (Gupta et al. 2019; Shanmugasundaram et al. 2021).

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Once infected with Rubella and developing antibodies, these antibodies persist throughout a person's life providing immunity (Chotta et al. 2017). In India at the age of 5 years, 50% of them develop Rubella antibodies due to the previous infection and almost 80–90% become immune to Rubella even without vaccination, naturally by the time they reach 15 years (Gupta et al. 2019). This childhood exposure and development of antibodies provide immunity to women, but periodic epidemics affect children and susceptible adult women, leading to epidemics of CRS (Shanmugasundaram et al. 2021).

The lack of standard assay techniques and different methods adopted by different laboratories poses a challenge in comparing data from different places (Shahapur and Kandi, 2020). To determine an effective strategy for prevention and control of Rubella and thereby CRS, it is essential to have an understanding of the specific epidemiology of Rubella in a country. India has witnessed multiple Rubella and Mumps outbreaks among children, while they are milder among this vulnerable population Administration of two doses of the Measles-Mumps-Rubella (MMR) (Rasheed et al. 2019). In this study serologic surveys were planned to monitor the rubella seroprevalence among the adult women during 2018 to 2020. The serosurvey conducted based on the seroprevalence data from the two phases, we estimated the incidence of CRS and the total number of CRS cases in India (Albrecht et al. 2021).

MATERIAL AND METHODS

The present study was carried at the department of Obstetrics and Gynaecology OPD and ward at Meenakshi Medical College Hospital and Research Institute (MMCHRI), Enathur, Kanchipuram, Tamil Nadu, India. All adolescents' girls aged 10years to 19 years residing in and around Kanchipuram. This is a hospital-based cross-sectional study, 240 adolescent girls were included in this study. The duration period of the study is from July 2018 to July 2020 for 2 years. The institutional human ethics committee was approved (IEC-25/Jan-2019) this study. All the Subjects who signed Informed written consent before the commencement of the study were allowed to participate. The risks and benefits involved in the study and the voluntary nature of participation were explained to the participants before obtaining consent. Confidentiality of the subjects was maintained.

Amongst the patients presenting to the Obstetrics and Gynaecology outpatient department, adolescent girls (according to WHO criteria) were chosen irrespective of their immunization status. The following information was obtained using a predesigned proforma from each patient, which includes name, date of birth, gender, residence, occupation/educational status, father and mother's educational status, family income, number of children in the family, type of family, vaccination status. Consent was taken from the patient. For pediatric cases, parent/guardian and patient consent were obtained. A blood sample (2 ml) was collected by venipuncture and tested for Rubella IgG antibody using a commercially available ELISA kit (Gupta et al. 2019). The test was performed and results were interpreted by plotting graphs as per the manufacturer's instructions. According to international guidelines Samples that show IgG antibody titer> 20 IU were positive, <15 IU as negative, and 15-20 IU as equivocal (Viswanathan et al. 2019).

Descriptive analysis was carried out for quantitative variables as mean and standard deviation and categorical variables as frequency and proportion. Data represented using appropriate diagrams, bar diagrams, pie diagrams, and box plots. Univariate binary logistic regression analysis was applied to check the association between the explanatory variables and outcome variables. An unadjusted Odds ratio along with 95% CI. P-value < 0.05 was considered statistically significant. Statistical analysis was carried using IBM SPSS version 22.

RESULTS AND DISCUSSION

Table.1. showed that the descriptive analysis of age in years in the study population, A total of 240 subjects were included in the final analysis. The mean child age was 15.29 ± 1.66 in the study population, ranged between 10 years to 19 years. The mean father's age was 44.98 ± 2.18 in the study population, ranged between 40 years to 51 years. The mean mother's age was 36.74 ± 2.82 in the study population, ranged between 31 years to 45 years.

Table 1. Descriptive analysis of age in years in study population (N=240)

Parameter	Mean ± SD	Minimum	Maximum
Child Age (in years)	15.29 ± 1.66	10.00	19.00
Father Age (in years)	44.98 ± 2.18	40.00	51.00
Mother Age (in years)	36.74 ± 2.82	31.00	45.00

Table 2. Descriptive analysis of vaccination status in the study population (N=240)

Vaccination Status of a study group	Frequency	Percentages
Yes	122	50.83%
No	118	49.17%

Descriptive Analysis of Vaccination status in the study population: Table.2. Indicated that the descriptive analysis of vaccination status in the study population Among the study population 122 (50.83%) children were vaccinated remaining 118 (49.17%) were non vaccinated, children.

Compilation of Factors affecting Rubella IgG Status in study population (bivariate analysis): Table.3 indicated that the Compilation of Factors affecting Rubella IgG Status in the study population. The mean age of the people with Rubella IgG positive was 15.28 ± 1.68 and it was 15.33 ± 1.59 in people with Rubella IgG negative (P=0.858). The mean age of the father with Rubella IgG positive was

44.99 ± 2.2 and it was 44.93 ± 2.11 in people with Rubella IgG negative (P=0.868). The mean age of the mother with Rubella IgG positive was 36.68 ± 2.71 and it was37.02 ± 3.3 in people with Rubella IgG negative (P=0.468). Among the people with previous exanthematous fever, all of them 26 (100%) participants had Rubella IgG positive (P=0.998). Out of the 122 children vaccinated, all of them 122 (100%) children had Rubella IgG positive (P=0.995) (Albrecht et al. 2021).

Among the people with the primary education of the father, 103 (85.53%) participants had Rubella IgG positive (P=1.000). Among the people with secondary education of father, all of them 24 (100%) participants had Rubella IgG positive (P=0.999). Among the people with bachelor's education of the father, 71 (74.74%) participants had RubelIa IgG positive (P=1.000). Among the people with the occupation of the father as a farmer, 149 (81.42%) participants had Rubella IgG positive (P=1.000). Among the people with the occupation of the father as business, 45 (88.24%) participants had Rubella IgG positive (P=1.000). Among the people with the occupation of the father as engineer, 1 (50%) participant had Rubella IgG positive (P=1.000). Among the people with the occupation of the father as the landlord, all of them 1 (100%) participant had Rubella IgG positive (P=0.999). Among the people with the occupation of the father as the driver, all of them 2 (100%) participants had Rubella IgG positive (0.999). Among the people with primary education of the mother, 69 (76.67%) participants had Rubella IgG positive (P=0.077) (Albrecht et al. 2021).

Among the people with secondary education of the mother, 60 (84.51%) participants had Rubella IgG positive. Among the people with bachelor's education of the mother, 69 (87.34%) participants had Rubella IgG positive. Among the people with housewife occupation of the mother, 149 (83.24%) participants had Rubella IgG positive (P=0.672). Among the people with duty work occupation of the mother, 35 (92.11%) participants had Rubella IgG positive (P=0.230). Among the people with tailor's occupation of mother, 7 (50%) participants had Rubella IgG positive (P=0.194). Among the people with the weaver occupation of the father, 7 (77.78%) participants had Rubella IgG positive. Among the people of the upper economic class, 47 (81.03%) participants had Rubella IgG positive (P=0.995). Among the people of the lower economic class, 59 (83.1%) participants had Rubella IgG positive (P=0.794). Among the people of the upper-middle economic class, 32 (86.49%) participants had Rubella IgG positive(P=0.530) (Murhekar et al. 2020).

Table 3. Compilation of Factors affecting Rubella IgG Status in study population (bivariate analysis)

Parameters	Rubella IgG status (Mean± SD)		Odds ratio (95% CI)	P value
	Yes	No		
Age in years	15.28 ± 1.68	15.33 ± 1.59	0.982 (0.804-1.200)	0.858
Any previous exanthematous fever (Baseline=No)				
Yes (N=26)	26 (100%)	0 (0%)	39447641.5 (0.001-0.001)	0.998
No (N=214)	172 (80.37%)	42 (19.63%)		
Vaccination status (Baseline=No)				
Yes (N=122)	122 (100%)	0 (0%)	89276241.2 (0.001-0.001)	0.995
No (N=118)	76 (64.41%)	42 (35.59%)		
Upper (N=58)	47 (81.03%)	11 (18.97%)	0.997 (0.348-2.856)	0.995
Lower (N=71)	59 (83.1%)	12 (16.9%)	1.147 (0.409-3.215)	0.794
Upper Middle (N=37)	32 (86.49%)	5 (13.51%)	1.493 (0.427-5.218)	0.530
Lower Middle (N=37)	30 (81.08%)	7 (18.92%)	1.000 (0.312-3.201)	1.000
Upper Lower (N=37)	30 (81.08%)	7 (18.92%)		
Type of family (Baseline=Joint)				
Nuclear (N=153)	123 (80.39%)	30 (19.61%)	0.656 (0.317-1.359)	0.257
Joint (N=87)	75 (86.21%)	12 (13.79%)		
Number of children in the family (Baseline=3)				
1 (N=64)	55 (85.94%)	9 (14.06%)	1.711 (0.681-4.297)	0.253
2 (N=112)	93 (83.04%)	19 (16.96%)	1.371 (0.634-2.963)	0.423
3 (N=64)	50 (78.13%)	14 (21.88%)		

Among the people of the lower middle economic class, 30 (81.08%) participants had Rubella IgG positive (P=1.000). Among the people of the upper-lower economic class, 30 (81.08%) participants had Rubella IgG positive. Among the people of the nuclear family, 123 (80.39%) participants had Rubella IgG positive (P=0.257). Among the people of the joint family, 75 (86.21%) participants had Rubella IgG positive. Among the family with one child, 55 (85.94%) participants had Rubella IgG positive (P=0.253). Among the family with two children, 93 (83.04%) participants had Rubella IgG positive (P=0.423). Among the family with three children, 50 (78.13%) participants had Rubella

IgG positive. The univariate logistic regression analysis had shown statistically no significant association with Rubella IgG status with all explanatory factors as presented (Murhekar et al. 2020).

Table 4. Compilation of Factors affecting Rubella IgG Status in Male and female population (bivariate analysis)

Parameters	Rubella IgG status (Mean± SD)		Odds ratio (95% CI)	P value
	Yes	No		
Age in years	15.28 ± 1.68	15.33 ± 1.59	0.982 (0.804-1.200)	0.858
Father Age in years	44.99 ± 2.2	44.93 ± 2.11	1.013 (0.870-1.180)	0.868
Mother Age in years	36.68 ± 2.71	37.02 ± 3.3	0.958 (0.852-1.076)	0.468
Father education (Baseline=Masters)				
Primary (N=120)	103 (85.83%)	17 (14.17%)	97883286.0 (0.001-0.001)	1.000
Secondary (N=24)	24 (100%)	0 (0%)	2.610 (0.001-0.001)	0.999
Bachelors (N=95)	71 (74.74%)	24 (25.26%)	47793336.0(0.001-0.001)	1.000
Masters (N=1)	0 (0%)	1 (100%)		
Father occupation (Baseline=Tailor)				
Farmer (N=183)	149 (81.42%)	34 (18.58%)	7079703965 (0.001-	
0.001)	1.000			
Business (N=51)	45 (88.24%)	6 (11.76%)	1.212	
(0.001-0.001)	1.000			
Engineer (N=2)	1 (50%)	1 (50%)	1615502918(0.001-	
0.001)	1.000			
Land Lord (N=1)	1 (100%)	0 (0%)	2.610 (0.001-0.001)	0.999
Driver (N=2)	2 (100%)	0 (0%)	2.610 (0.001-0.001)	0.999
Tailor (N=1)	0 (0%)	1 (100%)		
Mother education (Baseline=Bachelors)				
Primary (N=90)	69 (76.67%)	21 (23.33%)	0.476 (0.209-1.085)	0.077
Secondary (N=71)	60 (84.51%)	11 (15.49%)	0.791 (0.314-1.991)	0.618
Bachelors (N=79)	69 (87.34%)	10 (12.66%)		
Mother occupation (Baseline=Weaver)				
House Wife (N=179)	149 (83.24%)	30 (16.76%)	1.419 (0.281-7.168)	0.672
Duty Work (N=38)	35 (92.11%)	3 (7.89%)	3.333 (0.467-23.77)	0.230
Tailors (N=14)	7 (50%)	7 (50%)	0.286 (0.043-1.889)	0.194
Weaver (N=9)	7 (77.78%)	2 (22.22%)		

The odds of Rubella IgG positive were 0.982 times in age and the association was statistically not significant (P-value 0.858). The odds of Rubella IgG positive were 1.013 times in father's age and the association was statistically not significant (P-value 0.868) (Table 4). The odds of Rubella IgG positive were 1.013 times in mothers and the association was statistically not significant (P-value 0.468). Compare to bachelors, the odds of Rubella IgG positive were 0.476 times in primary, the odds of Rubella IgG positive in secondary were 0.791 times. In all the cases the association was statistically not significant (P value>0.05). Compared to the weaver, the odds of Rubella IgG positive were 1.419 times in housewives, the odds of Rubella IgG positive in duty work were 3.333 times, the odds of Rubella IgG positive in tailors were 0.286 times. In all the cases the association was statistically not significant (P value>0.05). Compare to upper lower, the odds of Rubella IgG positive were 0.997 times in upper, the odds of Rubella IgG positive in lower was 1.147 times, the odds of Rubella IgG positive in upper-middle were 1.493 times the odds of Rubella IgG positive in lower-middle were 1.000 times. In all the cases the association was statistically not significant (P value>0.05) (Murhekar et al. 2020).

Compare to joint family, the odds of Rubella IgG positive were 0.656 times in nuclear family and the association was statistically not significant (P value>0.05). Compare to the number of children in three, the odds of Rubella IgG positive were 1.711 times in only 1 child, the odds of Rubella IgG positive in 2 children were 1.371 times. In all the cases the association was statistically not significant (P value>0.05) (Table.3 and 4).

In 2017 the Indian government had included the Rubella vaccine in the National Immunization Program. For making policy decisions on implementing the Rubella control program, it is necessary to collect background data on the serological status of reproductive-age women (Murhekar et al. 2020). IgG positive and those belonging to families with three children, 78.13% were Rubella IgG

positive. Thus in the current study, there was no statistically significant association between the socio-economic factors, parents' age, father's education, father's employment status, mother's education, mother's employment status, number of children in the family (one child p-value 0.253; two children p-value 0.423), socio-economic class (lower (p-value 0.794), upper-lower, lower-middle (p-value 1.000), upper-middle (p-value 0.530), upper (p-value 0.995)), type of family (nuclear/joint p-value 0.257) and Rubella IgG status (Murhekar et al. 2020).

The study by Clark et al. (2016) showed no difference in IgG status in both parents meaning that Rubella is being transmitted equally among all income groups (Clark et al. 2016). In Poethko-Müller et al. (2012) study a high maternal educational level was associated with seronegative to Rubella (Poethko-Muller and Mankertz 2012). In (2018), Indian study reported that there was no significant difference in Rubella susceptibility among different socioeconomic classes, ages, and gravidity (Bavdekar et al. 2018; Murhekar et al. 2020).

Conclusion: The findings of the present study found that Rubella IgG positive was 0.656 times in nuclear family when compared with joint family the correlation was statistically not significant (P value>0.05) when compared with several children in three. The odds of Rubella IgG positive were 1.711 times in only 1 child, the odds of Rubella IgG positive in 2 children were 1.371 times we conclude that the a statistically no significant association between the socioeconomic status, parents' social economic status of father's, mother's education level, mother's employment status, and Rubella IgG status.

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