Prevalence of rubella antibodies among schoolgirls in Sana'a, Republic of Yemen

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معدل انتشار أعداد الحصبة الألمانية بين طالبات المدارس في صنعاء، بالجمهورية اليمنية

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الخلاصة: لتقدير معدل انتشار أضداد الحصبة الألمانية وتقدير عمر التعرُّض لها بين طالبات المدارس في اليمن، تمت دراسة عينات المصل المأخوذة من 323 طالبة (من عمر 11 إلى 21 عاماً؛ بعمر متوسطُه 16.26 ± 1.89 عاماً) من ثلاث مدارس في صنعاء. وتم تحرّي أضداد الغلوبولين المناعي من نوع الأيج – ج IgG للحصبة الألمانية باستخدام مقايسة الممتز المناعي المرتبط بالإنزيم. وفي حالة سلبية النتائج يتم تحرّي الغلوبولين المناعي من نوع الأيج – م IgM بغرض استبعاد احتمال حدوث تعرُّض حديث. وبيَّن التحرّي أن 296 طالبة من جملة الطالبات البالغ عددهن 323 (أي بنسبة 91.64%) كن إيجابيات للغلوبولين المناعي من نوع الأيج – ج IgG للحصبة الألمانية. كما بيَّن أن جميع الأمصال السلبية للغلوبولين المناعي من نوع الأيج – ج IgG كانت أيضاً سلبية للغلوبولين المناعي من نوع الأيج – م. وقد لوحظ معدل انتشار متقارب للأضداد في جميع الفئات العمرية. وتدل النتائج على ارتفاع معدل انتشار الغلوبولين المناعي من نوع الأيج – ج للحصبة الألمانية بين طالبات المدارس في اليمن، ولاسيَّما في الفئة العمرية 11–21 عاماً. وبالرغم من أن عمر التعرُّض قد يكون 13 عاماً أو أقل، إلا أن تأكيد هذا الافتراض يستلزم مزيداً من البحث.

ABSTRACT To determine the prevalence of rubella antibodies and age of exposure to rubella among Yemeni schoolgirls, we studied the sera samples of 323 female students (age range 11–21 years; mean age 16.26 ± 1.89 years) drawn from three schools in Sana'a. All samples were screened for rubella IgG antibodies using enzyme linked immunosorbent assay and, if negative, for IgM in order to exclude the possibility of recent exposure. Of 323 sera. 296 (91.64%) were positive for rubella IgG. All IgG negative sera were also IgM negative. Comparable antibody prevalence was observed in all age groups. The prevalence of rubella IgG among Yemeni schoolgirls is high, with most becoming immune between the ages of 11 and 21 years. Although the age of exposure seems to be ≤ 13 years, further investigation is needed to confirm this.

Prévalence des anticorps de la rubéole chez des élèves à Sanaa (République du Yémen)
RESUME Afin de déterminer la prévalence des anticorps de la rubéole et l'âge de l'exposition à la rubéole chez des élèves yéménites de sexe féminin, nous avons étudié les échantillons de sérum de 323 élèves (âge compris entre 11 et 21 ans ; âge moyen 16,26 ± 1,89 ans) prélevés dans trois écoles à Sanaa. Tous les échantillons ont été examinés à la recherche d'anticorps IgG anti-rubéole à l'aide du titrage immuno-enzy-matique et, si négatif, à la recherche d'IgM afin d'exclure la possibilité d'une exposition récente. Sur 323 sérums, 296 (91,64 %) étaient positifs pour les IgG de la rubéole. Tous les sérums négatifs pour les IgG étaient également négatifs pour les IgM. Une prévalence des anticorps comparable a été observée dans tous les groupes d'âge. La prévalence des IgG de la rubéole chez les élèves yéménites de sexe féminin est élevée, avec une immunité acquise entre l'âge de 11 et 21 ans pour la plupart d'entre elles. Bien que l'âge de l'exposition semble être inférieur ou égal à 13 ans, d'autres études sont nécessaires pour confirmer ce point.

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Introduction

Rubella is a mild illness caused by a non-arthropod-borne member of the family *Togaviridae*. At least half of all primary rubella infections go undiagnosed because of the subclinical nature of the infection [1]. However, the disease poses a particular threat to the developing fetus if contracted during early pregnancy. *In utero* infection of the fetus may result in congenital deformity or other consequences of congenital rubella syndrome [1,2]. It is, therefore, essential that girls develop immunity to rubella by the time they reach childbearing age to prevent such an outcome.

Rubella epidemics are, or have been, a worldwide phenomenon. Before the introduction of a vaccine in countries such as Australia, the United States of America, the United Kingdom and European countries, rubella epidemics occurred in cycles of 6–9-year intervals [3]. In the USA, before the introduction of the vaccine, a single epidemic resulted in 20 000 infants being born with permanent damage due to intrauterine infection with the rubella virus [4].

Elsewhere, while the immune status of many populations regarding rubella is less clear, some data have been reported. In Saudi Arabia, the antibody prevalence among girls aged 5–25 years has been reported to be 92% [5]. In some African countries, 80% of children have been found to be positive for rubella antibodies by the age of 10 years [6]. Post-epidemic rubella antibody prevalence in Ghana has been found to be 92.6% among pregnant women, with susceptibility associated with a younger age [7]. In Eritrea, the prevalence of antibodies to rubella has been reported to be as high as 99% in some female populations [8]. In Nigeria, rubella antibody prevalence in women of childbearing age has been reported to be 77% [9].

Some of these studies have reported an early age of exposure to rubella [6,7]. In equatorial countries, the highest seroprevalence has been seen in age groups as young as 5–9 years, and in preschool children [10,11]. In India, however, children between 1 and 5 years showed the lowest seropositivity (69.2%) [12]. Lower rates of rubella seropositivity have been found among Nigerian students compared with pregnant women, the explanation given for this being an association between high socioeconomic status and lower seropositivity [13].

In the Republic of Yemen, the epidemiology of rubella remains to be fully elucidated. Rubella vaccination is not part of the Expanded Programme of Immunization nor is the vaccine available in private clinics or hospitals; therefore, immunization through the private sector is non-existent. In this study, we explored the immune status and the likely age of exposure to rubella among schoolgirls in the national capital, Sana'a.

Methods

We enrolled 323 schoolgirls in the study (age range 11–21 years; mean age 16.26 + 1.89 years), from three schools serving major populated areas in three different geographical locations in Sana'a. Age and previous country of residence were documented and all girls who reported previous residence in another country were excluded because of the possibility of a history of immunization. Venous blood was collected and sera were separated and frozen at –20 °C until tested.

Enzyme-linked immunosorbent assay (ELISA, Denka Seiken® Company Limited, Japan) was used to screen for rubella IgG and IgM antibodies. Test procedures were performed according to the manufactur-

er's instructions. All samples were initially screened for rubella IgG. Those testing negative were further tested for rubella IgM to exclude the possibility of recent rubella exposure.

Data were analysed using *SPSS*, version 10.05 to calculate mean, standard deviation and chi-squared values. A value of $P < 0.05$ was considered significant.

Results

Of 323 sera, 296 (91.64%) were rubella IgG positive. The 27 samples that were negative for IgG, were also IgM negative. Only 27 girls (8.36%) therefore had no rubella antibodies. Comparable antibody prevalence was observed in almost all age groups (chi-squared likelihood ratio = 7.32, $P = 0.29$). The prevalence of antibodies in various age groups is shown in Table 1.

Discussion

Despite the fact that vaccination against rubella is not part of the Expanded Programme of Immunization in the Republic of Yemen, our data showed that 91.64% of girls aged 11–21 years had antibodies to rubella virus, suggesting previous exposure. Antibody prevalence ranged between 80.00% and 96.87% for the different age groups. The relatively low prevalence in the youngest group (11–13 years) may indicate an age association. Such an association might have been more clearly shown had children aged < 11 years been included in the study. A possible age association could be verified by a future study involving girls aged 5–12 years.

Our findings accord with the pattern of rubella antibody prevalence reported in Saudi Arabia, where a rubella immunization programme was initially implemented 12

Table 1 Rubella IgG antibodies among various age groups of 323 schoolgirls in Sana'a, Republic of Yemen

Age (years)	No.	Rubella IgG positive cases	
		No.	%
11–13	30	24	80.00
14	36	33	91.66
15	35	31	88.57
16	66	63	95.45
17	73	67	91.78
18	51	47	92.16
19–21	32	31	96.87

Chi-squared likelihood ratio = 7.32, P = 0.29.

years ago. A recent study from Saudi Arabia has reported antibody prevalence among girls aged 5–25 years to be 92% [5]. A similarly high antibody prevalence has been reported in a number of European countries where vaccination programmes against rubella exist. In Italy, an antibody prevalence of 93.3% among girls aged 16–20 years has been reported [14] and in Spain, 81.8% of girls aged 15–19 years were reported to have rubella antibody [15]. However, high antibody prevalence has also been reported in countries where rubella vaccination is non-existent, such as Ghana and Eritrea [7,8].

The prevalence of rubella IgG among Yemeni schoolgirls is high, indicating that the majority of girls become naturally immune by age 11–21 years. The antibody prevalence for the various ages within our sample was comparable. We conclude, however, that a comprehensive seroepidemiological study involving all age and socioeconomic groups in the Republic of Yemen should be a prerequisite to the planning of any future vaccination programme against rubella in the country.

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