

Original Article

Seroprevalence of Measles, Mumps, and Rubella antibodies among Southwestern Libyan students.

Shahlol Aisha^{1*}, Al Mahde Gena¹, Shahlol Elham², Elzahaf Raga^{3,4}.

1: Department of Medical Laboratory Technology
Faculty of Engineering and Technology Sabha
University, Brack, Libya
2: Department of pediatrics, Sabha Hospital, Libya
3: Public Health Department, College of Medical
Technology, Derna, Libya
4: MENA Research Group
* Corresponding author
Correspondence to:
Ais.shahlol@sebha.edu.ly
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Abstract:**Background**

Measles, Mumps, and Rubella (MMR) are vaccine preventable viral diseases. They cause significant mortality and morbidity worldwide. The seroprevalence data on MMR in Libya is limited. The aim of our study was to assess the immune status and infection susceptibility of primary school children and university students for measles, mumps, and rubella in Libya through a seroprevalence survey.

Methods

A cross-sectional serosurvey of MMR was conducted in Brack city, Libya among students of at Al-Shoroug Primary School (ASP) and the Faculty of Engineering and Technology, Sabha University (FETS).

Results

A total of 76 participants were surveyed. The age range was 7-20 years old with a mean of 13.6 years. The overall mumps IgG seropositivity rate was 43.4%.

Measles and Mumps IgG levels among children are significantly higher than University students. A high rubella IgG seroprevalence was noticed in female university students.

Conclusion

The measles and Mumps IgG sharply decreased with time compared to rubella IgG. According to the Libyan program the first and second dose of the MMR vaccine is given at the age of 12 and 18 months, respectively. That may not be protective in adult age. A third regular dose could be recommended in the national vaccine program to prevent outbreaks in young adults.

Clinical relevance

These results can inform the development of future screening programs and contribute to the management of viral infections in schools and universities.

Key words

Measles, Mumps, Rubella, seroprevalence, seroprotection, immunoglobulin G, Libya

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Introduction

Measles, mumps, and rubella (MMR) are frequent viral infection that causes considerable morbidity and mortality despite the availability of the vaccine. Mumps may cause deafness, aseptic meningitis, and encephalitis in childhood. Rubella infection can be responsible for congenital rubella syndrome and complicated pregnancies.

MMR vaccination is recommended in Libya. A two-dose schedule is assigned at 12 and 18 months of age [1].

According to some international studies, levels of antibody against MMR decreased more rapidly after childhood immunization compared to other vaccines. Despite the high vaccination coverage, the incidence of the disease increased in older individuals [2].

Several neighboring countries implemented a mass nationwide vaccination campaign to prevent MMR outbreak and to reduce the infection sequels. Libyan data about MMR is limited. Increasing MMR incidence, the unclear background on adult MMR serological status, and the lack of the studies about immunization success are the most remarkable epidemiological aspects of MMR in Libya.

The aim of our serosurvey was to assess the immune status and the susceptibility to MMR among students from different age groups in southern Libya.

Patients and Methods

Study population

This cross-sectional serosurvey of MMR included 76 participants. The survey was conducted in the southwestern Libyan Brack city at Al-Shoroug Primary School (ASP) and the Faculty of Engineering and Technology, Sabha University (FETS). The ethical approval to conduct the study was granted from the Research Ethics Committees of Sabha University. All the participants had previously received only two doses of MMR vaccine. Eligible participants were asked to complete a questionnaire including name, age, gender, MMR dose taken, place of vaccination, and the past medical history. Parental consents were obtained for school children participants.

Samples collection

A blood specimen was collected from each study participant. Blood samples plain tubes (4ml) were obtained from the vaccinated participants and centrifuged serum was kept at 20°C. Enzyme-linked immunosorbent assay (ELISA) dedicated kits was used for MMR IgG detection and dosage (NeoBiotech, France, BioCheck Inc, USA).

IgG Titers analysis

IgG titers for Measles, Mumps, and Rubella were assessed for each participant. The correlation of MMR IgG titers with age subgroups, gender and place of collection was noted. The evolution of the seroprotection was assessed via the correlation with the overall MMR IgG rates as marker of vaccine dose.

A positivity for mumps and measles was detected for IgG titer > 11NTU/ml. However, the required titer for Rubella was 15 IU/ml.

Statistical analysis

Statistical analysis was performed by using a Minitab 16.1 program (Microsoft Office 2010, USA) for descriptive data. The statistical analysis was performed by ANOVA two-way; Chi-Square and Pearson tests were used to rule out correlations. P value <0.05 indicated significant correlation and was used to calculate the confidence interval 95%.

Results

A total of 76 participants from ASP School and FETS were surveyed. The mean participant age was 3.69±5.04 years (7-20). There were 30 (39.5%) males and 46 (60.5%) females.

The age of school participants ranged between 7 and 12 years (M/F 29/9) and the age of university students ranged between 17 and 20 years (M/F 1/37).

The triple vaccination coverage was higher among school participants.

The overall positivity for Measles, Mumps, and Rubella IgGs were 71%, 53% and 93.4% respectively. However at least one vaccine IgG was negative for 56.5 % of the participants (28 from FETS and 15 from ASP School).

The overall vaccine IgG positivity was higher in male school students. Rubella IgG was significantly higher among university than school females (47.3%) ($\chi^2=82.086$, $P=0.001$) "Table1".

A higher level of MMR IgG was seen at the age subgroup of 7-8 years. The seroprevalence for Measles, Mumps, and Rubella in this subgroup were 23.6%, 19.7% and 22.3%, respectively.

There was a significant difference between age group and MMR IgG, Two-way ANOVA (82.95%, $P=0.009$). The inverse correlation of age and measles = -0.414 ($P < 0.0001$), age and mumps = -0.213 ($P = 0.0065$) and age and rubella = -0.089 ($P = 0.443$) (figure 1).

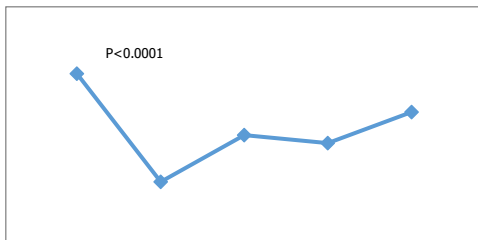
The overall concentration of MMR IgG antibodies was variable. The titers above 50-65 NTU for Measles, Mumps, and Rubella were 1.3 %, 1.3 % and 3.9% respectively. Adult participant had significantly a lowest concentration of Measles, Mumps IgG ($p=0.000$). The Rubella IgG record showed the same findings with no significance ($p=0.056$) "Figure 2".

The statistical analysis of MMR IgG in different age subgroups showed a significant trend of the decrease in the titer and concentration of Measles, Mumps vaccine antibodies with age.

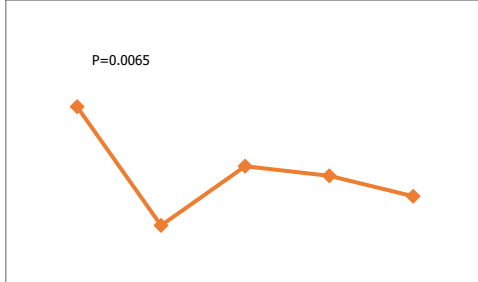
Seroprevalence of Measles, Mumps, and Rubella antibodies among Southwestern Libyan students.

Table 1: MMR IgG vaccine positivity among school and university participants.

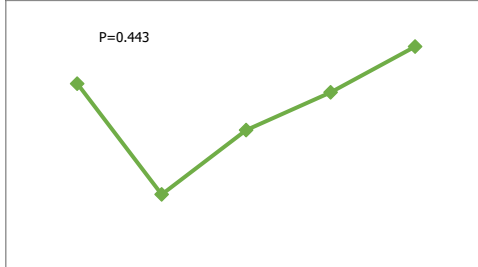
	Measles IgG		Mumps IgG		Rubella IgG	
	M(n /%)	F (n/%)	M (n/%)	F (n/%)	M(n/%)	F (n/%)
ASP School	25(32.8)	7(9.2)	22(28.9)	5 (6.5)	26(34.2)	8(10.5)
FETS	0(0)	22(28.9)	0(0)	14(18.4)	1(1.3)	36(47.3)
Pvalue	<0.0001		<0.0001		0.003	0.0001



Age	7-8	9-10	12-12	17-18	19-20
%	23.6	5.2	13.1	11.8	17.1



Age	7-8	9-10	12-12	17-18	19-20
%	19.7	3.9	11.8	10.5	7.8



Age	7-8	9-10	12-12	17-18	19-20
%	22.3	6.5	15.7	21	27.6

Figure 1: IgG positivity distribution according to age subgroups
 Measles —
 Mumps —
 Rubella —

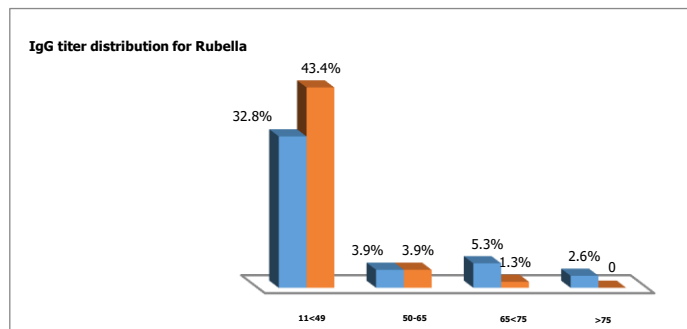
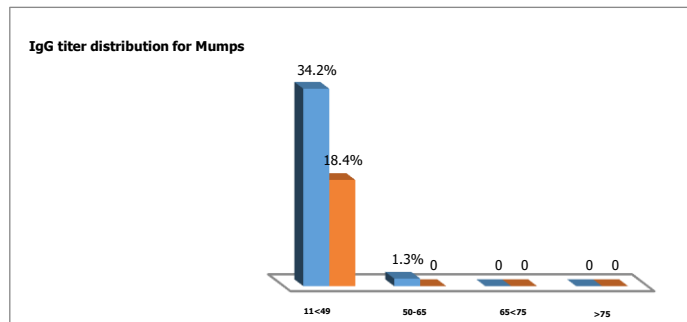
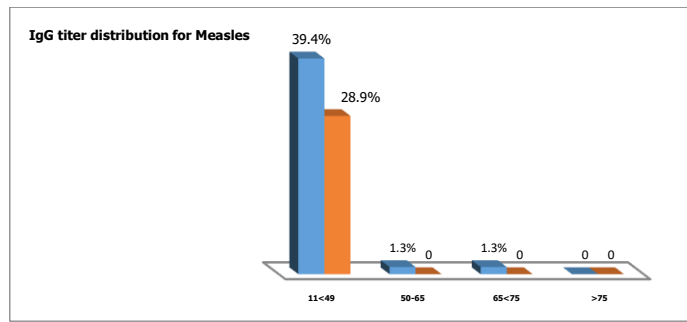


Figure 1: IgG titer distribution among school and university participants
 ASP —
 FETS —

Discussion

This is the first study that assesses the immune response to MMR vaccine in the south west of Libya. The estimated seroprevalence was 43%. It is lower but still comparable to the findings of other studies. This could be due to the older age of volunteers serum collection [3].

According to the Libyan vaccination program, two doses of MMR vaccine are assigned at 15 and 18 months [4]. That could partially explain the higher MMR IgG level for the school students compared to the university students. The Belgium vaccination program recommend a second dose of MMR vaccine at the age 5 years. A Belgian study estimated seroprevalence for measles IgG at 86.8% [5]. The same findings were noticed in other seroprevalence studies that confirmed the local variation of the IgG antibodies titers as well its decrease over the time [6,7].

Our study showed more persistent IgG protective titers for Measle in males participants. This could be explained partially by the male predominance in our series. This was not concordant with the conclusions of some other studies [4,7,8]. The Mumps IgG titer decrease with age as per most of the seroprevalence studies. A protective titer could be detected 5 years after the first vaccine dose [9]. Our study showed significant titer for Measles and Mumps 12 years after the vaccine dose. This Could advocate a longer life for these IgG and an objective protection in teenagers only. The Rubella IgG titers were significantly higher in adult females. Recent Indian study recorded 88% IgG Rubella seropositivity in university students [10]. This could be explained by the complexity of the immune reaction against Rubella and some independence of the immunoglobulin production after the first vaccine stimulation. The tardive immune system reaction to MMR vaccine is not yet totally clear especially in adults [11-14].

The immune reaction is variable and may depend on many hormonal, cytogenetic and familial factors. This diversity is noted mostly for the Rubella immunization while the mechanisms of the immune response variability are still unclear for Measles and Mumps [15,16]. Findings of concordant studies noted that the long interval between the first and second vaccine dose improves the avidity of IgG [17].

It is evident that the immunization by a vaccine dose is efficient in the prevention of viral infection outbreak. MMR vaccine is responsible for considerable direct and indirect immunity. This vaccine is safe and practical in large public scale [18]. Most of the seroprevalence studies confirmed the gradual decrease of IgG titers and avidities in adult patients [19,20].

We recommend the maintenance of protective IgG titers by giving a "reminder third dose" in the beginning of school education. That may contribute to the MMR immunity in young adults.

These results and our recommendations should be confirmed on larger trials with specific assessment of MMR IgG avidity behavior in this exposed scholar population.

Conclusion

This study tried to assess the level of MMR immunity related to the vaccination program implemented in Libya.

Three of the MMR IgGs are unstable and show a variable avidity in adults. South western Libya has a porous border with adjacent African countries due to high flow of migration. That could be an exposing factor for viral diseases outbreak. A revision of the MMR national vaccine program is advisable to ensure maximum protection of this population.

Conflict of interest

The authors declare that there is no conflict of interest.

Acknowledgement

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