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RUBELLA IMMUNITY IN JUNIOR HIGH SCHOOL GIRLS IN URBAN AND RURAL REGIONS OF TONKABON DISTRICT, MAZANDARAN PROVINCE, ISLAMIC REPUBLIC OF IRAN

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ABSTRACT

In this report, a seroepidemiological survey was performed to determine the prevalence of rubella immunity and antibody titer in 11-16 year old girls in urban and rural areas of Tonkabon district in northern Iran. The results and conclusion are presented.

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INTRODUCTION

Rubella is classified as a member of the togavirus family. The virion has 60nm diameter, it has an internal nucleocapsid surrounded by a glycoprotein envelope with short spikes of hemagglutinin. The incubation period of rubella infection is about 17 days, and prodromal symptoms including adenopathy, malaise, low grade fever, mild sore throat and coryza may precede the rash by one to five days. The rash persists two to three days. About 50% of children have inapparent infection, but this rate may be lower in adult populations.[1] During an epidemic it has been shown that the rate of subclinical infection was 17% in pregnant women.[2] The virus can be isolated from the pharynx and the blood about one week before the onset of symptoms. The virus may persist in the pharynx about two weeks and disappears from the blood with the appearance of antibody. In pregnant woman during the viremic stage, the virus can infect the placenta and the fetus. By serological studies, Cradock-Watson, et.al. have demonstrated that the placenta and fetus can be infected at any time during pregnancy,[3] but this particularly can occur during the first trimester. In this period of pregnancy, transplacental transfer of maternal antibody is defective[4] and the fetal immune defense is immature, and the virus can infect the placenta and fetal organs and a chronic infection may be established.[1] Infection of the placenta is more frequent than fetal infection, and fetal infection is not always accompanied by congenital malformation.[1,3] In a study based on viral isolation during the first trimester of pregnancy, the virus was found in 85% and 50% in the placenta and fetus respectively[5] in the case of maternal infection, but the rate of congenital malformation is about 20% in neonates in this period. At reexamination several years later, further signs of disease may be demonstrated in these children due to persistent infection of rubella virus, and the risk of damage will thus increase to 30-35 percent.[5] In this respect, hearing loss and occasionally panencephalitis may occur.[1,6] As subclinical infection is prevalent in rubella and as it is not possible to diagnose clinical rubella from other exanthematous diseases, the only evidence of past infection and immunity relies on the presence of specific antibody which is best determined by hemagglutination inhibition (HI) technique.[7] A serum HI titer equal to 1:10 or higher is indicative of passed infection and immunity to rubella. Variations in the level of immunity in different populations may be due to factors such as socioeconomic status, climate, occurrence of recent epidemics and population size and density.

To have a rubella immunity profile in our country, seroepidemiological surveys have to be done in different urban and rural regions of Iran. In this study, the prevalence of immunity and antibody titer in ll to 16

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year old junior high school girls in urban and rural regions of Tonkabon, a district situated in the north of Iran, is determined.

MATERIALS AND METHODS

Study population

During the year 1982 in Tonkabon district, 3089 and 658 girls were attending junior high schools in rural and urban regions respectively.[8] A total of 812 serum specimens were collected by random sampling; 613 from rural and 199 from urban regions. The size of the samples were approximately proportional to the number of total junior high school girls in these areas[8], and ensure that the estimated error does not exceed 3% with 95 percent correlation.

Collection of Specimens and Antibody Assay

5 ml of blood was collected from every student, separated sera were sent in cold storage to the Department of Virology, School of Public Health, Tehran University of Medical Sciences, and were stored at -20°C until tested.

Hemagglutination inhibition antibody was determined in dilutions from 1:10 to 1:640 of sera by microtiter technique.[9] The rubella antigen was obtained from a commerical source (Orion Diagnostica, Helsinky, Finland) and used in 4 hemagglutinating units. The sera were treated with 25% acid-washed kaolin and 50% pigeon red blood cells in dextrose gelatine veronal buffer to remove non-specific inhibitors and hemagglutinins. The test was controlled by including a negative and positive standard serum in each microtiter plate. A rubella HI titer of less than 1:10 was judged to be seronegative and greater than or equal to 1:10, seropositive. All seronegatives were retested.

RESULTS

812 serum samples were tested for rubella antibody and the results are summarized in Tables I to IV.

Of a total of 812 sera titrated, 17% had antibody titers below or equal to 1:10, but the rate of seronegativity was 20.5% in urban and 16.3% in rural areas (Table I).

Table II shows the number and the percentage of seronegativity in different age groups in rural areas. 80 percent of the 11-12 year age group and 85 percent of the 13-14 year and 15-16 year age groups are immune to rubella. In urban areas, the percentage of immune students gradually increased with age (Table III).

In the total of 812 sera, the relationship between antibody titer and age is shown in Table IV. The highest percentage of all students (27.4%) had 1:40 antibody titers. 19% have antibody titers of 1:20 and 20% have 1:80, and only 4% possess 1:10 HI titers. 17% of all students are susceptible to infection. Analysis of the data in Table IV with the X^2 test indicates that there is a statistically significant rise in the rate of immunity (titer> 1:10) with increasing age ($P = 0.05$).

Table I. Prevalence of susceptibility to rubella (HI antibody titer ≤ 1:10) in 812 junior high school girls in urban and rural areas of Tonkabon District, 1982.

Location	No of sera tested	No of susceptibles	Percent of susceptibles
Urban areas	199	41	20.6
Rural area	613	100	16.3
Urban and rural	812	141	17.3

Table II. Prevalence of susceptibility to rubella (HI antibody titer ≤ 1:10) in rural areas relative to different age groups.

Age group in years	No of sera tested	No of susceptibles	Percent of susceptibles
11-12	150	30	20.0
13-14	349	53	15.2
15-16	114	17	14.9
Total	613	100	16.3

Table III. Prevalence of susceptibility (HI antibody titer ≤ 1:10) in urban areas relative to different age groups.

Age group in years	No of sera tested	No of susceptibles	Percent of susceptibles
11-12	72	18	25.0
13-14	98	20	20.6
15-16	29	3	10.3
Total	199	41	20.6

DISCUSSION

In most parts of the world where children are not routinely vaccinated against rubella, this infection is predominantly a disease of preschool and school-age children and during epidemics they act as sources of infection for other susceptibles, including pregnant women, even when only a thin stream of susceptibility

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Table IV. HI antibody titers in 812 junior high school girls in urban and rural areas relative to different age groups.

Age group in years	No of sera tested	HI antibody titers						
		< 1:10 percent	1:10 percent	1:20 percent	1:40 percent	1:80 percent	1:160 percent	≥ 1:32 percent
11-12	222	21.6	4.0	15.3	25.2	22.5	6.4	4.9
13-14	447	16.3	4.4	20.1	28.6	18.5	10.4	1.7
15-16	143	13.9	3.4	22.3	27.3	20.9	7.7	4.3
Total	812	17.3	4.1	19.2	27.4	20.0	8.6	3.4

is observed.[10] By serologic survey during an outbreak, it has been possible to demonstrate that 3.5% of pregnant women became infected,[2] the rate of susceptibility being about 12.5% in these women. Our study in Tonkabon District shows that overall, 17% of junior high school girls are still susceptible to rubella and the rate of immunity shows a gradual increase with age groups: prevalence of immunity is about 78.4% in the 11-12 year age group and 86% in the 15-16 year olds. The percentage with antibody in urban areas is slightly lower than rural areas, a difference of 5% in immunity rate being observed in all age groups in rural and urban regions. Over all, 16.3% are susceptible in rural as compared to 20.6% in urban areas. As shown in Table IV, the highest proportion of children have antibody titers between 1:20 and 1:80. Low titers of 1:10 are only found in 4% and titers of ≥ 1:320 in 3% of this population. Scattered investigations concerning the rate of immunity[11-14] and studies about vaccine effectiveness[15-17] had been performed in Iran. In a study performed in 1981 in Teheran, 10-29% susceptibility had been observed in 18-25 year old girls and women.[14] Based on the seroepidemiological studies immunization programs are planned and are effectuated in different countries.

The two main immunization strategies are: 1) Immunization of all children in the second year of life in order to reduce the rate of infection and the rate of transmission to pregnant women.[18] This strategy is now supplemented by identification of seronegative non-pregnant women at child bearing age and the booster immunization in adolescent females. 2) In most areas of the world, vaccination is provided for 12-13 year old girls and women in the post-partum period.[18] Other schemes of vaccination consist of screening of all females of 12-45 years and vaccination of seronegatives.[19] In populations with high natural immunity in women of childbearing age, premarital testing and vaccination of seronegative females is also proposed.[20]

In Iran, information about the immunity status in different parts of the country is scant and it is advisable to monitor seroepidemiological studies in different geographical urban and rural regions in order to design the most suitable and economical vaccination policy.

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