Rubella serology in pregnant women attending health centres of Tehran University of Medical Sciences

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سيرولوجيا الحصبة الألمانية لدى الحوامل المراجِعات للمراكز الصحية لجامعة طهران للعلوم الطبية

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الخلاصــة: أجريت هذه الدراسة في المدة 2003 – 2005 للتعرُّف على الحالة السيرولوجية لعينات من دم الحوامـل، واعتبار ذلك دراسة تمهيدية لبرنامج التطعيم ضد الحصبة الألمانية. ومـن بـين 965 حـاملاً راجعـن المراكـز الـصحية لجامعة طهران للعلوم الطبية يلتمسن الرعاية الصحية للولادة، كان المعدل التقـديري للمناعـة ضـد الحـصبة الألمانيـة 91.1٪ (بفاصلة ثقة 95٪، وتراوُح بـين 89.3٪ و92.9٪)، في حـين كـان معـدل فقـدان المناعـة للحصبة الألمانية 8.9٪ (بفاصلة ثقة 95٪ وتراوُح بين 7.1٪ و10.7٪). وقد اختلف معدل المناعـة ضـد الحـصبة الألمانيـة بـاختلاف مناطق مدينة طهران، ولكنه اختلاف لا يُعْتَدُّ به إحصائياً. ومع ذلك، لوحظ اختلاف يُعْتَدُّ به إحصائياً في مـستوى المناعة ضد الحصبة الألمانية بحسب عدد الأشخاص الذين يقطنون في مسكن واحد وبحسب السن، و لم تكن هنـاك علاقة يُعْتَدُّ بها إحصائياً مع الوضع الاقتصادي أو المهنة أو مستوى التعليم.

ABSTRACT This study was performed in 2003–05 to determine the serological status of a sample of pregnant women as a preliminary study for the rubella vaccination programme. Out of 965 pregnant women attending health centres affiliated to Tehran University of Medical Sciences for prenatal care, the estimated rubella immunity rate was 91.1% (95% CI: 89.3%–92.9%) and the nonimmunity rate was 8.9% (95% CI: 7.1%–10.7%). The rubella immunity rate differed in different areas of Tehran but not significantly so. However, there was a significant difference in the level of rubella immunity by the number of persons per household and by age, but no significant relationship with economic status, occupation or level of education.

Sérologie de la rubéole chez des femmes enceintes fréquentant des centres de santé de l'Université des Sciences médicales de Téhéran

RÉSUMÉ Cette étude a été réalisée de 2003 à 2005 pour déterminer l'état sérologique d'un échantillon de femmes enceintes ; il s'agissait d'une étude préliminaire en vue du programme de vaccination contre la rubéole. Sur 965 femmes enceintes fréquentant les centres de santé rattachés à l'Université des Sciences médicales de Téhéran dans le cadre de la surveillance prénatale, le taux estimé d'immunité contre la rubéole était de 91,1 % (IC 95 % : 89,3 % - 92,9 %) et le taux de non-immunité de 8,9 % (IC 95 % : 7,1 % - 10,7 %). Le taux d'immunité contre la rubéole n'était pas le même dans les différentes parties de Téhéran, mais pas de façon significative. Il existait en revanche une différence significative de niveau d'immunité contre la rubéole selon le nombre de personnes par foyer et l'âge, mais pas de relation significative avec la situation économique, l'activité professionnelle ou le niveau d'instruction.

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Introduction

Rubella infection is one of a group of uterine infectious diseases that can be acquired by women during pregnancy (TORCH infections) and which are associated with complications such as abortion, delivery of a dead fetus and fetal anomalies. Thus it is important to know the proportion of rubella-sensitive women in a community in order to estimate the risk of a child developing congenital rubella syndrome (CRS). The World Health Organization (WHO) considers a rubella-sensitivity rate of more than 10% of all women in a community as a predisposing factor for CRS, and a value of more than 20% as very high risk [1].

In communities where rubella vaccination is performed erratically without a specific programme, the serologic pattern of that society will be disrupted and it may even lead to rubella infection occurring after childhood (in teenage or pregnancy), thereby increasing the risk of CRS [1].

WHO has drawn up guidelines for an organized programme of CRS surveillance and care for countries that have included rubella vaccination in their national immunization programme as well as for countries that are willing to do so [1].

It has proposed 3 stages of rubella control [1]. The Islamic Republic of Iran is now at stage 1, planning for rubella vaccine, which is when a country wishes to include rubella vaccination in its national immunization programme and requires some basic information. The WHO has suggested 4 methods for assessing the impact of CRS in these countries [1].

One method is to perform serological studies in pregnant women prior to delivery in order to estimate the risk of developing rubella and the proportion of women in the community who are sensitive to the infection during pregnancy.

Serological studies in 45 developing countries showed that in 13 countries the percentage of nonimmume women was < 10%, in 20 countries between 10%–25%, and in 12 countries > 25% [2,3]. Also in Oman a study in 1989 showed that 80% of women who were of reproductive age were nonimmune. In addition in the 1992–94 rubella epidemic of this country the incidence of CRS was 3.5 per 1000 live births [2].

Surveys on rubella immunity rates have been carried out in the Islamic Republic of Iran and other central Asian countries. A study on 946 women aged 15–39 years in Kyrgyzstan showed that 13% were nonimmune [4]. Various studies in the Islamic Republic of Iran showed that the proportion of reproductive age women without immunity towards rubella was between 10% and 24%. In 1986–90 in Shiraz the sensitivity rate to rubella after childhood was estimated to be 15% [5]. In 1996, 20% of high-school girls in Tehran were not immune [6]. In Shariati hospital in Tehran in 2000, around 24% of pregnant women were nonimmune [7]. A study in Urmieh in 2002 showed that 10% of fertile urban and rural women were not immune towards rubella [8].

Women are considered at risk of developing rubella infection when specific serum rubella IgG levels are absent or inadequate to cause immunity [1]. In the Islamic Republic of Iran, information about the rubella status of women of fertile age is patchy. Thus a study was performed with the aim of determining the rubella-specific IgG sensitivity rate in a sample of pregnant women attending prenatal care in Tehran.

Methods

In this cross-sectional study the rubella-specific IgG level was determined in the serum of 15–49-year-old pregnant women. To estimate the sample size, we considered the results of a study performed in Urmieh in 2002 which found the sensitivity rate to be 10% in women of fertile age [8]. Thus

for estimating the sensitivity rate of women in Tehran with an error of less than 2% and confidence level of 95%, the sample size was calculated to be 865 women, which increased to 970 when 10% loss was taken into account.

In this way, we studied 972 pregnant women attending for prenatal care at all treatment centres affiliated to Tehran University of Medical Sciences (Imam Khomeini, Shariati, Arash and Mirza Koochak Khan hospitals and Islam Shahr health centre). In addition to taking a venous blood sample, a questionnaire containing demographic, regional and vaccination history data was completed for each subject.

The blood samples were sent to the laboratory of the respective hospitals under cold temperature conditions and were kept at –20 ºC until testing. The samples were tested by enzyme-linked immunosorbent assay (ELISA, Dade Behring kit) and the antibody titre was calculated in relation to the control sera. Titres < 15 IU/mL, 15–30 IU/mL and > 30 IU/mL were considered as negative, borderline and positive respectively.

Of the total sample (972), 7 women were excluded from the study due to borderline values. In order to study the relationship between factors causing lack of immunity in the different regions, the chi-squared test was used and data were analysed using *SPSS* software, version 10.

Results

The estimated immunity rate of the women in the study was 91.1% (95% CI: 89.3%–92.9%). Thus the proportion of women susceptible to rubella was 8.9% (95% CI: 7.1%–10.7%).

The results showed that among the 965 women, 280 (29%) had a titre of 260 IU/mL, 125 (13%) had 240 IU/mL and the rest had titre < 240 IU/mL. The results also showed that the most frequent antibody titre was 260 IU/mL. The logarithmic mean rubella antibody titre in our subjects after translating these values to decimal values was 2.13 (standard deviation 0.32, range 0–2.47).

The descriptive data of Table 1 show that the rate of immunity differed in different areas of Tehran, so that the estimated rubella sensitivity rate of pregnant women ranged from 17.5% in north Tehran to 6.3% in central Tehran and 7.1% in the suburbs.

In order to study the relationship between age and immunity towards rubella, the women were divided into 2 groups (Table 1). Lack of immunity in women ≤ 25 years and > 25 years was 11.0% and 6.8% respectively. Statistical tests show that there was a significant statistical difference in the level of immunity towards rubella between the 2 groups ($P < 0.02$).

The results also show that the number of family members per household affected the rate of immunity ($P = 0.004$); this effect was not linear, in that families with < 3 members had a 9.3% rate of rubella sensitivity, which decreased to 3.6% in families with 4–5 members and rose slightly to 8.5% for households with ≥ 6 members (Table 1). There was no significant statistical relationship between socioeconomic status and rubella immunity (Pearson $\chi^2_2 = 0.19$, $P = 0.91$). In addition, living space area (m^2) (Pearson $\chi^2_1 = 0.17$, $P = 0.68$) and history of vaccination did not show any relationship (Pearson $\chi^2_1 = 0.003$, $P = 0.96$).

Discussion

In countries such as the Islamic Republic of Iran, which have been placed in stage 1 by the WHO, the key factors in identifying rubella disease in the region and determining immunization strategies are the serologic evaluation of women of fertile age, the estimation of the rate of sensitivity for

Table 1 **Frequency distribution of immunity to rubella in pregnant women (*n* = 965) attending prenatal care centres affiliated to Tehran University of Medical Sciences in 2004, by area of Tehran, age and number of family members in household**

Variable	Immune		Non-immune		Total	
	No.	%	No.	%	No.	%
Tehran area						
North	33	82.5	7	17.5	40	100.0
West	102	90.3	11	9.7	113	100.0
East	43	91.5	4	8.5	47	100.0
Central	89	93.7	6	6.3	95	100.0
South	191	88.0	26	12.0	217	100.0
Suburbs	421	92.9	32	7.1	453	100.0
Age (years)						
≤ 25	437	89.0	54	11.0	491	100.0
> 25	442	93.2	32	6.8	474	100.0
	Pearson χ^2 = 5.359, df = 1, *P* < 0.02					
No. of family members						
1–3	660	90.7	68	9.3	728	100.0
4–5	159	96.4	6	3.6	165	100.0
≥ 6	60	83.3	12	8.5	72	100.0

A total of 879 (91.1%) women were immune, while 86 (8.9%) were not.

acquiring rubella and, if possible, complete assessment of the country in order to assess the sensitivity rate of different groups.

The aim of our mostly descriptive study was to estimate the sensitivity (nonimmune) rate of pregnant women to rubella and we found that in our study population 8.9% of women were nonimmune, i.e. sensitive to rubella. According to the WHO definition [1], countries that are at risk of developing CRS are those in which the rate of sensitivity to rubella is ≥ 10% among women of fertile age. Serological tests related to 45 developing countries showed that < 10% of women of fertile age were unvaccinated against rubella in 13 countries, 10%–24% in 20 countries and > 25% in 12 countries [1].

Past studies in the Islamic Republic of Iran have reported the rubella sensitivity rate to be in the range of 10%–25% (15% in 1986 [5], 20% in 2000 in high-school girls [6], 24% in pregnant women at Shariati Hospital in Tehran in 2000 [7] and 10% in 2001 in nonimmune fertile women in Urmieh [8]). Our study therefore shows a lower rate than previous studies in our country.

In 1986 in Taiwan all 15-year-old high-school girls were vaccinated and in another programme in 1992 fertile-aged females were given rubella vaccination [9]. In the year 2000 a serologic study on 15–44-year-old women showed that 5.7% of nonimmune women were from this age group [9].

Our sensitivity rate of fertile women was much lower than in other developing countries such as Jamaica and Panama, 43% and 38% respectively [2]. However, our rate is slightly higher than in some Gulf countries which, like the Islamic Republic

of Iran, are included in the Eastern Mediterranean Region of WHO (Yemen 4%, Oman 8%) [*10*]. In our study the rate of immunity clearly increased in women aged > 25 years, especially those 31+ years ($P < 0.02$), with no relationship to history of vaccination. Similar to our study, a 6-year retrospective study of fertile-age women in Senegal showed that 90.1% were immune and there was no significant statistical difference with regard to age group or socioeconomic status [*11*].

Complementary studies, especially concerning the frequency of CRS in the Islamic Republic of Iran, may be required in the future in order to determine the rate of risk of developing CRS in the country, so that better decisions can be made about mass vaccination against rubella.

Acknowledgements

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