

Measles antibody titre in children up to 5 years of age in rural areas of Aligarh District, India

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ABSTRACT

Objective: To determine the pattern of decline of maternal antibodies in 0-9 month old infants and to study the prevalence of measles antibodies and their levels in 9 month to 5 year old children, regardless of their immunization status.

Method: A cross-sectional study covering 456 children in the 0-5 year age group residing in 9 registered villages in a rural area of Aligarh District was conducted. The study included the interview of parents, clinical examination of children, and Hemagglutination Inhibition Test for Measles Antibody Titre.

Results: There was rapid decline in seropositivity from 100% in the 0-3 month age group to 18% in the 6-9 month

age group. There was a positive correlation ($r = 0.77$) between decline of seropositivity and age. Measle immunization coverage rate was 64.5%. In 202 children where immunization was confirmed by availability of card, sero-conversion was 96.5%. Of the 118 unvaccinated children, 9% were sero-positive. Of the 71 children who had a history of measles infection, 75% were seropositive indicating correct identification of measles infection by the parents.

Keywords: Measles antibodies, Seropositivity, Hemagglutination Inhibition test.

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Measle antibodies may be passively or actively acquired. Passively acquired antibodies are transferred across the placenta during pregnancy from the mother to the infant. These antibodies continue to wane off after birth and may be completely lost by 6-9 months. The pattern of decline of these maternal antibodies has been shown to vary from country to country and between regions in the same country.¹⁻⁵ The pattern of decline is important for timing the measles immunization. Actively acquired antibodies are found following clinical or sub-clinical infection, or following immunization. The pattern of prevalence of antibodies differs in developed and developing countries as well as in the same country.³⁻⁶ This study was carried out to map the prevalence of

measle antibodies and the antibody end-titre in 0-5 year old rural children, regardless of their immunization status. The specific objectives were: 1. To determine the pattern of decline of maternal antibodies in 0-9 month old infants. 2. To study the prevalence of measles antibodies, and their level in children of 9 months to 5 years of age.

Methods. The study was carried out in 9 villages registered with the Rural Health Training Centre of the Department of Community Medicine, J.N. Medical College, Aligarh Muslim University, (AMU) Aligarh, India having a total population of 13,684 persons living in 2104 households. The total population of children in the 0-5 year age group was

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Table 1 - Distribution of children under 9 months of age and measles antibody of 74 seropositives.

Age	Total no. of children	Total no. of seropositive children	Measles antibody end titre (N = 74)					GMT
			1 : 16	1 : 32	1 : 64	1 : 128	1 : 256	114.47
0 - 3 months	25	25 (100)	0 (0)	0 (8)	7 (28)	9 (36)	7 (28)	114.47
3 - 6 months	50	40 (80)	6 (15)	11 (27.5)	14 (35)	8 (20)	1 (2.5)	51.08
6 - 9 months	49	9 (18)	5 (56)	2 (22)	2 (22)	0 (0)	0 (0)	13.29
TOTAL	124	74 (60)	11 (15)	15 (20)	23 (31)	17 (23)	8 (11)	61.62

Figures in parenthesis indicate percentage; χ^2 for linear trend = 5.13, P = < 0.02

1180, constituting 14% of the total population. Of these, 25% children i.e. 470, were included in the study by systematic random sampling. However, 14 children could not be traced and a total of 456 children were actually studied.

A house to house-visit was made. After obtaining informed consent from parents, information was collected and recorded on a proforma. Blood samples were collected on Whatman No. 3 filter paper having inscribed circles. Measle antibody titre was detected by Hemagglutination Inhibition Test (HAI), using a method described by Khare et al. Those samples which were sero-positive were further titrated to obtain the exact titre. Data was tabulated and analyzed. Statistical tests of significance were applied wherever necessary.

Results. 0-9 month age group. There were 124 children in the 0-9 month age group. A total of 74

(60%) children were seropositive (Table 1). In the 0-3 month age group, all children were seropositive. This number declined to 80% seropositivity in > 0 - 3 month age group and to 18% in > 6 months - 9 month age group. There is a positive correlation ($r=0.77$) between decline of seropositivity and age. Chi-square test for linear trend was also statistically significant (χ^2 for linear trend = 5.13, P = < 0.02). In the 0-3 month age group, a majority of children had a high end titre of more than 1:64, 1:128 or 1:256. The titre showed a linear decline with age. The Geometric Mean Titre (GMT) declined from 114.47 in 0-3 months age group, to 51.08 in 3-6 months age group and to 13.29 in 6-9 months age group.

Nine months to 5 years age group. The National Immunization Program in India recommends 9 months of age for measles vaccination. In this study population, 332 children were in the 9 month to 5

Table 2 - Measle vaccination status of children.

Age	Total no. of children	Children vaccinated against measles	Children not vaccinated against measles
9 - 12 months	44	28 (64)	16 (37)
1 - 2 years	88	57 (65)	31 (35)
2 - 3 years	83	54 (65)	29 (35)
3 - 4 years	50	32 (64)	18 (36)
4 - 5 years	67	43 (64)	24 (36)
TOTAL	332	214 (64.5)	118 (35.5)

Figures in parenthesis indicate percentage

Table 3 - Seropositivity in vaccinated and unvaccinated groups (n = 332).

Immunization status		Total no. of children	Total no. of seropositive children	Total no. of seronegative children
Group A**	Immunized	214	202 (94.0)	12 (6)
	1.Immunization card available*	202	195 (96.5)	7 (3.5)
	2.Card not available*	12	7 (58)	5 (42)
Group B**	Not immunized	118	11 (9)	107 (91)
	TOTAL	332	213	119

*p < 0.001 **p < 0.001

Table 4 - Measle antibody titre in all vaccinated seropositive children having immunization card (n = 195).

Age	Total no. of children	Measles antibody end titre					GMT
		1 : 16	1 : 32	1 : 64	1 : 128	1 : 256	
9 - 12 months	26	0 (0)	3 (11.5)	4 (15)	5 (19)	14 (54)	142.4
1 - 2 years	54	5 (9)	6 (11)	9 (17)	23 (44)	11 (20)	92.86
2 - 3 years	47	8 (17)	2 (4)	19 (40.5)	13 (28)	5 (11)	38.19
3 - 4 years	30	12 (40)	6 (20)	9 (30)	3 (10)	0 (0)	34.29
4 - 5 years	38	28 (53)	7 (18)	10 (26)	1 (3)	0 (0)	27.60
TOTAL	195	45 (23)	24 (57)	51 (29)	45 (23)	30 (15)	61.98

Figures in parenthesis indicate percentage

year age group (Table 2). Of these, 214 were vaccinated against measles, giving a coverage rate of 64.5%. One hundred and eighteen children were not vaccinated against measles. Age groups and vaccination status was not statistically significant ($\chi^2 = 0.04$, $P > 0.05$).

Antibody titre in vaccinated children. The vaccination status of 202 children was confirmed by the presence of immunization card. However, 12 children did not have a card, but their parents gave a history of having received measles vaccination. (Table 3). Measle antibody were present in 96.5% of children who had an immunization card available and in 58% of children who did not have the card. This

association between availability of card and seropositivity was found to be statistically significant ($P < 0.001$). Immunization status of Group A and seropositivity compared to Group B was statistically significant ($P < 0.001$). In 195 children who had the immunization card, the vaccine was effective in producing positive antibody response in 96.5% of cases and the vaccine failure rate was 3.5%. The antibody titre was high in the younger age group and showed a linear decline with age (Table 4). The GMT showed a linear decline from 142.4 in the 9-12 month age group to 27.60 in the 4-5 year age group. Of the 12 children who did not have the immunization card, only 7 were seropositive. The

Table 5 - Measles antibody titre in seropositive measles unvaccinated children.

Age	Total no. of unvaccinated children	Total no. of seropositive children	Measles antibody end titre (n = 11)					GMT
			1 : 16	1 : 32	1 : 64	1 : 128	1 : 256	
9 - 12 months	16	4	0	0	1 (25)	1 (25)	2 (50)	152.18
1 - 2 years	31	4	0	0	1 (25)	3 (75)	0	107.58
2 - 3 years	29	0	0	0	0	0	0	0
3 - 4 years	18	2	2 (100)	0	0	0	0	16.0
4 - 5 years	24	1	1 (100)	0	0	0	0	16.0
TOTAL	118	11	3 (27)	0	2 (18)	4 (36)	2 (18)	72.58

Figures in parenthesis indicate percentage

number is too small for further analysis. No other similar study could be traced for comparison.

Antibody titre in un-vaccinated children. One hundred and eighteen children in the 9 months to 5 year age group were unvaccinated. Out of these, only 11 (9%) were seropositive (Table 5), the probable reason being mild or unnoticed measles infection. The end titre was high in the younger age group and declined in the older age group.

Antibody titre in children who had a history of, or natural measles infection. The history of natural measles infection was present in 71 children (Table 6). Of these children, 53 (75%) were seropositive and 18 (25%) had low titre (<1:8). This observation suggests that while a majority of parents were able to correctly identify measles, 25% may have mistaken any other eruptive fever for measles. However, it must be kept in mind that the filter paper method of blood collection for antibody titre has some limitations, as such a titre below 1:8 may not be studied. But in rural areas with limited resources and facilities, probably only this method of blood collection is found feasible. No definite pattern of end titre was observed in the various groups and the titre varied from 1:16 to 1:128.

Discussion. There was a rapid decline in seropositivity from birth to 9 months of age. The pattern of decline in seropositivity is similar to that observed by Bhardwaj et al¹ in the state of Himachal Pradesh in India, where the seropositivity rate declined from 82% by 3 months to 13% at 9-12 months. Bhaskaran et al⁹ reported that maternal antibodies disappeared in 90% of infants by 9 months of age. However, in Northern America, Albrecht et al¹⁰ reported that maternal antibodies were still detectable in 12 month old infants and this was put forward as the probable mechanism of vaccine failure in such children. On the other hand, in Kenya, 90% of children no longer had maternal antibodies at 7-8 months⁵ while in Ghana,¹¹ only 3% of infants of 7 months or older had maternal antibodies.

In this study there was a positive correlation between decline of seropositivity and age in 0-9 month old infants. The maternal antibodies were still detectable in 18% of children in the 6 month - 9 month age group. In vaccinated children, positive antibody response was present in 96.5% of children having the immunization card compared to 58% not having the card. Thus children who do not have the immunization card should be considered as unvaccinated because history of measles vaccination may not be reliable. The coverage rate for measles vaccination was 64.5%. This is lower than the average national coverage of 88% (1992 - 93) but, higher than the coverage in 1992 in the same district, which was 56%. Measles immunization coverage should go up to at least 85% by the year 2000.

In developing countries where there is a high degree of wild type measles transmission, infants and children are at a greater risk of being exposed shortly after the maternal antibodies have waned. Since most of the cases of measles occur before the age of 9 months of age and are fatal, this necessitates early vaccination.¹⁸ George, in a study at Vellore,¹⁹ also concluded that measles vaccination at the age of 6-8 months is an effective and safe preventative measure for measles.

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