

## Prevalence of Rubella IgG Antibodies Among Productive-Age Women in Al-Mahweet Governorate, Yemen

### Abstract

**Background:** Rubella is an infectious viral disease caused by the rubella virus. The incidence of women during pregnancy stage by rubella infection leads to complications for fetus development and causing fetal death or congenital rubella syndrome. **Aims:** This study aimed to determine the prevalence rate of rubella among reproductive-age women in Al-Mahweet, Yemen. **Methods:** This across-sectional study was conducted among females attending healthcare and schools from July 2007 to June 2008. Blood samples were collected individually from 270 females aged 15-35 years and the rubella virus IgG antibody was determined by enzyme-linked immunosorbent assay (ELISA). The needed data were collected by using a pretested questionnaire and analyzed by statistical program. **Results:** Overall, 197 (73%) had IgG-positive antibody to rubella and 73 (27%) had IgG-negative antibody to rubella. The highest rate of rubella IgG antibody was among females aged 15-25 years and the lowest was among the females aged 31-35 years. Similarly, the higher rate was among females living in urban area compared to females from rural area. There was a significant association between most educational levels and positive results of anti-rubella IgG. In regarding marital status, the most frequent of rubella antibody was 72.3%, 73.1%, and 75.0%, respectively, recorded among single, married, and divorced females. The non-pregnant women had (73.7%) more incidence to rubella antibody than pregnant (66.7%). 82.2% of IgG-positive women had no history of stillbirth and 65% had a history of stillbirth. Nearly results were recorded among females had and non-had family history for rubella infection. **Conclusions:** The most of enrolled females had immunity against rubella virus, but still a remark percentage susceptible to rubella infection. So, it is essential to introduce of rubella vaccine to control and prevent the rubella virus circulating among the community.

**Keywords:** Al-Mahweet, Antibody, IgG, Prevalence, Rubella virus, Women, Yemen.

### INTRODUCTION

Rubella or German measles is a worldwide disease caused by the Rubella virus. It is an enveloped, positive, single-stranded RNA virus that belongs to the family *Togaviridae*<sup>1</sup>. Humans consider the only reservoir for the Rubella virus transmitted by airborne droplets from infected individuals during sneeze or cough. Both children and adults are susceptible to rubella infection that has an incubation period of 2–3 weeks<sup>2</sup>.

In children, the rubella is usually harmlessly characterized by only slightly swollen lymph nodes and a mild rash of flat, pink to red spots that persistent for three days. Whereas in adult causes a severe infection that may lead to arthritis or encephalitis<sup>3,4</sup>.

The most serious effects of the rubella infection occur in pregnant women throughout the first trimester of gestation, resulting in spontaneous abortions, stillbirths and congenital rubella syndrome (CRS). CRS causes heart defects, blindness, deafness, and mental retardation<sup>5,6</sup>. Globally, approximately 100,000 children are born with CRS each year<sup>7</sup>. There are no antiviral drugs available for treating rubella or preventing transmission to the fetus. So, it is important that girls obtain immunity to rubella before childbearing age to prevent such serious consequences<sup>8</sup>.

Rubella occurs an epidemics in different countries without routine immunization Programs. The prevalence of rubella antibody was 92% recorded among girls aged between 15 and 49 years in Saudi Arabia<sup>9</sup> and 94.6% among pregnant women in Iran<sup>10</sup>. Also, the prevalence of rubella antibodies was >90.0% in several African countries among pregnant women and the general population has been reported<sup>11,12</sup>.

In Yemen, many reports documented the pathogenic viruses prevalent among the population and there are few reports that investigated the prevalence of rubella antibodies<sup>13</sup>. In Sana'a city, Sallam *et al.*<sup>14</sup> revealed that 91.64% of schoolgirls aged 11-21 were positive for IgG rubella antibodies. Also, the prevalence rate of rubella antibodies was 85.4% among schoolchildren in Sana'a governorate<sup>8</sup>. Recently, Al-Qadas *et al.*<sup>15</sup> found that 3.7% of pregnant women were positive for rubella IgM antibodies.

Until now, the previous studies on the prevalence of rubella antibodies focused only in Sana'a and there no data about the rubella antibodies state in another governorate of Yemen such as Al-Mahweet. Therefore, this cross-sectional study aimed to determine the prevalence rate of rubella among reproductive-age women in Al-Mahweet governorate, Yemen.

## MATERIALS AND METHODS

### Study Design and Population

This across-sectional study was conducted in the Maternal and Child center at Al-Jomhory hospital and two secondary schools namely Al- Khansa'a and Aisha, from July 2007 to June 2008, that located in Al-Mahweet governorate. A total of 270 females aged 15-35 years (mean age 21.9 years) attending healthcare and schools.

### Sample Size Calculation

The sample size was calculated by using Epi Info version 6.04 (CDC, Atlanta, USA) with taking into consideration the size of the population in the study area that was 70,000. Also, the expected prevalence of the rubella virus is 5.0% and the worst acceptable percent is 4.0%, with a confidence level of 99.9%. Therefore, the sample size was 270.

### Data Collection

A structured and pre-tested questionnaire was approved by the Faculty of Medical Sciences of Sana'a University and subjected to each participated woman. The questionnaire included socio-demographic data (age, residence, marital status, educational level, occupational status), pregnancy status, and history of clinical information

### Specimens Collection and Examination

Five mL of blood samples were collected from each participant by venous puncture and serum separated by centrifuge. The obtained sera stored at  $-20^{\circ}\text{C}$  until the serological analysis was performed. The quantitative determination of anti-Rubella virus IgG antibody was performed by enzyme-linked immunosorbent assay (ELISA) (Equipar SRL, Italy). The concentration of IgG anti-rubella in serum sample  $\geq 20$  IU/mL were considered positive.

### Statistical Analysis

The obtained data were analyzed by SPSS version 14 (SPSS Inc., Chicago, IL, USA). The relative risk (RR >1), 95% confidence interval (CI), Chi-square test ( $\chi^2$ ), and probability value  $P < 0.05$  (significant) were used to examine the significance of the relations between the prevalence of rubella IgG antibody and potential risk factors.

## RESULTS

The present results revealed that the overall prevalence rate of rubella IgG antibody was 197 (73%) positive recorded among females. Whereas 73 (27%) of participants were negative for rubella IgG antibody (Figure 1).

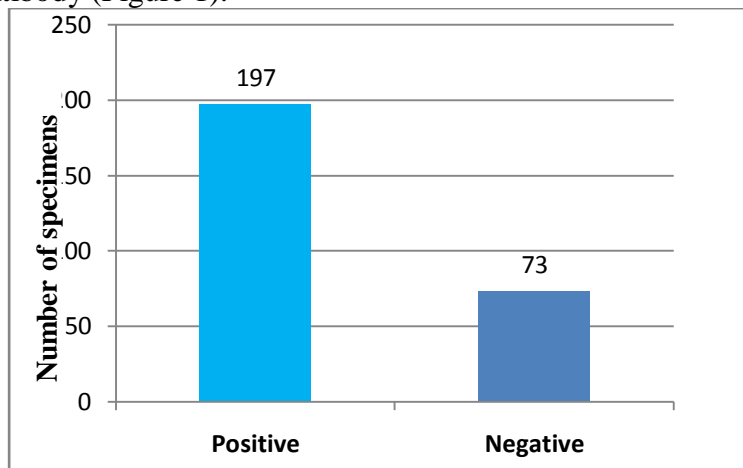


Figure 1. The distribution of rubella IgG antibody result

The current results according to age found that the highest rate of rubella IgG antibody frequency was reported among the age group 15-25 years and the lowest frequency rate was found among the age group 31-35 years. Also, there were no statistically significant differences listed in Table (1).

The females coming from the urban area had the highest rate (75.2%) of the rubella IgG antibody when compared to females coming from the rural area and there were no statistically significant. The result regarding occupation observed that the high prevalence rate of rubella IgG antibody was recorded among employee females (74.5%) followed by a student (72.5%), and house-wife (71.6%), and there also were no statistically significant (Table 1).

The current work according to the educational level, it was found that the most frequent of rubella IgG antibody was recorded among the secondary level (92%) followed by the illiterate (90.9%), university (66.2%), elementary (50%), and primary level with 38.1%. The results of elementary, secondary, primary and finally illiterate in terms of rubella IgG positivity were highly statistically significant with values of  $\chi^2 = 30.65$ ,  $P = 0.000001$ ;  $\chi^2 = 29.18$ ,  $P = 0.000001$ ;  $\chi^2 = 7.04$ ,  $P = 0.007$  and finally  $\chi^2 = 6.14$ ,  $P = 0.01$  respectively, (Table 1).

The result based on marital status showed that the nearly similar positive results were noticed among single, married, and divorced females with percentages of 72.3%, 73.1%, and 75.0%, respectively. In contrast, the two of participated widow females showed completely positive for the rubella IgG antibody (Table 1).

**Table 1. Prevalence of rubella IgG antibody in relation to socio-demographic characteristics**

Illustrative variables		No. examined (%)	No. of positive IgG (%)	RR	CI	$\chi^2$	P
Age in years	15-20	101 (37.4)	75 (74.3)	1.03	0.9-1.2	0.14	0.71
	21-25	71 (26.3)	53 (74.6)	1.12	0.6-2.2	0.14	0.70
	26-30	72 (26.7)	51 (70.8)	0.96	0.8-1.14	0.23	0.63
	31-35	26 (9.6)	18 (69.2)	0.94	0.7-1.23	0.22	0.65
Residence	Urban	145 (53.7)	109 (75.2)	1.07	0.92-1.24	0.78	0.78
	Rural	125 (46.3)	88 (70.4)	0.94	0.8-1.09	0.78	0.37
Occupation	Employee	98 (36.3)	73 (74.5)	1.13	0.6-2.06	0.18	0.66
	Student	98 (36.3)	71 (72.5)	0.99	0.85-1.15	0.02	0.88
	House-wife	74 (27.4)	53 (71.6)	0.98	0.8-1.2	0.06	0.8
Education level	Illiterate	33 (12.2)	30 (90.9)	1.29	1.13-1.48	6.14	0.01
	Primary	24 (8.9)	12 (50)	0.66	0.44-1.0	7.04	0.007
	Elementary	42 (15.6)	16 (38.1)	0.48	0.32-0.71	30.60	0.000001
	Secondary	100 (37)	92 (92)	1.49	1.3-1.7	29.18	0.000001
	University	71 (26.3)	47 (66.2)	0.88	0.37-1.06	2.24	0.13
Marital state	Single	130 (48.15)	94 (72.3)	0.98	0.85-1.14	0.05	0.081
	Married	130 (48.15)	95 (73.1)	1.0	0.87-1.16	0.00	0.96
	Divorced	8 (2.96)	6 (75)	1.03	0.68-1.55	0.02	0.96
	Widow	2 (0.74)	2 (100)	1.37	1.28-1.48	0.75	0.38

RR Relative risk >1 (at risk); CI Confidence intervals;  $\chi^2$  Chi-square  $\geq 3.84$ ;  $P < 0.01$  (significant)

In the result according to the pregnancy, the higher prevalence of rubella IgG antibody was (73.7%) reported among non-pregnant women, while the lower was (66.7%) noticed among pregnant women and there were no statistically significant as summarized in Table (2).

However, out of 130 married females, the rubella IgG antibody was more prevalent among women had no history of stillbirth with 82.2% whereas 65% of women had a history of stillbirth showing positive for rubella IgG antibody and there no statistically significant (Table 2).

Out of the 197 positive studied females, 25 (73.5%) of females had a family history for rubella and the rest 172(72.9%) of positive females had no family history for rubella and there were also no statistically significant (Table 2).

**Table 2. Prevalence of rubella IgG antibody in relation to pregnancy statue and history of clinical information**

Illustrative variables		No. examined (%)	No. of positive IgG (%)	RR	CI	$\chi^2$	P
Pregnancy statue	Pregnant	30(23)	20(66.7)	0.98	0.86-1.16	0.84	0.04
	Non-pregnant	100(77)	73(73)	1.0	0.7-1.1	0.99	0.06
Stillbirth state	Yes	40(30.8)	26(65)	0.87	0.86-1.16	1.51	0.21
	No	90(69.2)	74(82.2)	1.07	0.93-1.24	0.85	0.35
Family history for rubella	Yes	34(12.6)	25(73.5)	1.01	0.81-1.25	0.01	0.93
	No	236(87.4)	172(72.9)	0.99	0.8-1.23	0.01	0.93

RR Relative risk >1 (at risk); CI Confidence intervals;  $\chi^2$  Chi-square  $\geq 3.84$ ;  $P < 0.01$  (significant)

## DISCUSSION

Rubella has a worldwide distribution with the infection being endemic in all countries that had not a highly successful infant immunization policy or no immunization policy at all. An outbreak of rubella usually occurs in winter, spring, and early summer and spreads very easily through airborne droplets within the community<sup>16</sup>.

The current study revealed that 73% of total females were showed positive for rubella IgG antibody while 27% of females were negative. These findings are lower than the rates recorded from several studies among women that where the prevalence rates of rubella IgG antibody was reported 91.64% in Sana'a city<sup>14</sup>, 89.5 % in Poland<sup>17</sup>, 85.4% in Sana'a governorate<sup>8</sup>, 94.4% in Turkey<sup>18</sup>, 92% in Saudi Arabia<sup>9</sup>, and 94.6% in Iran<sup>10</sup>.

However, the lower rate of this study was reported by Olajide *et al.*<sup>19</sup> in Nigeria, revealing the anti-rubella IgG was 38.8% recorded among pregnant and non-pregnant women. Despite the fact that vaccination against rubella is not part of the expanded program of immunization in Yemen, the present data showed that most studied females had antibodies to rubella virus, suggesting a previous exposure rather than vaccination. Consequently, the presence of IgG antibody is a sero-marker of immunity against rubella virus<sup>20,21</sup>. Also, the absence IgG antibody indicates susceptibility to acquiring rubella infection particularly unimmunized women during the pregnancy statue and transmit it vertically to her fetus. The incidence of rubella infection through the first trimester or second trimester is representing a risk for developing the fetus resulting in congenital rubella syndrome<sup>5,6</sup>.

The antibody prevalence ranged between 69.2% and 74.3% for the different age groups. The relatively low prevalence in the older age group (31-35 years) may indicate an age association, therefore a possible clearly age association could be determined by an additional future study that includes females ranging between <15 and >35 years of age. Also, the statistical analysis showed there no significant statistical difference between the age groups and the IgG positive results.

Previous reports were revealed that the high rate of rubella IgG antibody was recorded among the age group of 5-8 years in Sana'a, Yemen<sup>8</sup>, 15-19 years in Jeddah, Saudi Arabia<sup>9</sup>, 26-30 years in Egypt<sup>22</sup>, 26-35 years in Mosul City, Iraq<sup>23</sup>. The vibration on increasing in different age groups doesn't seem to represent a risk factor.

The seroprevalence rate for the rubella antibody in this study showed an increased rate among women coming from the urban area, but no statistical differences were reported between the resident group and the prevalence of anti-rubella IgG. Similarly, the higher rate of IgG anti-rubella prevalent was recorded among females residents in the urban area in Mosul city, Iraq<sup>23</sup>. Also, it was found that the high rate was recorded among assayed women for rubella IgG antibody living in urban area in Ethiopia<sup>24</sup>.



Conversely, a study by Sallamet *al.*<sup>8</sup> observed that the participants from the rural area had a higher prevalence rate of rubella IgG antibody than the urban area. Also, Gadallah *et al.*<sup>22</sup> noticed that the participants belong to a rural area having a high rate than participated women coming from an urban area. Olajide *et al.*<sup>19</sup> found that the prevalence rate of rubella IgG was recorded 93.8% and 90.3% in urban and rural areas, respectively.

The differences in the prevalence rate of anti-rubella IgG in this study might be attributed to variance population density. In the urban area, the high density of the population might increase the transmission rate and females didn't have protective levels of rubella immunity might obtain the infections.

In the current result according to the occupation, it was observed that the high prevalence rate of rubella IgG antibody was recorded among employee females followed by the student, and house-wife, and there also were no statistically significant differences. In a similar investigation by Olajide *et al.*<sup>19</sup> reported that the prevalence rate of rubella IgG was 93.2%, 93.4%, and 92.5%, respectively, among student, worker, and housewife women. Also, Wondimene *et al.*<sup>24</sup> revealed that most frequency of rubella IgG antibody was recorded among student (88.9%), farmer (88.6%), merchant (88.1%), civil servant (77.8%), housewife (77.3%), and daily laborer (74%).

In this study, the seroprevalence of rubella in association with the educational level showed that the highest positive results were most frequently reported at the secondary level, followed by the illiterate, university, elementary, and finally the primary level. Also, the statistical analysis results showed the highly significant differences between anti-rubella prevalence and most of the educational level except individuals having a university degree. These results are in agreement with Wang *et al.*<sup>25</sup> in Taiwan, revealed that there was significantly associated between the low educational level and seronegativity to rubella.

A similar study by Wondimene *et al.*<sup>24</sup> observed that no formal education participants had a slightly high rate of anti-rubella IgG. In Iraq, Al-Mukhtar *et al.*<sup>23</sup> recorded that the higher prevalence was among individuals with the education of diploma or college and illiterate while the lower rate was among the high school individual. Also, Olajide *et al.*<sup>19</sup> registered the illiterate and primary school females showing completely IgG-positive while the secondary and tertiary ranging from 90% to 93.2%. Conversely, Gadallah *et al.*<sup>22</sup> illustrated the university grade and primary to secondary school individuals showing nearly similar in anti-rubella prevalence and no significant differences.

The variation in previous results to this result maybe referred to as many factors that play a minor role in rubella virus infection. These factors including frequency of exposure, diagnosis methods, the social variations such as the behavior of the population, environmental hygiene, cultural variances related to feeding habits, levels of the educational, and primary healthcare program.

In the present result, the single, married, and divorced females showed nearly similar results for anti-rubella IgG that ranged between 72.3% to 75%. Whereas, the two of the participated widow females showed completely positive for the rubella IgG antibody. This finding is in agreement with Gadallah *et al.*<sup>22</sup> observed that the prevalence rate of anti-rubella IgG was 84.6% and 80.3%, respectively, among married and single women. In contrast, Wondimene *et al.*<sup>24</sup> noticed that the highest rate was among married and lowest among single and divorced women. Also, it was found the rubella IgG antibody among unmarried women more than in married women<sup>23</sup>. In fact, all women are susceptible to rubella virus infection and the high potential risks present during pregnancy period.

In the current work, out of the 130 married females, it was reported that the highest prevalence of anti-rubella IgG were (73.7%) among non-pregnant women and the lowest was 66.7% among pregnant women. In a similar study conducted in Poland found that up to 90% of healthy pregnant females were positive for rubella antibody<sup>17</sup>. In Nigeria, Olajide *et al.*<sup>19</sup> observed that anti-rubella IgG prevalence was 93.75% among pregnant women and 90% among non-pregnant women. Also, in a study conducted in Iran among pregnant women that 15% of them were positive for rubella antibody<sup>26</sup>.

The current result according to the history of stillbirth, it was found that 82.2% of IgG-positive study participants no a had history of stillbirth were positive, whereas 65% of IgG-positive women had a history of stillbirth. In a similar study, Olajide *et al.*<sup>19</sup> showed that 92.5% of females non-had history of stillbirth were IgG-positive for rubella and 100% of IgG-positive

females had a history of one to four stillbirth. Also, Wondimenehet *al.*<sup>24</sup> reported that 79.2% of IgG-positive without a history of stillbirth, and 82.4% of IgG-positive females had a history of one to threestillbirth.

However, the result in this study revealed that 73.5% of females IgG-positive had a family history for rubella infection and 72.9% of IgG-positive females had no family history for rubella infection. It is noticed from this result that, there were no great differences between the families with history for rubella and the families without rubella, indicating that previous history for rubella does not influence in somehow the prevalence of infection.

## CONCLUSION

The high prevalence of rubella IgG antibody among enrolled females indicates that they had immunity against rubella virus. But, there are about a quarter of assayed females remain susceptible to rubella virus infection and cause the complications antenatal during development resulting in CRS. Therefore, all females should be vaccinated early for reducing the risk of rubella virus infection during pregnancy stage and CRS in infants.

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## AUTHOR'S CONTRIBUTION

The manuscript was carried out, written, and approved in collaboration with all authors.

## CONFLICT OF INTEREST

No conflict of interest associated with this work.

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