

Seroprevalence of mumps, varicella and rubella antibodies in children 1-16 years of age in eastern Turkey

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SUMMARY: Gürgöze MK, Yılmaz E, Gödekmerdan A, Akça Z, Doğan Y, Akarsu S, Aygün AD. Seroprevalence of mumps, varicella and rubella antibodies in children 1-16 years of age in eastern Turkey. Turk J Pediatr 2006; 48: 185-188.

In this study, seroprevalence of mumps, varicella and rubella was investigated in 803 unvaccinated children in eastern Turkey whose ages ranged between 1 and 16 years. Mumps IgG, varicella IgG and rubella IgG antibody levels in all children were studied by enzyme-linked immunosorbent assay (ELISA) method. Information regarding socioeconomic characteristics, number of siblings and disease history was gathered for each participant. No significant difference in seropositivity was detected between girls and boys. Seroprevalence of mumps increased with age, with a seropositivity rate of 29.9% in children aged 1-4 years and of 88.8% in those aged 13-16 years. Seroprevalence of varicella increased with age, with a seropositivity rate of 26.8% in children aged 1-4 years and of 90.3% in those aged 13-16 years. Seroprevalence of rubella also increased with age, with a seropositivity rate of 47.3% in the children aged 1-4 years and of 89.2% in those aged 13-16 years. There was a statistically significant increase in the rate of seropositivity with advancing age through the group of 13-16 years old ($p < 0.05$). In conclusion, in order to avoid mumps, varicella and rubella diseases and their possible complications, children should be vaccinated against these three diseases before the age of two, since seroprevalence increases with age.

Key words: seroprevalence, mumps, varicella, rubella.

In order to develop vaccination protocols and take appropriate preventive health care measures against viral childhood infectious diseases in different regions, it is very important to know the seroprevalence of any disease for individual countries. The seroprevalence of mumps, varicella and rubella in our region has not been thoroughly investigated.

Mumps is an acute, communicable, infectious disease caused by paramyxovirus and is seen commonly in childhood^{1,2}. Those who have the disease acquire life-long immunity. Although asymptomatic in 30-40% of infected individuals, it has a severe course in these patients and can even lead to death²⁻⁴.

Chicken pox is an infectious disease caused by varicella zoster virus (VZV). Ninety percent of all cases in the United States occur in children under the age of 15 versus 88% of all cases

in Turkey. The incidence of disease is similar in both sexes and among different races. Virus from an infected person contaminates a healthy individual via contact with fluids, skin lesions or droplets through the respiratory system. In general, life-long immunity develops following infection with chicken pox⁵⁻⁷.

Rubella is a benign infectious disease generally seen in childhood and characterized by fever, loss of appetite, lymphadenopathy and maculopapular rash^{8,9}. It is known that the disease can develop in later stages of life and that rubella in pregnancy can cause a clinical picture known as "congenital rubella syndrome". It is reported that congenital rubella incidence in a society varies according to the number of seronegative persons, virus circulation and the rate of rubella vaccination in that particular period in the society^{9,10}.

The present study was aimed at determining the seroprevalence of mumps, varicella and rubella in children 1-16 years of age in eastern Turkey and at emphasizing the need to expand vaccination in order to prevent incidence and complications of mumps, varicella and rubella diseases.

Material and Methods

The study included 843 children between 1 and 16 years of age living in our region. After parental consent was taken, it was inquired whether or not the children had mumps, varicella and rubella vaccination. Those who had been vaccinated against mumps, varicella and rubella were not included in the study. The study was conducted with students from kindergartens, primary schools and high schools in the urban area, and was carried out between September and December 2003. Number of siblings and socio-economic status of the children were recorded for each child. Socioeconomic status was evaluated as poor (minimum wage: \$250- 500), middle (\$500-1000) and good (≥\$1000) depending on the monthly family income.

Blood (3 ml) was collected from each child in the study. Sera were separated from blood duly and stored at -30°C until serological analysis. Mumps IgG, varicella IgG and rubella IgG antibodies were analyzed using Captia mumps IgG, varicella IgG and rubella IgG kit (Biotech, Trinity, USA) according to ELISA (enzyme-linked immunosorbent assay) method. In order to determine mumps, varicella and rubella IgG antibodies, results were calculated as indicated by the prospectus. Accordingly,

results below 0.90 were considered negative and those above 1.10 were considered positive. Values between 0.91 and 1.09 were analyzed again. Forty children had a value between 0.91 and 1.09, which were accepted as indeterminate results. These children were excluded from the study.

Statistical analysis was carried out with SPSS 10.0 for Windows. Chi-square (χ^2) test was used for the statistical evaluation of the results obtained in the study.

Results

The study included 803 cases 1-16 years of age, with an average of 50 children from each age group (range 46-62). Of these 803 children, 444 (55.3%) were boys and 359 (44.7%) were girls, and there was no statistical difference between them ($p>0.05$). There was no statistically significant difference between the children in terms of seropositivity for mumps, rubella and varicella (71.1%, 69% and 72.7%, respectively, $p>0.05$) (Table I). Mumps, varicella and rubella seropositivity increased with age, and this increase was statistically significant ($p<0.05$) (Fig. 1). Particularly,

Table I. Seropositivity in Mumps, Varicella and Rubella

	Seropositive		Seronegative		Total	
	n	%	n	%	n	%
Mumps	571	71.1*	232	28.9	803	100
Varicella	554	69.0	249	31.0	803	100
Rubella	584	72.7	219	27.3	803	100

* Column percentage, $p>0.05$

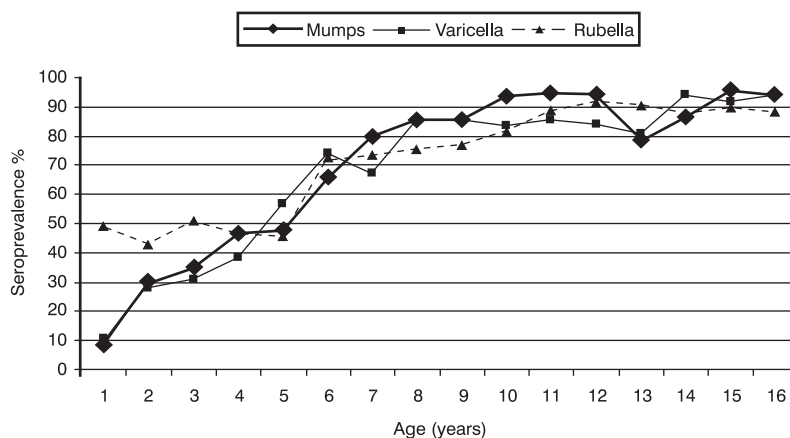


Fig. 1. Seroprevalence of antibody to mumps, varicella and rubella.

the rate of having all three diseases increased with age, and this increase was statistically significant until six years of age, but not thereafter. When age groups were considered, it was seen that mumps seropositivity was 29.9% at 1-4 years, 69.8% at 5-8 years, 92.9% at 9-12 years and 88.8% at 13-16 years. Varicella seropositivity according to age groups was 26.8% at 1-4 years, 70.9% at 5-8 years, 84.6% at 9-12 years and 90.3% at 13-16 years. Rubella seropositivity according to age groups was 47.3% at 1-4 years, 66.8% at 5-8 years, 84.9% at 9-12 years and 89.2% at 13-16 years. When seroprevalence of all three diseases was evaluated in relation to socio-economic status, it was found that mumps and rubella incidence increased as socioeconomic status declined, and this increase was statistically significant. Varicella seroprevalence also increased as socio-economic status worsened, but this increase was not statistically significant (Table II). It was established that as the number of siblings increased, the seroprevalence of all three diseases rose, and the increase was statistically significant (Table III).

Discussion

Mumps, varicella and rubella are childhood diseases that can be either symptomatic or asymptomatic. Risk of having the diseases and of being exposed to the virus increases with advancing age. Results of the study showed

that seropositivity rates increased both among age groups and cumulatively with age, and this increase was statistically significant ($p < 0.05$). When all age groups were considered together, there was a similarity between the seroprevalence of mumps, varicella and rubella (71.1%, 69% and 72.7%, respectively, $p > 0.05$).

In the previous studies, Glikmann et al.¹¹ found that mumps seropositivity in unvaccinated children was 90%. In a seroprevalence study including children between 1 and 15 years of age, Koç et al.¹² found 63.4% seropositivity for mumps. These results are similar to the mumps seroprevalence value we obtained in this study (71.1%). When seroprevalence was considered according to age groups, it was seen that seropositivity increased with age, which is also consistent with the previous studies^{12,13}. In a study covering unvaccinated children who immigrated to the United States, varicella seropositivity was found as 64%¹⁴. Kanra et al.⁵, in a study carried out in nine different cities of Turkey, established that seropositivity increased with age. But they also found that seropositivity changed according to regions. They saw that the western part of Turkey had the lowest (69.7%, Edirne) and the eastern part the highest seropositivity (83.6%, Diyarbakır). The varicella seroprevalence results we obtained resembled those in the western part of Turkey since socio-economic conditions and demographical movements of our region are similar to those

Table II. Distribution of Mumps, Varicella and Rubella Seroprevalence According to Socio-Economic Status

Seropositivity	good		middle		poor		p*
	n	%	n	%	n	%	
Mumps	136	23.8	181	31.7	254	44.5	<0.05
Rubella	133	22.8	187	32.0	264	45.2	<0.05
Varicella	136	24.5	184	33.2	234	42.3	>0.05

*Line percentage, middle-poor; p value.

Table III. Distribution of Mumps, Varicella and Rubella Seroprevalence According to Number of Siblings

Seropositivity	Number of siblings							
	0		1		2		≥3	
	n	%	n	%	n	%	n	%
Mumps	22	3.9	161	28.2	161	28.2	227	39.8
Varicella	24	4.3	151	27.3	157	28.3	222	40.1
Rubella	26	4.5	160	27.4	168	28.8	230	39.4

of western Turkey. As in mumps and varicella, rubella seroprevalence also increased with age. Previous studies also established that there was an increase in rubella seroprevalence with advancing age¹⁵⁻¹⁸. In a previous study, rubella seropositivity in unvaccinated children was found as 89.7% in Turkey¹⁹.

It has also been reported previously that mumps, varicella and rubella seroprevalence increased as the number of siblings increased^{12,20}. The relation between number of siblings and seropositivity was statistically significant in our study as well ($p < 0.05$). This finding is important, since it shows transmission of the disease among family members.

In addition to regional differences and age, seroprevalence also varied according to socio-economic status. Even though there are studies demonstrating that seroprevalence increased with improved socio-economic status, there are also studies reporting no relation between the two^{21,22}. In the present study, seropositivity for mumps and rubella increased as socio-economic status worsened, but there was no statistically significant relation between varicella seropositivity and socio-economic status. This finding was attributed to the higher transmission of varicella.

In conclusion, in order to avoid mumps, varicella and rubella diseases and their possible complications, children should be vaccinated against these three diseases before the age of two, since seroprevalence increases with age. As indicated in the license of the vaccines, we suggest that varicella should be administered at the 12th month, and rubella and mumps vaccines between the 12th–15th months. We believe it is feasible in terms of protection to vaccinate children over six years of age, after which time seroprevalence increases, and after determination of serum seropositivity, since the diseases can have an asymptomatic course in some.

REFERENCES

- Krugman S, Katz SL, Gerson AA, Wilfert CM. *Krugman's Infectious Diseases of Children* (10th ed). Philadelphia: Mosby Year Book Inc; 1998: 280-289.
- Baum SG, Litman N. Mumps virus. In: Mandel GL, Douglas RG, Bennett JE (eds). *Principles and Practice of Infectious Diseases*. New York: Churchill Livingstone; 1990: 1260-1265.
- Haltway WE, Groothuis JR, Hay WW, Paisley JW. *Current Pediatric Diagnosis and Treatment*. Lebanon: Appleton and Lange; 1991: 818-819.
- Nussinovitch M, Volovitz B, Varsona I. Complications of mumps requiring hospitalization in children. *Eur J Pediatr* 1995; 154: 732-734.
- Kanra G, Tezcan S, Badur S, Turkish National Study Team. Varicella seroprevalence in a random sample of the Turkish population. *Vaccine* 2002; 31: 1425-1428.
- Weller TH. Varicella-herpes zoster. In: Evans AS (ed). *Viral Infection of Humans. Epidemiology and Control* (3rd ed). London: Plenum Medical Book; 1991: 337-346.
- Benenson SA. *Control of communicable diseases in man* (15th ed). Washington DC: APHA publication; 1990: 83-86.
- Edwards MS, Baker JC. Rubella (German measles). In: Katz SL, Gershon AA, Hotez PJ (eds). *Infectious Diseases of Children* (10th ed). St. Louis: Mosby; 1998: 403-441.
- Gershon AA. Rubella virus (German measles). In: Mandell GL, Bennett JE, Dolin R (eds). *Principles and Practice of Infectious Diseases* (4th ed). New York: Churchill Livingstone; 1995: 1459-1465.
- Maldona Y. Rubella. In: Behrman RE, Kliegman RM, Arvin AM (eds). *Textbook of Pediatrics* (15th ed). Philadelphia: WB Saunders; 1996: 871-873.
- Glikmann G, Petersen I, Mordhorst CH. Prevalence of IgG-antibodies to mumps and measles virus in non-vaccinated children. *Dan Med Bull* 1988; 35: 185-187.
- Koç H, Ataş E, Baykan M, et al. Konya'da 1-15 yaş grubu çocuklarda kabakulak seroprevalansı. *Çocuk Sağlığı ve Hastalıkları Dergisi* 1999; 42: 357-365.
- Condorelli F, Stivala A, Gallo R, et al. Use of a microquantity enzyme immunoassay in large-scale study of measles, mumps and rubella immunity in Italy. *Eur J Clin Microbiol Infect Dis* 1998; 17: 49-52.
- Barnett ED, Chritiansen D, Figueira M. Seroprevalence of measles, rubella, and varicella in refugees. *Clin Infect Dis* 2002; 35: 403-408.
- Dutta SR, Atrash HK, Mathew L, Mathew PP, Mahmood RA. Seroepidemiology of rubella in Bahrain. *Int J Epidemiol* 1985; 14: 618-623.
- Lin DB, Chen CJ. Seroepidemiology of rubella virus infection among female residents on the offshore islets of Taiwan. *J Trop Med Hyg* 1994; 97: 75-80.
- Bartoloni A, Bartalesi F, Roselli M, et al. Seroprevalence of varicella zoster and rubella antibodies among rural populations of the Chaco region, South-eastern Bolivia. *Trop Med Int Health* 2002; 7: 512-517.
- Causser J, Mira M, Karr M, et al. Serological survey of measles and rubella immunity in Sydney preschool children. *J Paediatr Child Health* 2000; 36: 418-421.
- Akşit S, Egemen A, Özacar T, et al. Rubella seroprevalence in an unvaccinated population in İzmir: recommendation for rubella vaccination in Turkey. *Pediatr Infect Dis J* 1999; 18: 577-580.
- Arroyo M, Alia JM, Mateos ML, Carrasco JL, Ballesteros F, Lardinois R. Natural immunity to measles, rubella and mumps among Spanish children in the pre-vaccination era. *Int J Epidemiol* 1986; 15: 95-100.
- Gutierrez Trujillo G, Munoz O, Tapia Conyer R, Bustamante Calvillo ME, Alvarez y Munoz MT. The seroepidemiology of rubella in Mexican women. A national probability survey. *Salud Publica MEX* 1990; 32: 623-631. Abstract-MEDLINE.
- Ceylan A, Çaksen H, Ceylan N, Arslan Ş, Öner AF, Kırımı E. Van yöresinde adolesan çağındaki kız çocuklarda kızamıkçık seroprevalansı. *Çocuk Sağlığı ve Hastalıkları Dergisi* 1999; 42: 351-356.