Seroprevalence of rubella among Turkish women and children in Afyonkarahisar, Turkey

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SUMMARY: Demirdal T, Demirtürk N, Toprak D, Aktepe OC, Aşcı Z. Seroprevalence of rubella among Turkish women and children in Afyonkarahisar, Turkey. Turk J Pediatr 2009; 51: 534-538.

The objective of this study was to determine the seroprevalence of rubella virus infection among women and female children/youth (0-17 years old) in Afyonkarahisar, Turkey.

This study was conducted between November 2005 and February 2006. One thousand four hundred nine serum specimens were studied by the enzyme-linked immunosorbent assay (ELISA) method. Age, educational level, economic and marital status, smoking habit, application or not of measles-mumps-rubella (MMR) vaccination, and previous skin rash of the patients included in the study were questioned and noted.

Positive rubella-specific IgG antibodies prevalence was found as 18.5% in girls between 0-1 years of age, 28.6% in girls between 2-6 years of age, 36.8% in girls between 7-17 years of age, and 80.0%, 80.9%, 78.5%, 73.7% and 78.1% in women between 18-20, 21-30, 31-40, 41-50, and 50+ years of age, respectively. There were no statistically significant correlations between immunity to rubella and other sociodemographic characteristics.

In conclusion, nearly 20% of women of reproductive age are sensitive to rubella and should be vaccinated. The clear effects of adding MMR to the routine vaccination schedule will be observed in the following years in Turkey.

Key words: rubella, seroprevalence, vaccine.

Rubella (German measles) is an acute exanthematous viral infection in children and adults. The clinical illness is characterized by rash, fever and lymphadenopathy, and resembles a mild case of measles (rubeola). Although many infections with the agent are subclinical, this virus has the potential to cause fetal infection, with resultant birth defects[1].

Rubella can be a disastrous disease in early gestation and can lead to fetal death, premature delivery, and an array of congenital defects. The incidence of congenital rubella in a given population is quite variable, depending on the number of susceptible individuals, circulation of the virus in the community, and in recent times, the use of rubella vaccine. The rubella epidemic of 1964 left 30,000 affected infants in its wake in the United States. After this epidemic in 1969, the rubella vaccination was added to the routine vaccination schedule in the United States. Between 1969 and 1979, however, an average of 39 cases per year were reported to the Centers for Disease Control and Prevention (CDC)[1,2]. In October 2004, the CDC convened an independent panel of internationally recognized authorities on public health, infectious disease and immunization to assess progress toward elimination of rubella and congenital rubella syndrome (CRS) in the United States, a national health objective for 2010[3].

Rubella and CRS were included in the surveillance system in Turkey in 2005[4]. A total of 2,245 and 1,058 cases of rubella were reported in 2005 and 2006, respectively. Two cases of CRS were reported to the Ministry of Health in 2005 and no cases were reported in 2006[5]. Unfortunately, there are still problems

in the surveillance system in Turkey, and there is the possibility that uninformed cases exist. In Turkey, the rubella vaccine has been available on the markets from the private sector since 1989. It has been included in the national vaccination program since September 2006, shortly after we arranged this study. Our aim was to determine the seroprevalence of rubella virus infection and its relation with sociodemographic characteristics between different age groups.

Material and Methods

This cross-sectional study was supported by a grant from Kocatepe University. Afyon is a city located in middle Anatolia in Turkey, 350 km from the capital Ankara, with a population of approximately 800,000. The present study was conducted between November 2005 and February 2006. Ethical approval was given by Afyon Kocatepe University Ethics Committee, and Afyonkarahisar Governorship also gave permission for the study. Rural and urban inhabitants selected for the study were detected from local health data recordings randomly. The candidates were informed by telephone and the volunteers who accepted to participate were included into the study. An informed consent form was obtained from all volunteers in the study. The minimum sample size for the current study was calculated to be 1,409 with a 5% error and 95% confidence interval. Female children/youth (0-17 years old) and women (18 years and older) were included into the study. They were divided into eight groups according to age (0–1, 2-6, 7–17, 18–20, 21–30, 31–40, 41–49, and 50+). As the antibodies transmitted from the mother can cause false positivity, 0-1-year-old babies were defined as a separate group. The age group of 2-6 years represented the preschool-age period and of 7-17 years the school-age period; the other groups were defined as reproductive (childbearing age) and post-reproductive (post childbearing age) periods.

Age, educational level, economic and marital status, smoking habit, previous skin rash history, and application or not of measles-mumps-rubella (MMR) vaccination were questioned and the responses noted. The research team included five doctors, two laboratory technicians and a nurse. Serum samples were collected by the laboratory technicians and the nurse, in the primary health care centers in the areas where the subjects lived.

Economic status was evaluated in three categories: 0-500 USD/month as low income, 501-1000 USD/month as moderate income, and 1001 and more USD/month as high income groups. The relationship between sociodemographic characteristics and rubella seroprevalence was investigated. The data form was filled out during a face-to-face interview with 1,194 women and 215 female children/youth (0-17 years old) who agreed to participate in the study after signing the informed consent form. Sociodemographic data and questionnaires were recorded by the five physicians in the study group.

Venous blood (5-7 cm^3) was taken from each participant. The serum was separated from blood and stored at -70°C. Rubella-specific IgG antibodies were screened qualitatively using a commercial immunoassay (Trinity Biotech, Ireland). The procedure and the interpretation of the results were performed according to the manufacturer's instructions.

Statistical analyses were performed using the chi-square or Fisher's exact test when the predicted number of observations in either cell was less than 5, and statistical significance was defined as $p<0.05$. We used the t test to compare continuous variables.

Results

The mean ages of the 1,194 women and 215 girls (0-17 years old) who were included in the study were 48.76±22.16 and 11.17±6.13 years, respectively. The sociodemographic characteristics demonstrated that 63.7% of women had at least graduated from primary school, 78.7% were married, 17.8% were divorcees, and 3.5% were unmarried. Forty-six point six percent of volunteers were rural and 53.4% were urban inhabitants. Seventy-nine percent of women had low, 20% moderate and 11% high economic status (Table I). Neither the women nor the girls (0-17 years old) in this study had been vaccinated against rubella. Our study showed that 78.3% of the women did not smoke.

Positive rubella-specific IgG antibodies prevalence was found as 18.5% in girls between 0-1 years of age, 28.6% in those between 2-6 years of age, and 36.8% in those between

Table I. Seropositivity According to the Characteristics of Adults (18 years and above)

	Total		Seropositivity		
	No	%	No	%	P value
Marital status					
Married	949	78.7	726	76.5	0.620
Divorced	205	17.8	164	80.0	
Unmarried	40	3.5	32	80.0	
Education status					
Primary school or less	1087	91	838	77.1	0.443
Secondary school	89	7.5	68	76.4	
High school	18	1.5	16	88.9	
Economic status					
Low	943	79.0	726	77.1	0.945
Moderate	238	20.0	186	78.1	
High	13	11.0	11	87.5	
Residence					
Rural	556	46.6	416	74.8	0.440
Urban	638	53.4	508	79.3	
Smoking					
Never consumed	1179	98.9	906	76.7	0.218
From time to time	11	0.8	8	72.7	
Often	4	0.3	3	75.0	
Skin rash					
Yes	1141	95.6	878	77.0	0.066
No	53	4.4	44	83.0	

7-17 years of age, and 80.0%, 80.9%, 78.5%, 73.7%, and 78.1% in women aged 18-20, 21-30, 31-40, 41-50, and above 50 years of age, respectively (Table II). There was a statistically significant difference in terms of seropositivity between girls and women; however, there was no significant difference between the women participants above 18 years of age. In addition, there was no significant relationship between rubella seroprevalence and sociodemographic characteristics such as marriage, education level, economic status, place of residence, and smoking habit.

Discussion

Rubella is a mild disease, usually without consequences or complications. Natural rubella virus infection is characterized by fever, sore

Table II. Seroprevalence of Rubella Immunity According to the Age Groups

	Total		Seropositivity		P value
Age	No	%	No	%	
0-1 years	27	12.6	5	18.5	0.265
2-6 years	63	29.3	18	28.6	
7-17 years	125	58.1	46	36.8	
18-20 years	15	1.2	12	80.0	0.392
21-30 years	94	7.9	76	80.9	
31-40 years	223	18.7	175	78.5	
41-49 years	323	27.1	238	73.7	
50 years and above	539	45.1	421	78.1	

throat, lymphadenopathy, and skin rash, which usually resolve quickly. These symptoms are also indicative of several other common viral infections; therefore, clinical rubella is difficult to diagnose. As a result, rubella has not been completely eradicated and outbreaks occur at regular intervals[6].

Rubella appears in epidemics in countries without routine immunization programs. An antibody prevalence of 92% among girls between the ages of 5 and 25 years was reported in Saudi Arabia, 94.6% among pregnant women in Iran and 77.5% among pregnant women in Russia. Studies conducted in the past in India and in Bolivia in children aged 1-4 years have shown seronegativity ranging from 31 to 82%[7]. According to studies from different regions in Turkey, rubella seroprevalence was reported as 87.8% in adults from Istanbul, 95.5% in young girls from Manisa, 86% in women of childbearing age from Ankara, 93.8% in young girls from Erzurum, 82.4% in women of childbearing age from Malatya, and 93.1% in pregnant women from Denizli[8-12]. In our study, we found a seropositivity ratio of 73.7-80.0% in the adult age group, and this result was similar to the other studies in Turkey.

Congenital rubella is a clinically serious form that occurs when a non-immunized pregnant woman is infected with rubella virus during pregnancy. Thus, the vaccination of women of childbearing age is very important. Rubella vaccine has been included in the national vaccination program in Turkey since September 2006, a short time after the conduct of this study. It is considered that the results of this program will become clear in the near future. According to the national vaccination program in Turkey, the MMR vaccine is planned in children at 12 months and 7 years of age. In addition, application of the rubella vaccination in children aged 15 years (primary school 8th grade) was initiated. Childhood immunization of both sexes reduces the number of infections and extends the inter-epidemic interval by reducing the circulation of rubella virus in the community. Hence, one consequence of a childhood-only immunization program may be an increase in the proportion of susceptibles in the adult population[13]. With respect to these data, in Turkey, the number of rubella-sensitive adults may increase in the following years; therefore, this group should be vaccinated.

In our study, we found no significant difference in the seropositivity prevalence among girls in the 0-1, 2-6 and 7-17 age groups ($p=0.265$). However, comparison of this group and the adult group showed that seropositivity prevalence was higher in the adult group and the difference was statistically significant ($p<0.05$). In many studies, increased seropositivity prevalence with age was reported[14-16]. Corcoran et al.[17] reported that there was no statistically significant difference in the rate of rubella susceptibility between the four districts tested. On the other hand, the seropositivity increased in correlation with age among 0-17-year-old girls. When these girls reach reproductive ages, nearly 80% of them are introduced to the virus.

Rubella seroprevalence was found to be higher in Nigerian women living in rural residence areas[18]. However, there were many studies reporting no relationship between rubella seropositivity and economical status or area of residence[19,20]. Among the unvaccinated population in Turkey, urban residence area and higher socioeconomic groups were reported to have lower susceptibility, but the socioeconomic factor was not statistically significant[21]. A large study in Mexico showed a significant increase in susceptibility as the educational level decreased[22]. That is to say, the effect of socioeconomic status on seropositivity is different in different countries. In our study, we did not find a positive correlation between seropositivity and economic status, place of residence or education level. These results determine that the virus circulation is the same between different socioeconomic groups, in our rural and urban areas. It also indicates that the women of both areas in Afyonkarahisar, Turkey are at similar risk of infection with rubella virus. According to these results, regardless of residence in rural or urban areas, it seems to be convenient to include the women of childbearing age in any vaccination program.

Smoking suppresses the proliferation of T cells, which are the elements of cellular immunity, affects the natural killer cell functions, and decreases the serum levels of IgG and IgA. Inhibition of the T cell response causes a tendency towards increased airborne infections[23,24]. Thus, the relation between rubella seropositivity and smoking was evaluated, but no significant relationship could be determined ($p=0.218$).

In conclusion, despite the increased seropositivity prevalence in adult women, about 20% of the reproductive population is sensitive to rubella. Based on determined similar ratios in many studies in different regions of Turkey, the necessity of rubella vaccination campaigns including the females of childbearing years should be considered.

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