SEROPREVALENCE OF RUBELLA ANTIBODIES AMONG ADULT EGYPTIAN FEMALES AGED 20–30 YEARS. IS THERE A NEED FOR RUBELLA VACCINATION?

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SUMMARY

Introduction: Egypt adopted a comprehensive strategy to eliminate measles and rubella by conducting a catch up campaign (in 2008) targeting children and young adults in the age group 10–19 years. This study aimed to explore the seroprevalence of rubella among females aged 20 to 30 years in order to provide the Ministry of Health with information to develop future strategies for rubella supplemental immunization activities among women of childbearing age before marriage and conception.

Methods: A total of 339 females in the age group 20 to 30 were selected. The study group comprised women who attended the central laboratory of the Ministry of Health for checking up before travelling abroad as pre-travel requirements for visa application. The collected serum samples were tested for rubella-specific IgG antibodies.

Results: The overall prevalence of rubella antibodies in the study group was 88.2%. Around 5.0% of females, who reported that they had been vaccinated, were susceptible to rubella. Age, history of measles, mumps and rubella (MMR) vaccination and past history of rubella infection were considered factors associated with seropositivity for rubella.

Conclusion: The seroprevalence rate of rubella antibodies among our female study group was considered low.

Key words: seroprevalence, rubella, rubella campaigns, rubella vaccine

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INTRODUCTION

Rubella, also called German measles, is a mild febrile rash illness in children and adults; however, women infection early in pregnancy, particularly during the first trimester can severely affect the foetus resulting in miscarriage, foetal death, or an infant born with a combination of disabling conditions collectively called congenital rubella syndrome (CRS), which includes heart disease, blindness and deafness (1).

WHO reports reveal that a minimum of 100,000 cases of CRS occur annually worldwide, which makes rubella a leading cause of preventable congenital defects. The CRS burden is highest in South East Asia (approximately 48%) and African regions (approximately 38%) (2, 3).

Safe and effective rubella vaccines have been available since 1969. However, until the 1990s, developed countries primarily used rubella vaccines, because the disease burden caused by rubella virus had not been documented sufficiently in the developing world, and because of the additional cost of the rubella vaccine component when combined with Measles and Rubella (MR) or Measles, Mumps and Rubella (MMR) vaccine and concern that the risk for CRS might increase if high vaccination coverage could not be achieved and maintained. Low coverage might result in increased virus circulation, which could increase the average age of rubella infection for females from childhood to the childbearing years (4). Rubella vaccine was introduced into the Egyptian routine programme in 1999 in the form of MMR administered at the 18 months of age (5). Measles has long been a recognized public health problem in Egypt, but the burden of rubella and CRS has been underappreciated until recently. In 2002, Egypt established a goal to eliminate measles and rubella and to prevent CRS by 2010. Large-scale rubella and measles outbreaks in 2005–2007, however, made it difficult for Egypt to achieve the 2010 goals, and accordingly the Egyptian Ministry of Health (MOH) adopted a comprehensive strategy to eliminate rubella and measles and to rapidly prevent their transmission in Egypt by conducting a national catch up immunization campaign in 2008–2009 targeting 36 million children, adolescents and young adults from 2 to 19 years. Subsequently the number of the confirmed cases of measles and rubella in 2009 and 2010 were the lowest ever reported (5). Catch up campaigns have been previously and successfully implemented in different countries. In Iran, the targeted population for catch up campaign for measles and rubella was between the age group of 5–25 years old (6), while in Costa Rica the targeted group was 15–39 years (7). In Brazil, the rubella vaccination campaign targeted 12–30 years old girls and women (8).

Females ≥ 20 years old were not included in the national catch up immunization campaign in 2008–2009 and they are women

in child bearing period who were born before 1999 (i.e. before introducing the MMR vaccine in the compulsory list of vaccination of infants in Egypt) and did not get the compulsory vaccine.

The hypothesis of this study is that females aged 20 to 30 years who were born before 1999 are not fully immune against rubella. The rational of this study is to explore the seropositive status of rubella antibodies among females aged 20 to 30 years. The results of the study might add more information about the current status of the immunity level of those adult females which will support MOH to take decision about including them in the coming catch up campaigns against measles and rubella.

We aimed to assess the immunity status for rubella among females aged 20 to 30 years and its relation to residence, marital status, educational grade, past history of vaccination against rubella and past history of rubella infection.

MATERIALS AND METHODS

This cross-sectional study involved 339 female adults in the age group 20 to 30 years.

Sample Size Calculation

The sample size was calculated using Epi Info software StatCalc. The assumption was that the seroprevalence of rubella was 90% ± 3 with a confidence interval 95%, study power of 80% and 10% addition for any losses in the collected sera. This yields a sample of 355 females. Out of 355 females approached to participate in the study only 339 agreed with a response rate of 95.5%. The estimate of seroprevalence was based upon previous studies among similar age group in Egypt.

Selection of Subjects and Study Site

The field study was conducted over a period of 6 months from May 2010 to October 2010. The study group comprised females who attended the MOH central laboratory for checking up (for Viral markers) before travelling abroad as a prerequisite for visa application for some Gulf countries. Inclusion criteria included all female attendees in the age between 20 and 30 years and signed consent. There were no exclusion criteria except for women refusing to participate. The daily flow to the central laboratory was erratic and there was no accurate sampling frame of the total lab attendees. Thus selection of sample using random sample technique was impractical and a consequence convenient sample was applied instead.

Written approvals from MOH and central laboratory authority were obtained. The research proposal was approved from the Faculty of Medicine Ethical Committee. Serum samples were collected and each participant then filled a data collection sheet. Data collection sheet includes socio-demographic characteristics of the persons and past history of rubella and history of MMR vaccination. The collected serum samples were tested for rubella-specific IgG antibodies. The used kit is a quantitative enzyme-linked immunosorbent assay (ELISA) for the detection of specific IgG antibodies to rubella virus in human serum and the dilution is 1:81. The concentration of IgG anti-rubella in the unknown samples was determined using the standard curves. Serum sample with IgG anti-rubella concentration > 15 IU/mL was considered positive.

Statistical Analysis

The data were entered, verified and analyzed using SPSS version 13. Chi-square test was used to compare different groups. Fisher exact test was used for 2 by 2 tables in case that expected cell value was less than 5. Seroprevalence ratios with 95% confidence intervals (CI) were calculated for all risk factors. Adjustment for confounding was assessed using binary logistic regression model. The adjusted odds ratios with 95% CI were calculated. The level of significance was set at 0.05.

RESULTS

The study group consisted of 339 females. The overall prevalence of rubella antibodies in the study group was 88.2% (95% CI 84.8%–91.6%) as seen in Table 1. The prevalence was 83.9% among women aged 20–25 years and 93.9% among those aged 25–30 years.

As shown in Table 2, educational level, marital status and residence were not significantly associated to the prevalence of rubella antibodies. Forty seven out of 339 reported positive history of rubella infection and the majority of them (97.9%) were immune (positive for rubella antibodies). The results showed that 86.6% of those reporting no history of rubella were positive for rubella antibody. The difference between the two groups were statistically significant (p = 0.027).

Eighty one persons mentioned that they had been vaccinated yet four persons out of them (4.9%) were still susceptible to rubella (Table 2). The percentage of positive rubella antibodies among vaccinated (95.1%) was significantly higher than the corresponding percentage among non-vaccinated (86.0%).

Using binary logistic regression model, the factors associated with susceptibility of females to rubella were age less than 26 years, no history of vaccination against rubella and no history of exposure to rubella infection. The adjusted odds ratios and 95% confidence interval were 10.07 (1.33–75.98) and 3.786 (1.29–11.11) for no history of rubella infection and no history of vaccination against rubella, respectively. The adjusted odds ratio for females aged 20–25 years was 3.40 (1.54–7.48).

DISCUSSION

The incidence of CRS has been decreasing worldwide due to increasing coverage of rubella vaccination, but it remains a threatening and costly disease in regions where pregnant women were not immunized and have low levels of IgG against rubella virus (< 10 IU/ml) (9).

Table 1. *The prevalence of Rubella Antibodies (RA) among Egyptian adults according to the age groups and sex*

Age groups (years)	Positive RA		Total (N)
	Frequency (%)	95% CI	
20–25	161 (83.9)	78.7–89.1	192
26–30	138 (93.9)	90.0–97.8	147
Total	299 (88.2)	84.8–91.6	339

X^2 test = 8.037 , p = 0.005

Table 2. *Distribution of rubella antibodies according to marital status, residence, educational degree, past history of rubella infection and past history of MMR vaccination*

		Rubella antibodies		X^2 test (p value)
		Positive (%)	95% CI	
Marital status	Married (n = 246)	218 (88.6)	84.6–92.6	0.150 (p = 0.698)
	Single (n = 93)	81 (87.1)	80.3–93.9	
Residence	Urban (n = 149)	127 (85.2)	79.5–90.9	2.247 (p = 0.134)
	Rural (n = 190)	172 (90.5)	86.3–94.7	
Education	University grade (n = 98)	86 (87.8)	81.3–94.3	0.026 (p = 0.871)
	Primary to secondary school (n = 241)	213 (88.4)	84.4–92.4	
History of rubella infection	Yes (n = 47)	46 (97.9)	93.8–100.0	p = 0.026#
	No or don't know (n = 292)	253 (86.6)	82.7–90.5	
History of rubella vaccination	Yes (n = 81)	77 (95.1)	90.4–99.8	4.814 (p = 0.028)
	No (n = 258)	222 (86.0)	81.8–90.2	

using Fisher's exact test

Table 3. *Variables associated with susceptibility to rubella using binary logistic regression model*

Risk variables	Adjusted odds ratio	95% CI	p value
Age group 20–25 years	3.40	1.54–7.48	0.002
No past history of rubella infection	10.07	1.33–75.98	0.025
No past history of rubella vaccination	3.78	1.29–11.11	0.016

Current information about the immunity status of women in childbearing age against rubella is lacking in our country, however, we found two Egyptian studies assessing rubella seroprevalence among women of childbearing age (10, 11). The precise prevalence of CRS in Egypt has not been reliably estimated but there is a plan to start CRS surveillance system in Egypt. To contribute towards monitoring of rubella elimination, the present study was designed to assess rubella seroprevalence among susceptible women of childbearing age 20–30 years who were not included in the catch up immunization campaign in 2008–2009 and may give birth to infants with CRS.

The seroprevalence rate of rubella antibodies among our female study group was 88.2% (84.8–91.6%), and this means that about 12% of them were susceptible to rubella. This positive seroprevelance rate is considered low when compared with rates in other countries. In France, the rate of seroprevalence of rubella antibodies among French women aged between 19–31 years joining French army was 93.3% and accordingly they recommended a preventive campaign to all non-immune women in the childbearing period (12). In Argentina, the seroprevalence of rubella antibodies was 92.2% and 91.2% among women in the age group of 20–24 years and 25–29 years, respectively (13). In several studies conducted in Turkey among pregnant and non pregnant women in childbearing age, rubella seropositivity ranged from 93.8% to 100%, suggestive of natural virus circulation within the community (14–16).

In a cross sectional population-based seroprevalence of rubella antibodies in Italy, the overall proportion of rubella seroprevalence was 81.2% (17). In Taiwan, a study conducted among women in the childbearing period, the results revealed also high seroprevalence rate of 94.3% but the authors concluded that there were a substantial proportion of childbearing-age women still susceptible who need booster vaccination (18). In Japan, the seroprevalence of rubella was 92.2% among female healthcare workers (19).

In African countries, the seroprevalence of rubella antibodies in South Africa was 95.3% among women in the 15–24 year age group and 97.5% in the 25–34 year group (20) while in Nigeria, 68.5% of pregnant women were rubella seropositive (21). In Kenya, the seroprevalence of rubella antibodies was 92.9% among women in the age group 20–24 years and 93.4% in the age group 25–29 years (22).

In Arab countries, a multistage cluster sampling was conducted in Jordan and the overall immunity rate to rubella among women in childbearing age was 90.9% (CI: 88.8–92.9) (23). A study from Jeddah, Saudi Arabia showed high rubella seropositivity (92.2%) among females aged 20≤25 (24). In another study from Morocco, about 17.8% and 15.6% of females in the age group of 20–24 years and 25–29 years, respectively, were susceptible to rubella based on the absence of IgG antibodies (25). In Algeria, high percentage of women in childbearing age (31.4%) were not immune to rubella (26).

In Egypt, a research was done to determine the level of rubella virus antibodies in females in the childbearing age (from 15–40 years). It was found that the percentage of antibody positive sera was 92.2%. Most susceptible females were reported in the age group of 20–25 years (10). Another study from Egypt to determine the rubella sero-susceptibility among Egyptian females in late childhood and childbearing period (6–45 years old) revealed that the proportion of seropositive females was 90.3%, with the highest proportion of susceptible females among those aged 6–25 years (11). The prevalence in these 2 studies is slightly higher than ours but the difference may be due to the difference in the age groups examined in our study, the age groups targeted were women 20–25 years old. Their results support our findings that the seroprevalence rate is not high among females in the age group of 20–25 years and there is a substantial proportion of females with increased susceptibility to rubella infection which in turn may increase the occurrence of CRS.

In the current study, susceptibility rate decreased with increasing age which may be attributed to acquired immunity by previous natural infection specially among female population who experienced no routine or compulsory vaccination programme against rubella during their childhood period. Our finding was consistent with the results of other studies from Italy, Kenya, Poland, England, and Canada (17, 22, 27–29) but in contrast to other study from Turkey reporting lack of association between these two variables (15).

In addition to age, other risk factors associated with seropositivity of rubella antibodies as marital status, educational level, place of residence, past history of rubella infection and vaccination history were investigated. Our findings showed that marital status was insignificant predictor of rubella seropositivity. Some studies were in agreement with our finding (18, 22), while other studies were contrary to our results (17, 30).

The results of this study revealed that educational level was insignificant risk factor, a finding consistent with the results of other studies (13, 17, 22) while Wang et al. in Taiwan reported that low educational level was associated significantly with seronegativity to rubella (30).

The current study showed that there was insignificant difference between the proportion of seropositivity in urban and rural areas indicating that virus circulation is similar in urban and rural zones and that the women of both areas are at similar risk of infection to rubella virus. Most of studies were in agreement to our finding (15, 23–25).

The majority of females in this study affirmed they did not get rubella infection or they did not remember having had rubella although about 87% of them were seropositive for rubella antibodies. This reflects the fact that most of rubella cases are mild or not clinically recognized.

In this study, all participating females were born before 1999. This is the year of introducing the routine vaccination of children with MMR. Therefore, only 81 female participants reported having received rubella vaccination although 4.9% of them tested negative for rubella antibodies which could be attributed to waning of immunity.

It should be highlighted that both past history of rubella infection and vaccination history are significantly associated with seropositivity of rubella even after adjustment for other confounding risk factors.

Limitations of the Study

This study is not a community based study. The subjects of this study were selected by a convenient sample technique which may limit generalization of the results although the study participants came from different geographical areas from all over Egypt.

CONCLUSION

The authors concluded that a substantial risk of rubella infection exits among Egyptian women of childbearing age and supported the presence of virus circulation all over Egypt. The need to ensure the protection of seronegative susceptible women of childbearing age by immunization before marriage or pregnancy is emphasized. We recommend including females aged 20 to 30 years to the next regular catch up immunization campaigns for measles and rubella and to offer vaccination to all susceptible women of childbearing age.

Conflict of Interests

None declared

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