

# Seroprevalence of IgG Antibodies against Rubella in Young Females in a Medical College in Chennai, India

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## ABSTRACT

**Introduction:** Rubella being a mild infection, rarely causes any complications in childhood, will cause adverse effects during pregnancy ranging from miscarriage to a child born with congenital rubella syndrome. Females of reproductive age group must be immune to rubella to prevent infection during pregnancy. Medical students and healthcare workers should have sufficient immunity to rubella as there are increased chances of them getting exposed to the infection. To estimate the immune status against rubella, measurement of Immunoglobulin G (IgG) antibody titre will be helpful.

**Aim:** To detect the level of IgG antibodies specific to rubella in the sera of young female students in a Medical College in Chennai, Tamil Nadu, India and to determine the proportion of anti-rubella IgG seropositivity.

**Materials and Methods:** A cross-sectional study was conducted at ESIC Medical College and PGIMSR, KK Nagar, Chennai, Tamil

Nadu, India, from July 2019 to August 2019. A total of 90 female students of the age group 19-26 years were selected by random sampling method. After obtaining informed consent, their blood samples were collected. The IgG antibody titre in the serum was estimated by indirect Enzyme Linked Immunosorbent Assay (ELISA). Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) version 26.0.

**Results:** Based on the test results, 62 (68.9%) were immune, 25 (27.8%) were not immune, and 3 (3.3%) had indeterminate results. No association was found between the age of the participants and their immune status.

**Conclusion:** Through the present study, it can be concluded that there was a low level of seropositivity of protective rubella antibodies among females, particularly the medical students who were the study population.

**Keywords:** Immunoglobulin G, Immunity, Medical students, Seropositivity

## INTRODUCTION

Rubella is a viral disease caused by the Rubella virus belonging to the family *Togaviridae* [1]. It is transmitted by airborne droplets. Infection among children and adults will be asymptomatic or, it will present as a maculopapular rash and fever with lymphadenopathy. Rubella is a vaccine preventable disease. Rubella infection during pregnancy can lead to miscarriage, foetal death, still birth or infants born with congenital rubella syndrome [2]. Females of reproductive age group must be immune to rubella to prevent infection during pregnancy [3]. As a part of strategies to eliminate congenital rubella syndrome, World Health Organisation (WHO) has recommended three strategies: to vaccinate adolescent girls/women of child-bearing age, to include rubella vaccination as a part of national immunisation schedule and to report cases of rubella within 48 hours [4]. Rubella infection presents with atypical features or may be asymptomatic, so clinical diagnosis is unreliable [1]. Recent rubella infection can be diagnosed by serological assays like enzyme immunoassay by detecting IgM antibodies against rubella [5]. Immunity to rubella is reflected by IgG antibody titre.

Healthcare professionals and medical students are exposed to infectious agents in the hospital environment. Since rubella is transmitted by droplets, unimmunised healthcare workers and medical students can get infected. Infants with congenital rubella syndrome shed the virus in urine and nasopharyngeal secretions, increasing the risk of transmission to the healthcare workers in the vicinity [6]. With many studies being done in India, among adolescent girls [7], pregnant women [8], medical students [9, 10] and healthcare workers [6], they have all been done before the Measles-Rubella (MR) vaccination campaign. Limited studies have been done post MR vaccination campaign [11-13]. Study done in Gujarat among

pregnant females in 2019, recorded a seroprevalence of 88.9% [11]. Among the studies conducted on medical students in South India [9,10], only few have been done in Tamil Nadu [9] and they were done before the vaccination campaign. So, the current study was done in Southern India, post the establishment of the vaccination campaign and IgG titre was measured to find the immune status against rubella in medical students.

## MATERIALS AND METHODS

The present study was a cross-sectional study, conducted at ESIC Medical College and PGIMSR, KK Nagar, Chennai, Tamil Nadu, India, for a duration of two months from July 2019 to August 2019. The study population was of female students of second year MBBS to final year MBBS and the interns at Medical College. After getting approval from the Institutional Ethics Committee (IEC), the study was conducted (IEC Number is: IEC/2019/1/10). Informed consent was obtained from the participants.

**Inclusion criteria:** Female students of age 18-26 years.

**Exclusion criteria:** Individuals with known rubella vaccination, previous infection of rubella and age less than 18 years were excluded from the study.

**Sample size calculation:** By using the expected proportion (P) of 0.06 from the study by Sharma H et al., and precision (d) of 5%, the sample size was calculated using the formula  $n=4P(1-P)/d^2$  [14]. The sample size (n) is 90.

## Study Procedure

The list of all the female students studying from second year to final year and the interns in the medical college was collected, and their names were written on small slips of paper. By lottery

method, 26 people from each year were selected randomly. Out of the selected individuals, 23 participants from second and third year each, and 22 participants from final year and internship took part in the study. Those who were selected were asked to assemble at a specific place and written informed consent was obtained. A proforma was then distributed to each of the participants which were answered by them. The proforma included socio-demographic and relevant clinical details. It included details about their age, residency, native, place of birth, educational qualification of their parents, history of rashes, knowledge of their vaccination status, and co-morbidities.

**Sample collection:** For the serological testing of IgG antibodies against rubella, 3 mL of blood was collected from each participant. Venipuncture was done by the laboratory technicians under aseptic conditions. The samples were collected in yellow capped tubes.

**Processing of the samples:** By centrifugation, serum was separated from the blood samples. The serum samples were stored at a temperature of -20°C till the ELISA test was performed.

**Laboratory techniques:** IgG antibody titre was measured using Anti-rubella IgG kit, Euroimmun ELISA. It employs an indirect method of ELISA. An automated Euroimmun analyser was used for doing the procedure.

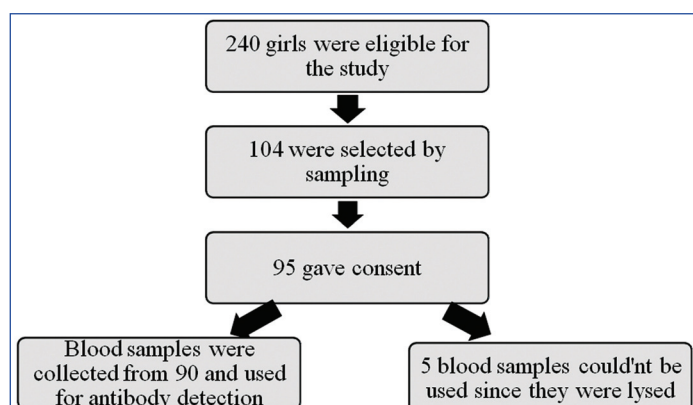
**Interpretation of the results of ELISA:** According to the Euroimmun ELISA kit, the IgG antibody titre values were interpreted as follows: IgG antibody titre <8 IU/mL signifies that the person is not immune to rubella; titres 8-11 IU/mL is an indeterminate result and titres >=11 IU/mL signifies that the person is immune to rubella.

### STATISTICAL ANALYSIS

The data were entered in Microsoft Excel 2016 version. Frequencies and percentages of the demographic details were tabulated and presented in the form of graphs. Frequency, percentage, mean, median, mode and percentiles of the study variable (IgG antibody titre) were calculated in SPSS version 26.0. The Chi-square test was applied to find the association between the study variable and the socio-demographic factors.

### RESULTS

The study included 90 female students studying from second year MBBS to final year MBBS and interns. The following flow chart explains the method of sample collection [Table/Fig-1].



[Table/Fig-1]: Flow chart showing the method of sample collection.

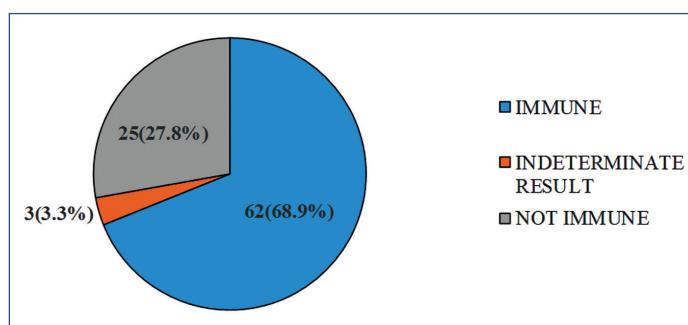
**Characteristics of the study population:** The age of the participants ranged from 19-26 years. The mean age was 21.1 years. None knew about their vaccination status. None had any history of fever with rashes. One individual had polycystic ovarian disease. [Table/Fig-2] shows demographic details of the participants.

**Immune status of the participants:** The [Table/Fig-3] pie-chart shows the immune status of the participants against rubella. In the

following table the median, minimum value, maximum value and the percentiles of the study variable are mentioned [Table/Fig-4].

Variables	Sub-variables	Number (%)
Age (years)	19-20	30 (33.3)
	21-22	51 (56.7)
	≥23	9 (10)
Study year	Second year	23 (25.6)
	Third year	23 (25.6)
	Final year	22 (24.4)
	Internship	22 (24.4)
Paternal educational qualification	SSLC (Secondary school leaving certificate)	13 (14.4)
	Higher secondary	13 (14.4)
	Diploma	4 (4.5)
	Graduate	60 (66.7)
Maternal educational qualification	SSLC (Secondary school leaving certificate)	16 (17.8)
	Higher secondary	16 (17.8)
	Diploma	3 (3.3)
	Graduate	55 (61.1)
Place of birth	Tamil Nadu	60 (66.7)
	Outside Tamil Nadu	30 (33.3)

[Table/Fig-2]: Demographic details of the participants.



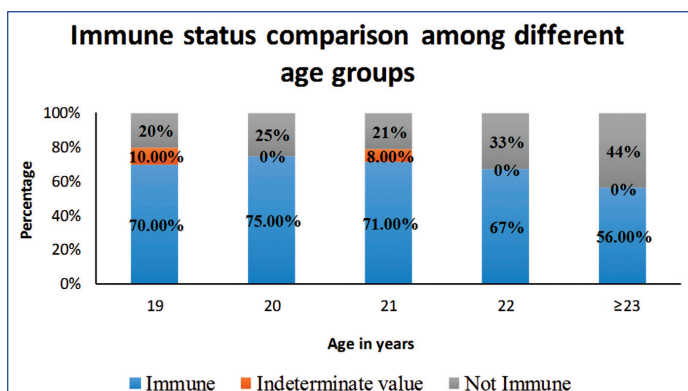
[Table/Fig-3]: Pie-chart showing immune status against rubella.

Descriptive statistics	IgG antibody titre in IU/mL	
Median	31.42	
Minimum	3*	
Maximum	186**	
Percentiles	25	14.88
	50	31.42
	75	48.57

[Table/Fig-4]: Descriptive statistics of the study variables.

\*-The minimum value was <1 IU/mL.\*\*-The maximum value was >200 IU/mL

The ELISA test kit that was used had an antibody detection range of 1 IU/mL to 200 IU/mL. So it couldn't exactly identify the extreme titre values that were less than 1 IU/mL and more than 200 IU/mL. It gave titre values for 14 participants as <1 IU/mL instead of a specific value. Similarly for four participants, titre values came as >200 IU/mL. These were the lowest and highest values respectively. Since the actual values weren't given by the test, the above mentioned values (<1 IU/mL and >200 IU/mL) couldn't be taken while calculating the descriptive statistics. These 18 entries of the titre value were excluded. [Table/Fig-5] shows the comparison of immunity to rubella among different age groups. To find the association between age and the immune status, Pearson's Chi-square test was used. Statistical significance was considered at p-value <0.05. The calculated p-value for age and immunity is 0.508 (>0.05). No association was found between age and immunity to rubella.



[Table/Fig-5]: Comparison of immunity to rubella among different age groups.

## DISCUSSION

Among the studies done on healthcare professionals and medical students, the maximum percentage of seronegativity (27.8%) has been recorded in the present study in recent years. 62 (68.9%) were seropositive, 25 (27.8%) were seronegative and 3 (3.3%) had indeterminate results. Maximum seronegativity (44%) was seen in participants more than 23 years of age.

Similar to the current study, results have been obtained in a study done by Thayyil J et al., in girl children, with a seronegativity of 28.5% [3]. Higher seroprevalence of immunity to rubella had been demonstrated in a study done by Arunkumar G et al., in South India with seropositivity among 83.4% of medical and paramedical students [10]. None of the studies have shown an association between age and immunity to rubella. Rustgi R et al., have found an association between the socio-economic status and immune status to rubella. A significantly higher seronegativity was seen in participants of the high socio-economic class [15].

Valsan C et al., found rubella seropositivity of 58.8% and seronegativity of 33.8% among female healthcare students in Kerala in 2008. Only 40% were MBBS students and others were paramedical students [16]. In a study done by Sheek-Hussein M et al., among medical students in United Arab Emirates (UAE) immunity to rubella, measles and mumps, a high prevalence of immunity (97%) was recorded. This may be because of the fact that MMR (vaccine against measles, mumps and rubella) vaccination was available from 1980's in that country [17].

Sharma H et al., found the seroprevalence of IgG anti-rubella antibodies among female children of 12 different districts in Maharashtra. Larger sample size and widespread areas of sample collection were the advantages of their study. Their study was different from others because it recorded the immunity twice, before and after vaccinating the participants with rubella vaccine, with a gap of 6-8 weeks after vaccination. From a seropositivity of 76.4%, it increased to 99.7% after vaccination [14]. Hayford K et al., found a major immunity gap among the age group 16-30 years as compared to the participants less than 16 and more than 40 years of age. This was conducted after Zambia's first ever MR vaccination campaign. It signifies that those not included in the campaign are at increased risk of getting the rubella infection [18].

The MMR vaccine was available in India only in the private sector before 2017. It was made available in the public sector after 2017. Seroprevalence study done by Pandya HB et al., in Gujarat post MR vaccination campaign showed 84.4% of seropositivity among 20-24 year-old females compared to 100% seropositivity in women of 30-35 year age group [11]. This shows an immune gap in the age group of 20-24 years. This is on par with the immunity gap seen in Zambia following their first MR vaccination campaign [18]. Children from nine months of age to 15 years were only included in India's MR campaign [4]. The older age groups weren't included. But the older individuals will be most susceptible to rubella infection since they were neither included in the immunisation campaign nor

covered under the routine Universal Immunisation. Girls above 18 years are the ones who will give birth in the near future. If they aren't immune, there will be difficulties in controlling rubella and congenital rubella syndrome. If the vaccination coverage is not widespread, there are also chances of increased incidence of congenital rubella syndrome due to age shifting of rubella infection [19]. This age shifting is because the girls would reach child-bearing age without vaccination or exposure to natural rubella infection. In this study, the age of the participants was from 19 to 26 years. They weren't included in the MR vaccination campaign, and some (27.8%) are susceptible to rubella infection. The results of this study show that older individuals don't have adequate immunity to rubella. But statistically, no significant association was found between age and immunity to rubella. The present study included a particular group of the population, i.e., female medical students and interns who will be in direct contact with patients. Being future medical professionals and during their medical education, they are susceptible to rubella. Since the seronegative students are at risk of contracting rubella infection, they can also potentially transmit the infection to non immune pregnant women. So, all medical professionals must be immune to rubella.

If left unimmunised now, there are chances of getting the infection during pregnancy. The children born to them will bear the brunt of decreased immunity of the mother. Effective control of rubella and Congenital Rubella Syndrome can be made by increasing the eligible age of MR vaccination up to 25 or 30 years.

## Limitation(s)

Small sample size was a limitation of the study. Males can also be included since they can potentially transmit the rubella infection to other people.

## CONCLUSION(S)

The present study shows a low level of seropositivity of protective rubella antibodies among females, particularly the medical students who were the study population. Rubella vaccination should be made mandatory for all medical students before joining the medical college. The present study helped in creating awareness among the medical students about the need and importance of vaccination. All the seronegative individuals were advised to take rubella vaccination.

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