e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(8); 294-298

Original Research Article

Determining the Association of Measles Antibody Titres with Nutritional Status in Paediatric Population: Hospital Based Cross-Sectional Study

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Received: 10-02-2023 Revised: 20-03-2023 / Accepted: 25-04-2023
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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to find out any association of measles antibody titres with nutritional status in children 1 to 12 years.

Methods: This hospital based cross-sectional study was conducted in the duration of five months on 1–12-year-old children attending the Pediatric O.P.D. of Department of Pediatrics with the objective of finding out the seroprevalence and anti-measles antibody levels, and studying their association with age, gender, as well as nutritional status of these children.

Results: A significant proportion (62.50%) of the overall participants had received vaccination for measles. Nevertheless, the statistical analysis did not reveal a significant correlation between age and vaccination status (p=0.164). There were no statistically significant differences identified in the baseline parameters between the vaccinated and unvaccinated groups, except for the mean weight for age Z score, which was considerably lower in the unvaccinated group. A total of 38.34% of the individuals aged ≤5 years had severe wasting, also known as severe acute malnutrition, while 35% displayed moderate wasting. Among children aged five years and older, 23.34% exhibited extreme thinness, while 13.33% were classified as thin. Additionally, just two cases, accounting for 0.6% of the sample, were identified as overweight. A significant proportion of the vaccinated individuals aged five years or younger, namely 43%, exhibited severe wasting, often known as severe acute malnutrition. Additionally, 35% of the participants had moderate wasting. A strong statistical correlation was found between BMI Z scores (in individuals aged ≥5 years) and seropositivity, indicating that children with higher BMI Z scores had a greater likelihood of becoming seropositive. Likewise, a statistically significant correlation was found between height-for-age Z scores and seropositivity, indicating that children with greater height-for-age Z scores exhibited higher levels of seropositivity.

Conclusion: Children's nutritional condition is related to their measles antibody titres and the measles immune globulin (GMT) of measles specific IgG antibody.

Keywords: Measles, Vaccine, Antibody, Vaccination, Malnourished, Anthropometry

Introduction

In India, measles is responsible for 2.3% of all fatalities and 10% of mortality in pre-schoolers. [1] Death rates in the range of 5%-30% have been documented, with the majority of fatalities occurring among isolated tribal people. The median case fatality ratio is 3.7%. Measles is still a leading cause of illness and death among children in India, despite the fact that the number of reported cases has decreased from 162,560 in 1989 to 2,933 in 2011. [2] Vaccination against measles begins at 9 months of age, however in the event of an epidemic, the age threshold might be lowered to 6 months. Regardless of the amount of national routine coverage for the first dose of MV, the WHO recommends that all countries add a second routine dose of MV. [3]

Supplementary Immunization Activities (SIA) are used to reach children who may have been missed due to limited healthcare coverage in the DRC; these activities were linked by Doshi et al. to a reduction in measles cases. [4] There are geographical variances in seroprevalence, and the ability of a newborn to seroconvert depends on the amount and decay of maternal antibodies and immunological development. Protein-losing enteropathy, higher metabolic needs, and reduced food intake are all ways in which measles contribute to the development of malnutrition. Young children who have measles often have lower mean weights for age than similarly aged children who do not contract measles. [5]

There are geographical variances in seroprevalence, and the ability of a newborn to seroconvert depends on the amount and decay of maternal antibodies and immunological development. It is possible that pregnant women living in endemic areas are more likely to have had natural measles infection, resulting in higher measles antibody levels, and therefore are more likely to pass on higher levels of measles antibody transplacentally to their infants, resulting in longer lasting protection than would occur in expectant mothers with vaccine-induced antibody. [6,7] Protein-losing enteropathy, higher metabolic demands, and reduced food intake are all ways in which measles may play a role in the onset of malnutrition. Young children who have measles often have lower mean weights for age than similarly aged children who do not contract measles.

Thus, this research set out to determine whether or not the levels of measles antibodies in the blood of children aged 1-12 years were correlated with their dietary intake.

Material & Methods

Seroprevalence and anti-measles antibody levels, as well as their association with age, gender, and nutritional status, were investigated in a hospital-based cross-sectional study spanning five Months among children aged 1-12 who visited the Pediatric O.P.D. of the Department of Pediatrics at Nsmch,Bihta, Patna, Bihar, India. Initial assessments were performed on 480 individuals. Of them, 400 patients were recruited in the trial because their parents gave their informed permission. Subjects were chosen using a rigorous random sampling process. Antibodies against measles (IgG) were measured in blood samples.

Inclusion Criteria

- Children in the age group of 1 to 12 years.

Exclusion Criteria

- Refuses to give parental consent,
- Received blood or
- Blood components within last 3 months, received corticosteroid therapy or other immunosuppressive therapy, are HIV positive, are transplant recipients (bone marrow/ solid organ), received of gamma globulins within last 2 months, are on dialysis and are having malignancies.

Methodology

Clearance was sought from Institutional Ethics Committee of Department of Pediatrics, Nsmch, Bihta, Patna, Bihar, India. The techniques of measurement described in Cogill's (2003).[8] Anthropometric Indicators Measurement Guide were followed to make the following measurements.

Weight was measured using a portable electronic weighing scale with a weighing capacity from 1 kg to 150 kg in 100 g divisions, accuracy +/- 100g.

Height: was measured in centimetres to a precision of 0.1cm by a wall mounted tape measuring up to 2 meters. An infantometer was used to measure the length for children less than 2 years of age.

The following indices & their z scores were calculated:

Body Mass Index (BMI) = $Weight\ (Kg)/\ Height\ (m)^2$.

Weight for age: for children less than 10 years of age by W.H.O standard growth chart and z score was calculated.

Height for age: for all children based on W.H.O standard growth chart and z score was calculated.

Weight for height: for children less than 5 years based on W.H.O standard growth chart and z-score was calculated.

Nutritional status of children was classified on the basis of the WHO Growth Standards, 2006 for 0-60 months; and the WHO Reference, 2007 for 5-19 years.

Children 5-19 Years:

Overweight: >+1SD (equivalent to BMI 25 kg/m2 at 19 years) Obesity: >+2SD (equivalent to BMI 30 kg/m2 at 19 years). Thinness: <- 2SD. Severe thinness: <-3SD.

Children 0-60 months:

Moderate wasting: weight-for length/ height Z -score -2 to -3 Severe wasting (severe acute malnutrition): weight-for length/ height Z –score <-3.

Overweight: BMI-for-age or weight-for-length/ height Z -score > 2. Obesity: BMI-for-age or weight for- length/ height Z -score>3. Moderate stunting: length/ height for age Z -score -2 to -3. Severe stunting: length/ height for age Z -score < -3.

Blood samples were collected, and serums were separated by centrifugation and stored at -20 degree Celsius till the time of assay. Measles specific IgG antibodies were detected by using a commercial IgG ELISA kit (Measles Virus IgG ELISA, IBL International GMBH) in accordance with the manufacturer's instructions.

Results

Table 1: Vaccination status of children against measles

Age group (years)	Vaccinated N (%)	Unvaccinated N (%)	Total	P value
1-12	250 (62.50)	150 (37.50)	300	0.164

Majority (62.50%) of the total subjects had been vaccinated against measles. However, the relationship between age and vaccination status was not found to be statistically significant (p=0.164).

Table 2: Baseline characteristics of measles vaccinated and unvaccinated children

Characteristics	Vaccinated mean±SD	Unvaccinatedmean±SD	P value
Age (years)	6.3±3.0	5.7±3.4	0.522
Weight (kg)	16.4±7.3	16.2±6.1	0.244
Height (cm)	104.6±20.2	108.2±20.5	0.655
BMI (kg/m^2)	14.6±2.6	14.7±1.7	0.120
Weight for age Z score (1-10 years)	-1.4±1.2	-2.6±1.6	0.028
Height for age Z core	-1.6±0.4	-1.7±1.4	0.0758
Weight for height Z score(1-5 years)	-1.6±1.6	-1.6±1.8	0.428
BMI Z Score	-1.6±2.4	-1.6±1.8	0.650

No statistically significant difference was observed in the baseline characteristics of vaccinated and unvaccinated group except for mean weight for age Z score which was significantly lower in the unvaccinated group.

Table 3: Nutritional status of subjects

Parameter of Nutritional status		Total	(%)	Vaccinated	(%)	Unvaccinated N	(%)
Weight for age Z Score (age ≤10yrs)	< -3	90	22.5	65	26	25	16.66
	-2 to-3	140	35	95	38	45	30
	>-2	170	42.5	90	36	80	53.34
	Total	400	100	250	100	150	100
Weight forHeight Z Score (age ≤ 5 yers)	<-3	110	27.5	80	32	30	20
	-2 to-3	145	36.25	91	36.4	54	36
	>-2	145	36.25	79	31.6	66	44
	Total	400	100	250	100	150	100
Height for Age Z Score	<-3	40	10	38	15.2	12	8
	-2 to-3	100	25	70	28	30	20
	>-2	260	65	152	60.8	108	72
	Total	400	100	250	100	150	100
BMI for age Z score (age > 5yrs;	<-3	100	25	55	22	45	30
	-2 to-3	60	15	30	12	30	20
	>-2 to 1	236	59	161	64.4	75	50
	>1	4	1	4	1.6	0	0
	Total	400	100	250	100	150	100

36.25% of the total subjects ≤5 years old had severe wasting (severe acute malnutrition), while 36.24% had moderate wasting. In children > 5 years, 25% had severe thinness, 15% had thinness and only 4 (1%) case was overweight. 36% of the vaccinated subjects ≤5 years old had severe wasting (severe acute malnutrition), while 38% had moderate wasting.

Table 4: Relationship of measles antibody status with nutritional status of total subjects

Parameter of nutritional status		Antibody status						Total	P value
		Positive	N (%)	Negative	N (%)	Equivocal	N (%)		
Weight for Age z score (age ≤10yrs)	<-3	55	61.1	25	27.77	10	11.1	90	0.054
	-2 to-3	105	75	28	20	7	5	140	
	>-2	120	70.58	24	14.11	26	15.29	170	
Height for Age Z Score	<-3	20	50	12	30	8	20	40	0.024
	-2 to-3	45	45	40	40	15	15	100	
	>-2	180	69.23	65	25	15	5.76	260	
Weight for	<-3	60	54.54	33	30	17	15.45	110	

Height z Score (age <5 years)	-2 to-3	90	62.06	36	24.82	19	10.10	145	0.636
	>-2	90	62.06	36	24.82	19	10.10	145	
BMI Z score (age≥5yrs)	<-3	55	55	38	38	7	7	100	0.001
	-2 to-3	36	60	18	30	6	10	60	
	>-2 to 1	180	76.27	38	16.10	18	7.62	236	
	>1	2	100	0	0	0	0	4	

A highly statistically significant relationship was observed between BMI Z scores (in subjects aged ≥5yrs) and seropositivity, with higher seropositivity being noted in children with higher BMI z scores. Similarly, a statistically significant relationship was observed between height for age Z scores and seropositivity, with higher seropositivity being noted in children with higher height for age z scores.

Table 5: Nutritional status wise geometric mean titer (GMT) of measles specific igg antibody of total children

Parameters of nutritional status		GMT (mIU/mL)	P value
W/A z score	> -2SD	930	0.001
	<-2SD to-3SD	670	
	<-3SD	550	
H/A z score	-2SD	1780	0.005
	-2SD to-3SD	675	
	<-3SD	380	
W/H z score	> -2SD	575	0.555
	-2SD to-3SD	568	
	<-3SD	556	

It was not found statistically significant with p value 0.05 for seropositivity but significant with p value for antibody levels. In weight for length/height both seropositivity and GMT were found insignificant in well-nourished, moderately malnourished as well as severely malnourished subject.

Discussion

Measles is a highly contagious illness that mostly affects youngsters. Myxoviruses are the causative agents here.9 Measles accounts for 38 percent of all vaccine-preventable diseases worldwide. 10 Despite the availability of a safe and inexpensive vaccination, measles remains a leading killer of young children, particularly in underdeveloped nations. [11] 400 children die from measles per day, or 16 every hour, according to WHO data for 2014. [12,13] By their first birthday, 84% of children worldwide had gotten at least one dose of measles vaccine via regular vaccination. Despite these efforts, measles remains a major killer in third world nations because of underlying hunger and overpopulation. [14]

Sixty-two percent and counting of the individuals had proof of measles vaccination. However, no statistically significant association between age and vaccination status was discovered (p=0.164). Except for the unvaccinated group having a considerably lower mean weight for age Z score, there was no statistically significant difference between the groups at baseline. One-third had moderate wasting (36.24%), and one-third had severe wasting (36.25%) due to severe acute malnutrition. Of the children aged 5 and above, 25% were severely underweight, 15% were underweight, and just 4% were overweight. There was moderate wasting among 38% of the vaccinated individuals 5 years old and severe wasting among 36%. Vaccination had no influence on the children's nutritional health, according to McMurray et al. [15] There is no difference in the children's immune responses in relation to their dietary state. [14] months after immunization, all dietary groups show a small decrease in mean hemagglutination-inhibition titres. Antibody responses were robust in children who were not extremely malnourished, as reported by Smedman et al. [16], Halsey et al. [17], and Ekunwe et al. [18] Similarly, Lyamuya et al. [19] observed no statistically significant correlation between measles antibody levels and dietary intake. Even though cell-mediated immunity is inhibited rather than humoral immunity in malnourished children, seroconversion rates have been observed to be at least as high as in children who are not malnourished. [20,21] Similar to ours, one research found that stunting is linked to a diminished immune response. [22] Although we did not find this to be the case, similar research found that extreme wasting, like severe stunting, was linked to a reduced antibody response. Antibody titre was reported to be low in children with Kwashiorkor by Idris et al. [23] The humoral response to the measles vaccination was reported to be lower by Hafez et al. [24]

Children with higher body mass index z scores had a significantly greater prevalence of seropositivity, suggesting a strong correlation between the two. Seropositivity was also shown to be correlated with height for age Z scores, with greater seropositivity identified in children with higher height for age z scores. This demonstrated that even very undernourished youngsters in the neighborhood responded well to the measles vaccine.

Conclusion

Children's nutritional condition is related to their measles antibody titres and the measles immune globulin (GMT) of measles specific IgG antibody. However, there is conflicting evidence from different research on the quality of the antibody response. There is still a lack of understanding when it comes to the processes that drive the immune response. More studies are required in this area before any conclusions can be made.

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