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A Study of Sero-Prevalence of IgG Rubella Antibodies in Indian Adolescent Girls

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Abstract

In the present study was investigate that the seroprevalence of IgG rubella antibodies in Indian adolescent girls. Rubella, an acute infection, also known as "German Measles" or three day Measles. It is predominantly a childhood disease. The most common cause of concern in Rubella patients is teratogenicity. This is a more serious problem among pregnant women. If a mother gets infected with Rubella Virus in early pregnancy, the new-born has congenital malformations known as congenital Rubella syndrome. The study 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. The current study was a hospital based cross sectional study. 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 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 was 1.371 times. In the present study we conclude that the statistically not 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.

Article Info

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Keywords

IgG antibody, Adolescent girls, Children and Pregnant women.

Introduction

In India, CRS is the most common cause of non-traumatic childhood cataract after the hereditary cataract. Cataract due to CRs accounts for about 10% of paediatric cataracts in India[1].Of all the TORCH (Toxoplasma, Others, Rubella, Cytomegalo virus, and Herpes) group of agents, Rubella virus is the major cause of congenital anomalies.[2]

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. Hence live Rubella vaccines (RCV) is vigorously promoted by WHO in many countries.[3] Before the introduction of Rubella vaccine in 1969, the global incidence of CRS was 0.8-4/1000 live births during epidemics and during the endemic periods from 0.1-0.2/1000 live births during endemics.[4] 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. Same was the case with the Rubella vaccine, but it was included in the National Immunization Schedule (India) recently.[5]Immunization studies reported that less than

50% of the children are covered with MMR vaccine. This forced the Indian government to take stringent measure thereby it was decided in 2017 to include the Rubella vaccine in the National Immunization Program.[6]Each country adopted its own strategy as per their requirements and implementation feasibility. Covering all adolescent girls and susceptible women in reproductive age is one such strategy.[7]

Previous infection and immunity against Rubella can be estimated through Rubella IgG in unvaccinated population. Once infected with Rubella and developing antibodies, these antibodies persist throughout a person's life providing immunity[7]. In India at the age of 5 years, 50% of them develop Rubella antibodies due to previous infection and almost 80–90% become immune to Rubella even without vaccination, naturally by the time they reach 15 years[8,9]. 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[10].

Surveillance data on CRS was available in majority of developed countries whereas the developing countries including "India" have no such data. India has not registered for Rubella national surveillance that provides the estimate of Rubella infection and its burden. Lack of standard assay techniques and different methods adopted by different laboratories poses a challenge in comparing data from different places[11]. 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[12].India has witnessed multiple Rubella and Mumps outbreaks among children, while they are milder among this vulnerable population[12].Administration of two doses of Measles-Mumps-Rubella (MMR) vaccine has been the chosen strategy by The Indian Academy of Paediatrics to eliminate these diseases[13].A vaccine coverage of over 80% should be maintained to lower the increasing incidence of CRS[14].

Materials and Methods

In 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. Sample size was calculated by CDC EPI INFO SOFTWARE after feeding the above-mentioned parameters. The duration period of the study from July 2018 to July 2020 for a period of 2 years. The institutional human ethics committee was approved by 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 voluntary nature of participation were explained to the participants before obtaining consent. Confidentiality of the subjects was maintained.

Methodology

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 family, type of family, vaccination status.

Consent was taken from the patient. For paediatric cases parent/guardian and patient consent was obtained.

Estimation of anti-Rubella IgG antibody

Blood sample (2 ml) was collected by venipuncture and tested for Rubella IgG antibody using commercially available ELISA kit (Meriline: Merilisa). 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 titre > 20 IU were positive, <15 IU as negative and 15-20 IU as equivocal.

Statistical methods

Descriptive analysis

Descriptive analysis was carried out for quantitative variables as mean and standard deviation and for categorical variables as frequency and proportion. Data was also represented using appropriate diagrams, bar diagram, pie diagram and box plots. Univariate Binary logistic regression analysis was applied to check the association between the explanatory variables and outcome variables. Unadjusted Odds ratio along with

95% CI is presented. P value < 0.05 was considered statistically significant. Statistical analysis was carried using IBM SPSS version 22.

Results and Discussions

Descriptive analysis of age in years in study population

Table.1. showed that the descriptive analysis of age in years in 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 fathers age was 44.98 ± 2.18 in the study population, ranged between 40 years to 51 years. The mean mothers age was 36.74 ± 2.82 in the study population, ranged between 31 years to 45 years.

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%) was 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 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 pervious 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). Among the people 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 occupation of father as farmer, 149 (81.42%) participants had Rubella IgG positive (P=1.000). Among the people with occupation of the father as business, 45 (88.24%) participants had Rubella IgG positive (P=1.000). Among the people with occupation of the father as engineer, 1 (50%) participant had Rubella IgG positive (P=1.000). Among the people with occupation of the father as landlord, all of them 1 (100%) participant had Rubella IgG positive (P=0.999). Among the people with occupation of the father as 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).

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 house wife 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 weaver occupation of the father, 7 (77.78%) participants had Rubella IgG positive. Among the people of 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). 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.

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 fathers' age and the association was statistically not significant (P value 0.868).

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 study group	Frequency	Percentages
Yes	122	50.83%
No	118	49.17%

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
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
Any pervious 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%)		
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%)		
Socio economic class (Baseline=Upper lower)				
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 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%)		

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 was 0.476 times in primary, the odds of Rubella IgG positive in secondary was 0.791 times. In all the cases the association was statistically not significant (P value>0.05). Compared to weaver, the odds of Rubella IgG positive was 1.419 times in house wife, the odds of Rubella IgG positive in duty work was 3.333 times, the odds of Rubella IgG positive in tailors was 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 was 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 was 1.493 times the odds of Rubella IgG positive in lower middle was 1.000 times. In all the cases the association was statistically not significant (P value>0.05). Compare to 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). Compare to number of children in three, the odds of Rubella IgG positive was 1.711 times in only 1 child, the odds of Rubella IgG positive in 2 children was 1.371 times. In all the cases the association was statistically not significant (P value>0.05). (Table.3)

In 2017 the Indian government had included the Rubella vaccine in the National Immunization Program. For making policy decisions on implementing the Rubella control programme, it is necessary to collect background data on the serological status of reproductive age women.

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. Thayyil*et al.,* [15], study showed no difference of IgG status in both parents meaning that Rubella is being transmitted equally among all income groups. In Poethko-Müller *et al.,* [61], study a high maternal educational level was associated with sero-negativity to Rubella. Even in Kori *et al.,* [16], study there was no significant difference in Rubella susceptibility among different socioeconomic classes, ages, and gravidity. Sharma *et al.,* **[17],** in their study found pre-vaccination Rubella immunity higher in the urban population80.2% population compared to the rural population, which was 73.1% but following R-vac vaccination, all (100%) in the urban and 99.5% of rural participants were found to be sero-positive. Miramb*oet al.,* [18], study population had significantly high Rubella IgG antibodies with high socio-economic status and peri-urban areas of the city. Hindu religion, mothers' education of schooling and above, and good communication with field workers were noted as significant predictors of vaccination by MR campaign in a study by Joe *et al.,* [19]. In developing countries majority of the children do not receive these live vaccines and the recent nation-wide survey data in India on 26 million infants showed only 61% had received all these due vaccine.20

In the present study we conclude that the statistically not 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.

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