

Efficacy of Measles Vaccination Schedule in Diyala Province, Iraq

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Abstract

Measles is a highly contagious systemic viral illness. Despite the availability of a safe and effective attenuated measles vaccine for more than 50 years measles is still a major causes of children morbidity and mortality. In recent years, it has become a global public health problem, attributed to low vaccination coverage observed in different countries. The causative agent of illness is Measles virus (MeV), which is a member of genus *Morbillivirus* within the *Paramyxoviridae* family, it has a negative-sense, single-stranded RNA genome. In the 1963, the live measles vaccine was introduced and consequently there was dramatical reduction of these numbers. The vaccine was initially given as one dose. The MMR is a live attenuated vaccine, which are used to stimulate the immune system to protect against measles, mumps and rubella. The study aims to determination of the efficacy of measles vaccine among vaccinated children in Diyala province and assessing of effect of certain socio-demographic factors on vaccine efficacy. A study was performed from 1 Nov 2020 to 20 Oct 2021 in Health centers in Diyala Governorate. The study was conducted on 270 vaccinated children with the MMR, the control group was 65 unvaccinated children. The IgG antibody determined by the enzyme-linkid immunosorbent assay methodology. Ms excel package and SPSS 27 software was used for analysis. Among 270 vaccinated children 92.6% were positive for IgG antibody and IgG positivity rate was directly proportionate with number of vaccine doses, as those children received four vaccine doses had significantly higher rate of positive measles IgG compared to those received one or two doses , and only 7.4% were negative for IgG.

Key word: Measles vaccine, MMR vaccine, Diyala province.

INTRODUCTION

References to measles can be found as far as the 7th century A.D. In fact, measles was described by Rhazes (Abu-Baker Mohammed Bin Zachariah, Arabian philosopher and physician) in the 10th A.D. as "more dreaded than smallpox." But Ibn Rhaze thought that measles and smallpox were two different parts of the same diseases (Schoenstadt, 2007). Measles also known as rubeola is an acute, highly communicable viral exanthematous illness caused by a virus. Measles, a vaccine-preventable disease (Uchendu *et al.*, 2019). It is predominantly a childhood disease, but can affect any age (O'Donnell *et al.*, 2019). MeV is transmitted via respiratory route (Anichini *et al.*, 2020). Transmission happens from person to next, through nasopharyngeal secretions via speaking, coughing, sneezing, or breathing (Xavier and Forgie, 2015). Measles infection is divided into four phases, incubation, prodromal, exanthematous (rash), and recovery(Gans *et al.*, 2019).

Before 1963, measles infected almost everyone, it was an expected life event. But all changed in 1963, when measles vaccine was first authorized in the United States. Each year in the United States, there were approximately 3-4 million cases, and an average of 450 deaths (Lixia *et al.*, 2003). Measles vaccine is a complex and delicate biological preparation that provides sufficient protection against measles disease that is deadly worldwide (Adeel *et al.*, 2020). Several strains of the vaccine, such as Edmonston-Zagreb, Schwarz/Moraten and Alk-C strains, have been developed from the pathogenic wild-type virus via multiple passages in various cellular substrates (chicken embryo fibroblasts, chicken eggs) under different conditions (Frantz and Teeravechyan, 2018). Two doses of measles-containing vaccine (MCV) WHO recommended, in order for children receive full protection against measles infection (Magodi *et al.*, 2019). In Iraq, the measles immunization schedule recommends measles vaccine for infants at nine months of age (Al-Shamsi *et al.*, 2010).

MATERIAL AND METHODS:

This study was conducted to determination of the efficacy of measles vaccine among vaccinated children. It was performed from the period between November 2020 to October 2021 in the health centers/ Diyala. 270 blood samples was collected from vaccinated children with MMR vaccine (1-14 years of age). Questionnaire was prepared, distributed, and collected through each patient and control group. Parents child answer on the questions of questionnaire in Health center. For each child, a questionnaire was applied to obtain demographic information regarding age, sex, residence, number of vaccine doses, time of vaccine, Parents' educational level, vaccines other than measles vaccine, number of children in family.

Ethical Considerations:

Diyala Medical Collage and Health Directorate of Diyala Iraq, approved this study. The parents child endorsements to the questionnaire in the study and blood sample.

Blood sample:

Blood sample was taken from each participant children in study 4-5 ml of venous blood was withdrawn under complete aseptic condition from the cubital vein, the blood divided in two parts; 2 milliliters of blood were placed in to a properly labeled EDTA (Ethylene diamine tetraacetic acid) anticoagulated tube for determination of complete blood count (CBC). The remaining of blood was dispensed into a properly labeled gel tube with an upright position inside the plastic rack. The tubes were left in room temperature for 15-30 minutes for the blood to be clotted. The samples were centrifuged at 3000 rotation/minute (rpm) for 15 minutes to separate the serum. The obtained serum put into eppendrof tube and then kept frozen at -20°C to be analyzed by ELISA technique later for measles IgG antibody.

Detection of IgG antibody:

For in vitro diagnostic used CD Creative Diagnostics, USA. ELISA Kit for detection measles IgG in human serum.

Statistical analysis:

Analysis of data was carried out using the available statistical package of SPSS-27). Data were presented in sample measure of percentage and mean± standard deviation. The significance of difference to different means (quantitative data) were tested using Students-t-test for difference between two independent means or Paired-t-test for difference of paired

observations (or two dependent means), or ANOVA test for difference among more than two independent means. The significance of difference of different percentages (qualitative data) was tested using Pearson Chi-square test (χ^2 -test) with application of Yate's correction or Fisher Exact test whenever applicable. Statistical significance was considered whenever the P value was equal or less than 0.05

RESULTS:

Anti-measles IgG status

Table (1) shows the positivity rate of measles IgG. The anti-measles IgG positivity rate was significantly higher in vaccinated group compared to control group.

Table (1) Distribution of study groups by anti-measles IgG positivity.

Anti-measles IgG status	Study groups			
	Vaccinated		Control	
	No	%	No	%
Positive	250	92.6	3	4.6
Negative	20	7.4	62	95.4
P value	*0.0001			

Association of anti-measles IgG with age:

Table (2) shows that the anti-measles IgG positivity rate was insignificantly ($P=0.073$). higher among those vaccinated children in 4 years of life (100%), while the lowest rate of IgG positivity was among children with 2 years old (75.0%).

Table (2): Distribution of anti-measles IgG positivity by age.

Age (Ys)	Study groups			
	Vaccinated		Control	
	No	%	No	%
1	-	-	-	-
2	6	75.0	-	-
3	14	82.4	1	25.0
4	28	100	-	-
5	30	93.8	-	-
6& more	172	93.0	2	5.3
P value	0.073*		-	

Association of anti-measles IgG with gender:

Table (3) shows that there is no statistically significant association between anti-measles IgG positivity and gender since the positivity rate is almost the same among male (92.2%) and female (93.0%) of vaccinated children ($P = 0.796$). similarly, there was insignificant difference regarding the control group ($P=0.466$).

Table (3): Distribution of anti-measles IgG positivity by gender.

Gender	Study groups			
	Vaccinated		Control	
	No	%	No	%
Male	130	92.2	1	2.9
Female	120	93.0	2	6.7
P value	0.796 *		0.466*	

Association of anti-measles IgG with number of doses:

Results in table (4) shows that the IgG positivity rate was directly proportionate with number of vaccine doses, as those children received four vaccine doses had significantly higher rate (100%, P= 0.0001) of positive measles IgG compared to those received one or two doses.

Table (4): Distribution of anti-measles IgG positivity by number of doses.

Number of doses	Study groups			
	Vaccinated		Control	
	No	%	No	%
No dose	-	-	3	4.6
One	3	21.4	-	-
Two	23	71.9	-	-
Three	82	100	-	-
Four	142	100	-	-
P value	0.0001*		-	

DISCUSSION:

In our community, Measles or what historically called “Hasbah” in the local cultural heritage was a well-known disease of childhood since antiquity. Moreover, before the introduction of measles vaccine, one of the important known features of the measles since that time was that it occurs only once in the life time, and thus every child had to pass this obstacle anyhow. This is because what scientifically affirmed later on that natural infection provides lifelong protection against all serotypes of measles virus (Lochlainn, *et al.*, 2019). The live-attenuated measles vaccines are among the most highly effective vaccines available (providing 97% protection with two doses, given at 12 to 15 months and 4 to 6 years of age), with a proven safety record (Rota *et al.*, 2016). Regarding the anti-measles IgG, the positivity rate in this study among vaccinated children was 92.6% which was significantly higher compared to control 4.5%. These results are comparable with the results of other studies. For instance, the study by Mahallawi and Ibrahim, (2021) in Saudi Arabia who found that the rate of anti-measles IgG seropositivity among participants was 92%. the current study found that a higher anti-measles IgG positivity rate among vaccinated children of older ages (4 years and older). These results are consistent with that of Nogareda *et al.*(2020) who conducted a study among 4598 participants and they found that the seropositivity of measles IgG was 94% and that the IgG seropositivity was associated with increasing age and thus achieving protection. In contrast, the present results are disagreed with the results of Samoilovich *et al.*,(2020) who carried out their study on 2229 participants 2-75 years old, found that the

seroprevalence was highest (96.9%) in children 2-5 years old. Regarding both anti-measles IgG positivity rate and mean concentration in vaccinated group as well as unvaccinated there was insignificant difference between male and female in the current study. This result is comparable with the result of several previous studies, that all documented insignificant difference in the anti-measles IgG regarding gender (Jablonka *et al.*, 2017; Kumari and Kutty, 2021; Coppeta *et al.*, 2020). The present study found a significant increase in anti-measles IgG positivity rate in those children received three or four measles vaccines. The current result is consistent with that obtained in Korean study by Han *et al.* (2021), who found that the measles IgG seropositivity was significantly higher in those who received two or more measles doses compared to those received one dose. Furthermore, the seroprevalence of IgG was found to be influenced by the number of vaccine dose (Wang *et al.*, 2017).

CONCLUSION:

Measles is a viral disease that led to increased morbidity and mortality among children, Measles vaccine is one of the most cost-effective health interventions discovered. Because MeV has extremely high contagionist, requires a > 95% vaccination rate.

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