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Original Research Article

A Hospital Based Observational Study to Evaluate the Association of Vitamin D Deficiency with Recurrent Respiratory Tract Infections in Children Less Than 5 Years

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Abstract:

Aim: The aim of the study was to evaluate the association of vitamin D deficiency with recurrent respiratory tract infections in children less than 5 years.

Methods: The present study was conducted in the department of Pediatrics, DMCH, Darbhanga, Bihar, India and all patients aged less than 5 years with and without recurrent respiratory tract infections attending the outpatient department or admitted as inpatient in the Department of Pediatrics who fulfill the inclusion criteria were included in the study. A total of 100 children were considered for study during the study period. Out of total 100 cases, 50 children with recurrent respiratory tract infections were taken as group I, while 50 children without recurrent respiratory tract infections (RRTI) were taken as Group II.

Results: Out of 100, 60 (60%) were males and 40 (40%) were females with mean age and mean weight of 35 ± 16.8 versus 36.3 ± 15.5 months and 12.1 ± 3.4 versus 11.5 ± 3.2 kg, respectively, and no significant difference was found (P > 0.05) between them. Majority (36; 36%) of the patients were in the age group of 51–60 months. In Group I (RRTI), 84% (42) children had vitamin D deficiency whereas, in Group II (no RRTI), 40% (20) had vitamin D deficiency having vitamin D deficiency increases the odds of RRTI by 11 times (the risk in increased by 11 times. In Group I (RRTI), Vitamin D was deficient in 55% of children who had not received exclusive breast feeding for 6 months whereas in Group II(no RRTI) 70% were Vitamin D deficient in non-exclusive breast feeding. 76% of Group I (RRTI) 75% of Group II (no RRTI) who was not exposed to sunlight had vitamin D deficiency.

Conclusion: Children with recurrent respiratory tract infections exhibited a significantly higher proportion of vitamin D deficient subjects. Vitamin D levels should be evaluated in children with recurrent respiratory tract infections and treated timely for better management of the problem.

Keywords: Vitamin D Deficiency, Respiratory Tract Infections, Children, Recurrent

Introduction

Globally, acute respiratory tract infections (ARTIs) are more common in children, leading to frequent visits to pediatricians and accounting for 20%–30% of deaths. Despite advances in the treatment of RTIs, pneumonia is the leading cause of death in 13%–16% of hospitalized pediatric patients in India. [1,2] Hence, there is a

need for effective and novel treatment modalities. [3] In addition to antibacterials, micronutrients and vitamin supplementations (especially A and C) play a significant role in the clinical resolution of RTIs. [4]

Researchers indicate that probably Vitamin D has a potential role in the prevention of ARTIs by increasing the production of natural antibodies in the body. [5] A study reported Vitamin D deficiency in children as a predisposing factor to RTIs and concluded that Vitamin D‐deficient children were 2.5 times more prone to RTIs, especially pneumonia, than children with adequate Vitamin D levels. [6] Vitamin D supplementation coupled with standard treatment might be useful in the treatment of antimicrobial‐resistant and opportunistic infections. [7] The active form of Vitamin D (cholecalciferol) has anti‐inflammatory effects on the acquired immune system by shifting CD4+ T‐cells pool from a T‐helper cell 1/T‐helper cell 17 response to a regulatory T‐cell/T‐helper cell 2‐dominated response. [8,9] Cholecalciferol also suppresses the T‐helper cell 2 response in allergic bronchopulmonary aspergillosis. Hence, cholecalciferol modulates both the acquired and innate immune systems. [10]

In India sub clinical vitamin D deficiency is wide spread in all age groups. Vitamin D can be obtained from sunlight exposure and diet. Since few foods contain vitamin D, sunlight exposure is the primary determinant of vitamin D status in humans. [11] The amount of Vitamin D from sun differs with skin colour, season and pollution. [12] Dietary intakes of both calcium and vitamin D are very low in majority of population except in high socioeconomic groups. [13] The concentration of Vitamin D must be interpreted in the context of season, as higher concentrations are observed during summer months. [14]

Vitamin D is found naturally in very few foods. Foods containing Vitamin D include some fatty fish (mackerel, salmon, sardines), and fish liver oils, egg yolk. Other sources of Vitamin D include fortified foods particularly dairy products and some cereals. Concentration of vitamin D is 0.5-101U/100m1 of breast milk. Pediatric respiratory tract infections are one of the most common reasons for physician visits and hospitalization, and are associated with significant morbidity and mortality. Respiratory infections are common and frequent diseases and present one of the major complaints in children. Recurrent throat problems in children are common and have an impact on the family. Time off school or parental time off work was significantly associated with parental worry and disruption.

The aim of the study was to evaluate the association of vitamin D deficiency with recurrent respiratory tract infections in children less than 5 years.

Materials and Methods

The present study was conducted in the department of Pediatrics, DMCH, Darbhanga, Bihar, India and all patients aged less than 5 years with and without recurrent respiratory tract infections attending the outpatient department or admitted as inpatient in the Department of Pediatrics who fulfill the inclusion criteria were included in the study. A total of 100 children were considered for study during the study period. Out of total 100 cases, 50 children with recurrent respiratory tract infections were taken as Group I, while 50 children without recurrent respiratory tract infections (RRTI) were taken as Group II. About 3 ml of blood was collected and sent for serum 25 (OH) vitamin D analysis.

Sampling Methods: This study was designed to detect a difference of at least 40% in the prevalence of vitamin deficiency between cases and controls. In order to detect this difference at 5% level

of significance a 90% power of the test the minimum sample required is 36 per group.

In order to reach a set of 72 evaluate children (cases and controls) we targeted 90 patients after factoring anticipated dropouts and patients who will not consent to participate. Serum 25 (OH) D levels were measured by Radio Immune Assay (RIA).

Inclusion Criteria:

1. Children between 1 month and 5 years of age.
2. Children with symptoms of recurrent respiratory tract infections.

Exclusion Criteria:

1. Children less than 1 month of age and greater than 5 years of age.
2. Children with congenital heart disease.
3. Recipients of massive dose of Vitamin D supplementation within last 4 weeks.

Statistical Methods: Statistical analysis was done using appropriate software.

Results

Table1: Age- and gender-wise distribution of recurrent respiratory tract infection patients

Age group (months)	Mean±SD	Males, n (%)	Females, n (%)	P value
11-20	14±3.2	14 (14)	10 (20)	0.350
21-30	26±2.6	10 (10)	10 (20)	
31-40	36±1.8	6 (6)	6 (6)	
41-50	43.3±4.1	8 (16)	14 (14)	
51-60	56±2.1	22 (22)	14 (14)	
Total		60 (60)	40 (40)	

Out of 100, 60 (60%) were males and 40 (40%) were females with mean age and mean weight of 35 ± 16.8 versus 36.3 ± 15.5 months and 12.1 ± 3.4 versus 11.5 ± 3.2 kg, respectively, and no significant difference was found (P > 0.05) between them. Majority (36; 36%) of the patients were in the age group of 51–60 months.

Table 2: Vitamin D levels Vs RRTI and Vitamin D mean (SD) among studied groups

Vitamin D levels(ng/ml)	Group I (RRTI) n=50	Group II (No RRTI) n=50	Total	OR (95% CI)	P Value
Deficiency<20	42(84%)	20 (40%)	62 (62%)	11.41 (3.69-37.17)	<0.001
Normal=/>20	8 (16%)	30 (60%)	38 (38%)		
Total	50	50	100 (100)		
Vitamin D mean (SD) among studied groups					
	Vitamin D nmol /I	**Group I (RRTI) n=50**	**Group II (no RRTI) n=50**	**T**	**P-Value**
	Mean (SD) Range	41.7 (15.1) 20-100	64.6 (34.2) 20-140	4.25	0.0001

In Group I (RRTI), 84% (42) children had vitamin D deficiency whereas, in Group II (no RRTI), 40% (20) had vitamin D deficiency having vitamin D deficiency increases the odds of RRTI by 11 times (the risk in increased by 11 times).). In addition to the above analysis, mean values of vitamin D were compared between the two groups. The mean value of vitamin D for Group I (RRTI) was 41.7 compared to Group II 64.6 (no RRTI). There is a highly significant positive correlation between vitamin D and RRTI group.

Table 3: Exclusive breast-feeding V/s Vitamin D among the studied Groups

Exclusive breast feeding for 6 months	Group I (RRTI) n=50			Group II (no RRTI) n=50		
	Vitamin D Deficient	Vitamin D Normal	Total	Vitamin D Deficient	Vitamin D Normal	Total
Given	20(45%)	4(50%)	24(48%)	6(30%)	20(66%)	26 (52%)
Not given	22(55%)	4(50%)	26(52%)	14(70%)	10(34%)	24 (48%)
Total	42	8	50	20	30	50
OR Df	0.65 (0.1-4.4)			0.02 (0.0004-0.19)		
P value	0.90			<0.001		

In Group I (RRTI), Vitamin D was deficient in 55% of children who had not received exclusive breast feeding for 6 months whereas in Group II(no RRTI) 70% were Vitamin D deficient in non-exclusive breast feeding.

Table 4: H/o Sunlight Exposure v/s Vitamin D among the studied Groups

H/o Sunlight Exposure (Between 10 am to 3 pm)	Group I (RRTI) n=50			Group II (no RRTI) n=50		
	Vitamin D Deficient	Vitamin D Normal	Total	Vitamin D Deficient	Vitamin D Normal	Total
Yes	10 (24%)	2 (25%)	12 (48%)	5 (25%)	23 (77%)	28 (56%)
No	32 (76%)	6(75%)	38 (76%)	15 (75%)	7 (23%)	22 (44%)
Total	42	8	50	20	30	50
OR Df	0.66 (0.1-8.1)			0.02 (0.0004-0.2)		
P value	0.95			<0.001		

Discussion

Respiratory tract infections in children are commonly encountered in clinical practice. These infections are one of the most frequent reasons for consulting a physician and contribute significantly to childhood morbidity and mortality. Globally, deaths across all age groups due to respiratory tract infections were reported to be 2.65 million in 2013. [15-18] India, Bangladesh, Indonesia, and Nepal accounted for 40% of the global acute respiratory infection mortality. Reports suggest that children under five years of age suffer about five episodes of acute respiratory infection per year. Moreover, acute respiratory infections are a leading cause of deafness as sequelae of acute otitis media. [19]

Vitamin D levels are significantly lower among children with recurrent respiratory tract infections. Studies have suggested further exploring the relationship between vitamin D deficiency and respiratory infections in children. [16,20,21]

In our study, there were insignificant differences between Group I (RRTI) and Group II (no RRTI) regarding age, gender and site of residence to explain the low levels of Vitamin D in the group l (RRTI). Similarly study done by Albannaet.al, also showed no significant difference between cases and controls regarding socio demographic variables. In a another similar study done by Wayse et.a1 [22] with 80 cases and 70 controls there was no significant difference between cases and controls with age distribution (P value= 0.09) similarly the study didn't find any

significance in the proportion of children in cases and controls pertaining to other socio demographic variables.

The main finding of our study was that serum 25- hydroxy Vitamin D concentrations in the Group I (RRTI) was significantly lower than those in the Group II (no RRTI). In Group 1 (RRTI), 84% had Vitamin D deficiency where as in Group II (no RRTI) 20% which is comparable to Wayseet.al22 (80% and 31%), Roth et.al [23] (84% and 60%), and little higher percentage of deficiency was found in Karatekin [24] i.e. 92% in group I and 80% in group II. Mean value of Vitamin D was low 41.7 in Group I (RRT1) compared to 64.6 in Group II (no RRTI) which is comparable with Wayse et.al [22] (22.8 and 38.4), Roth [23] et.al 48 (29.1 and 39.1) and Karatekins [24] (22.8 and 40.8). There is a significant correlation was found between Vitamin D deficiency and RRTI group (P-value= <0.001).

In our study, there were no significant differences with Vitamin D deficiency with respiratory tract infections between the age groups 1 month-5 years. However, Nighathaider et al [25] in their study of 137 children with respiratory tract infections showed that highest incidence of Vitamin D deficiency was found in age group of 2-12 months (79.8%). Vitamin D deficiency was seen (45%) in exclusively breastfed infants for 6 months. No significant association was found between exclusive breast feeding and Vitamin D deficiency in recurrent respiratory tract infections (F-value = 0.91). However, in another study done by Nighathaideret. a1 [25], Vitamin D deficiency was more common in breast fed infants i.e. 85%.

76% of Vitamin D deficiency was seen in children who were not exposed to sunlight and only in 24% cases Vitamin D was deficient even with adequate sun exposure (P-value=0.95) which is comparable to a study done by Nighathaider et.al [25], which showed Vitamin D deficiency is more common in children who were not exposed to sunlight (98.3%). [26]

Conclusions

Children with recurrent respiratory tract infections exhibited a significantly higher proportion of vitamin D deficient subjects. Vitamin D levels should be evaluated in children with recurrent respiratory tract infections and treated timely for better management of the problem. There is a need for prospective randomized trials in this field to establish cause effect relation between Vitamin D and RRTI. Education regarding the importance and timing of sun exposure should be done (1/2 hour a day for 5-6 day/week bet. 10 am to 3 pm). As most of the children are deficient in serum Vitamin D levels, routine Vitamin D supplementation may be recommended from birth onwards.

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