SERO-PREVALENCE OF MEASLES IGg ANTIBODIES AMONG NURSERY AND SCHOOLCHILDREN IN KADUNA STATE, NIGERIA

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ABSTRACT
Measles epidemics, with its consequent morbidity and mortality, continue to occur in Nigeria. Coupled with the falling level of vaccine coverage in the country, the large population of children at risk of measles infection gives a cause for worry. The study was conducted in Kaduna state northern Nigeria, to determine the level of measles virus IgG antibody among public primary school children. The study is a cross sectional study involving primary school pupils aged 15 years and below who were randomly selected by multistage cluster sampling from schools in local government areas from the three geopolitical zones of Kaduna state, Nigeria. The study subjects were interviewed using a questionnaire and blood samples were subsequently obtained for measles virus antibody level assay using a commercial enzyme linked immune sorbent assay (ELISA) from Demedetec diagnostics GmbH Germany. Data were summarized as percentages, charts and frequency tables and results computed and analyzed using Epi- info version 3.0.Results obtained showed a marked increase in IgG level with increasing age and overall only 67 (20.9%) of the children had IgG antibody levels above 200 IU/ml, while 79.1% had levels below 200 IU/ml. This study suggests that a considerable number of children are unprotected against measles infection and thus epidemics in measles are bound to be recurrent unless further measures to strengthen measles vaccination among children are instituted and implemented via concerted collaboration and contribution from all stakeholders.
Keywords: Measles, virus, Antibody, IgG, ELISA.

INTRODUCTION

Measles infection remains a major vaccine preventable cause of childhood morbidity and mortality in developing countries. It is the fifth leading cause of death in children under 5 years of age. Although measles vaccine has been available for over 40 years in Nigeria, outbreaks of epidemics occur at frequent intervals, with associated high case fatality especially in under-fives (Adeboye *et al.,* 2011).Measles may occur at any age, particularly in individuals who have not acquired immunity against the infection. Immunity following vaccination or natural infection confers protection against measles infection and re – infection as well as prevents complications where modified measles occur. Both IgM and IgG antibodies are produced in response to measles viral infection. Peaked levels of IgG antibodies are usually attained about two weeks after appearance of rash with subsequent decline in levels but remain detectable for several years (WHO, 2000).The decline in immunity overtime after immunization coupled with other factors such as failure to seroconvert, the age and time of vaccination and the level of vaccination coverage in a population all determine the susceptibility of an individual to measles infection in a population(Marcelo *et al.,* 2006). Studies have shown varying seroprevalence in children of different age groups and populations. Cutts, *et al.* (1995) have documented measles IgG levels in children. Generally a neutralizing IgG antibody level of 200IU/ml is considered protective against measles and vaccine coverage of 83 – 94 % with an average of 90% is required for attainment of herd immunity and prevention of transmission in a population (Thomas, 2011). Thus this study was aimed at establishing a baseline prevalence of measles IgG in the study population and to compare the levels of IgG among vaccinated and unvaccinated children.

MATERIALS AND METHODS

The study subjects were selected from public primary schools randomly selected from three local government areas, one each from the three senatorial zones of the state. Consent for the study was obtained from the ministry of education, the school management and the guardians of the selected subjects.

Three hundred and twenty (320) pupils aged less than 15 years were selected from the schools and using questionnaire, information were obtained including demographic data of the pupils, history of measles infection and vaccination history. Venous blood sample was collected from each subject, centrifuged and the sera subsequently analyzed for specific IgG against measles virus in the department of microbiology Ahmadu Bello University Zaria using the enzyme linked immunosorbent assay (Measles IgG ELISA, Demedetec, GmbH Germany). Following the manufacturers guidelines IgG antibody titers < 8 IU/ml were recorded as negative while titers > 10 IU/ml were considered positive. Data were summarized as percentages, charts and frequency tables and results computed and analyzed using Epi- info version 3.0. Chi-square test was performed, and statistical significance was established at P value of ≤ 0.05.

RESULTS
Three hundred and twenty pupils were investigated out of whom 168 (52.5%) were males while 152 (47.5%) were females. A total of 234 (118 males and 116 females) of the 320 pupils were positive for measles serum IgG giving an overall measles seroprevalence of 73.1% (Table 1). The seroprevalence for measles IgG was highest (80.4 %) in the age group 11 – 15 years (Table 1). Measles IgG seropositivity was statistically significantly associated with increasing age x^2 = 6.618 and P =0.037 but was not with sex x^2 = 1.500 and P = 0.136.

Table 1: Age Distribution and Measles IgG Seroprevalence status of Primary School Pupils in Kaduna State.

Age group (years)	Number tested	Number seropositive	Percentage (%)
1 – 5	39	26	66.7%
6 – 10	143	97	67.8%
11 – 15	138	111	80.4%
Total	320	234	73.1%

x^2 = 6.618, P = 0.037.

A total of 261 (81.6%) of the subjects had received measles vaccination and of this number 191 (73.2%) were positive for measles serum IgG antibodies while of the 59 unvaccinated subjects 43 (72.9%) were positive for measles serum IgG antibodies (Table 2). There were 25, 99 and 110 pupils between the age ranges of 1 - 5, 6 - 10, 11 – 15 years respectively who were seropositive for measles IgG antibodies, however only 7 (17.9%), 31 (21.7%) and 29 (21.0%) pupils from the respective age groups had measles serum IgG antibody levels greater than 200 IU/ml (Fig 1). Overall 67 (20.9%) of the studied subjects had IgG levels > 200 IU/ml.

Table 2: Age and Mean Measles Serum IgG Titers for Vaccinated and Unvaccinated Primary School Pupils in Kaduna State

| Age (years)	Number of children	Number of vaccinated children	Vaccinated children with positive measles serum IgG	Mean IgG titer for vaccinated children IU/ml	Number of Unvaccinated children	Unvaccinated children with positive measles serum IgG	Mean IgG titer for Unvaccinated children IU/ml
1 – 5	39	38 (97.4%)	25 (65.8%)	81.6	1 (2.4%)	1 (100%)	10.5
6 – 10	143	118 (82.5%)	82 (69.5%)	80.1	25 (17.5%)	16 (64%)	68.9
11 - 15	138	105 (76.1%)	84 (80.0%)	103.5	33 (23.9%)	26 (60.6%)	70.6
Total	320	261 (81.6%)	191 (73.2%)		59 (18.4%)	43 (72.9%)	
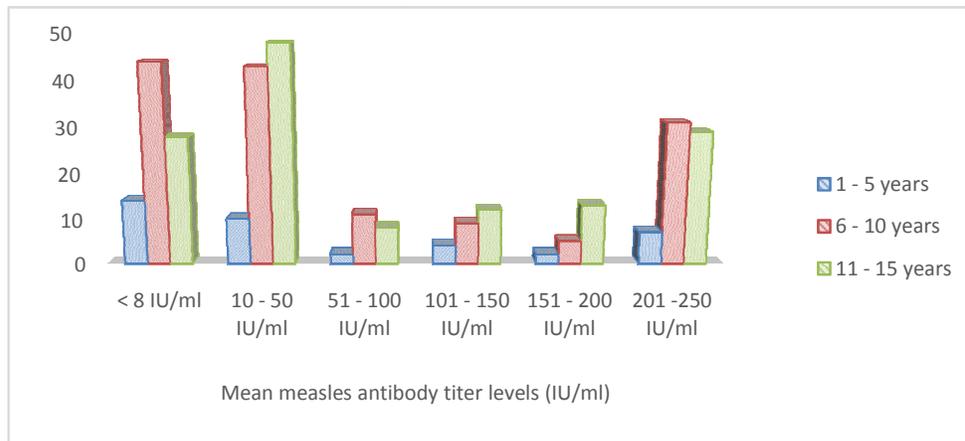
Figure 1: Age and mean measles serum antibody of primary school pupils in Kaduna state

Discussion

The overall measles IgG seroprevalence of pupils aged < 15 years from our study was 73.1%, this conforms to the findings of (Takechi *et al.,* 2001) who demonstrate 74% of seroprevalence in Malawian children. This however is generally lower than (83 – 94% with average 90%) rate required to provide herd immunity (WHO, 2009) and therefore significant reduction in the spread of measles infection and decreased risk of epidemic outbreaks. This becomes even more obvious when the seroprevalence for the various age groups is examined where the age groups 1 – 5 years and 6 – 10 years had seroprevalence less than 70%. Seroprevalence among our study population was found to be associated with increasing age as has been documented by other researchers (Mossong *et al.,* 2003; Ghazanfar *et al.,* 2009).This suggest that in our studied population the risk of measles infection may be less in the age group 11 – 15 years with seroprevalence of 80% compared to the < 10 years subjects with seroprevalence less than 70%. Furthermore our finding showed that only 20.9% of the subjects had IgG levels > 200 IU/ml implying that 79.1%, which will translate to a huge number of under 15 years in our study population, were at risk of measles infection and its complications.

The study showed that 86.1% of the subjects were vaccinated implying a fairly high coverage, particularly when the age group 1 – 5 years (though small number) is considered, where vaccine coverage was 97.4%, yet the seroprevalence among this group was 65.8 % and overall 73.2% in the entire vaccinated group. This suggests that 3 out of every 10 vaccinated children in our study population were not immunized and may be attributed to problems associated with efficacy of the vaccination process including potency of the vaccine, the storage of the vaccines, its administration and or variable individual immune response to the vaccine. Some studies have shown low seroprevalence amongst under-fives in populations where single measles vaccine was administered to infants due to interference from maternally acquired antibodies and this may be playing out in our study population. Another plausible explanation could have been inaccuracy of the history of vaccination but this was less likely as efforts were made to confirm cases of vaccination through the infant immunization records. It is however; difficult to identify which of these factors either individually or in combination would have been implicated as cause of the observed prevalence in the vaccinated subjects. On the other hand the unvaccinated group had a seroprevalence rate of 72.9% suggesting that there is a risk of about 3 in 4 of the unvaccinated in our study population becoming infected with measles infection and therefore supportive of the fact that there exist little or no herd immunity in the study population.   .

CONCLUSION

This study suggests that a considerable number of children in our study population are unprotected against measles infection and thus, epidemics of measles are bound to be recurrent unless further measures to strengthen measles vaccination and surveillance among children are instituted and implemented via concerted collaboration and contribution from all stakeholders.

Changes in timing of routine immunization schedule for measles is also suggested such that infants can be vaccinated against measles at 9 and 12months.

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