



STUDY OF VITAMIN D LEVELS IN CHILDREN WITH LOWER RESPIRATORY TRACT INFECTION AT CRGH AND ASSOCIATED HOSPITALS OF R.D. GARDI MEDICAL COLLEGE

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ABSTRACT **Background:** Lower Respiratory tract infections (LRTIs) remain among the most important causes of morbidity and mortality among children. Several studies have associated vitamin D deficiency with an increased risk of LRTIs. The main objective of this study is to assess the prevalence of vitamin D deficiency in children from 6 months to 5 years of age with LRTI, and to evaluate the correlation between vitamin D levels and the incidence and severity of LRTI. **Material and Methods:** A hospital based observational study was carried out in the patients admitted for LRTI in pediatric ward of CR Gardi hospital of RDGMC from October 2018 to July 2020. A total of 70 children were included between the age group 6 months to 5 years were selected for the study. Data were entered in MS excel and analyzed by software Stata 10. **Results:** Vitamin D levels were divided into three categories, deficient, insufficient, and sufficient. Average Vitamin D levels were 25.98ng/dl. Out of 70 children with lower respiratory tract infections 28.57% (n=20) children, had deficient levels (<20ng/ml) of vitamin D, 38.57% (n=27) had insufficient levels (21-29ng/ml), while 32.86% (n=23) patients had sufficient (>30ng/ml) vitamin D levels. **Conclusion:** Vitamin D levels are found to be deficient in 39% cases of LRTI, However 26% children had Vitamin D levels in a deficient range. Since 65% of children with LRTI had either deficient or insufficient levels of Vitamin D. Vitamin D should be estimated in all children with LRTI. In places where Vitamin D levels cannot be estimated Vitamin D supplementation should be given. There is a need of more studies to be done on a larger sample size to reach to a certain conclusion.

KEYWORDS : LRTI, Vitamin D levels, Children

INTRODUCTION:

Lower respiratory tract infections (LRTIs) remain among the most important causes of morbidity and mortality among children. Several studies have associated vitamin D deficiency with an increased risk of RTIs, and vitamin D supplementation has been proposed as a possible preventive measure against RTIs in children.⁽¹⁻³⁾ The Vitamin D is a regulator of immune function and is implicated in predisposing to infection, autoimmune and cardiovascular diseases, mental illness, and cancer. Vitamin D, or the “sunshine vitamin”, is not just a vitamin, it is also a prohormone with numerous functions in the body.⁽⁴⁾ “Prohormone” refers to a group of fat soluble secosteroids. The two major forms of are vitamin D2, or ergocalciferol, and vitamin D3, or cholecalciferol.⁽⁵⁾ The best understood function of vitamin D is in the absorption of calcium from the small intestine, which helps to prevent diseases such as osteoporosis and osteomalacia in adults and rickets in children.⁽⁶⁻¹⁰⁾ Accordingly, there is accumulating evidence that consumption of vitamin D may reduce respiratory tract infection (RTI) susceptibility in children.^(11,12) Initially, the prototypal disease link was tuberculosis (TB), but there are now studies that support, a connection with several other RTIs, such as acute otitis media, pharyngitis, rhinosinusitis, bronchiolitis and pneumonia.^(13,14) Several recent studies have shown that vitamin D has different immunomodulatory properties associated with the risk of RTIs in childhood. In this regard, it is very important to understand the definition of deficiency and insufficiency of vitamin D and when and how to treat this condition. Unfortunately, there is no consensus, although a level of at least 10ng/ml 25-hydrocholecalciferol (25-OH-D) is thought to be necessary to promote bone mineralization and calcium homeostasis, and a concentration between 20ng/ml and 50ng/ml is considered adequate to provide an immunomodulatory effect. Available data support a role of vitamin D deficiency in the risk of pediatric tuberculosis, recurrent acute otitis media, and severe bronchiolitis, whereas further studies are needed to confirm an association in children with recurrent pharyngotonsillitis, acute rhinosinusitis and community acquired pneumonia.⁽³⁾ Lower respiratory tract infections (LRTI) or pneumonia affect nearly 120 million children worldwide annually and account for 1.8 million deaths annually in those aged under 5 years.⁽¹⁷⁾ The aim of this study is to assess the prevalence of vitamin D deficiency in children from 6 months to 5 years of age with LRTI, and to evaluate the correlation between vitamin D levels and the incidence and severity of LRTI in our institution.

MATERIAL AND METHODS:

A hospital based prospective observational study was carried out in children (According to NFHS IV (2015-2016), children <3yr suffered from ARI (cough+ short, rapid breathing) during preceding 2wks) who

were of 6 months to 5 years of age with LRTI with clinical signs and laboratory findings of lower respiratory tract infections (LRTI) with or without co morbidities admitted at pediatric ward of C.R.G.H. and associated hospitals of R.D. Gardi Medical College, Ujjain from October 2018 to July 2020. In a study the proportion of children with LRTI having Vitamin D deficiency was 30% Newcastle-Ottawa Scale (NOS). To calculate the sample size we assumed the proportion of Vitamin D deficiency in LRTI as 30% or 0.30.

The sample size calculation was done to detect a 20% difference around the proportion of 0.3, with power of 90% and a two-sided alpha of 0.05, for a sample 65 comparison of proportion. The estimated minimum sample size is 70 children with LRTI. A pretested written Proforma was used to record the detailed history, clinical findings and investigations. A detailed history including age, gender, birth order, socioeconomic status, malnutrition status, vaccination status, medical and drug history, nutrition and breastfeeding history. A detailed physical examination was also performed on each child infected with LRTI. Vitamin D estimation was done using MAGLUMI 25-OH VITAMIN D Kit manufactured by Snibe diagnostics. The test will be performed on MAGLUMI fully auto chemiluminescence immunoassay (CLIA) analyzer. Data was entered in MS excel and analyzed by a software STATA 10. Descriptive studies of mortality and complications will be analyzed and presented in terms of percentages. Chi-square test will be used to compare the proportion of death and complications between the groups.

OBSERVATION AND RESULTS:

In the present study group, total n=70 patients were enrolled. Mean age of children was 21 months. With 44% male or 56% females. (Table 1)

Table 1 shows distribution of study group according to the age and sex

Age Group (in months)	Number of patients(n=70)	Percentage (%)
<12	16	22.85
12-23	10	14.28
24-35	13	18.57
36-47	11	15.71
48-60	17	24.28
Total	70	100
Sex		
Male	31	44.3
Female	39	55.7
Total	70	100

Table 2 shows results of Vitamin D levels in 70 children involved in the study

Vitamin D3 Levels	Number of patients with LRTI (n=70)	Percentage (%)	P value
Deficient (<20ng/ml)	20	28.57	0.004
Insufficient (21-29ng/ml)	27	38.57	
Sufficient (>30ng/ml)	23	32.86	
Total	70	100	

Table 3 shows correlation of vitamin D levels with socio-demographic characteristics

Characteristics	Total	Normal	Deficiency + Insufficiency	Odds Ratio (OR)	p Value	Confidence Interval (CI)
Age						
6-12 months	16 (22.85%)	6 (37.5%)	10 (62.5%)	1.305	0.044	0.40-4.1
12-60 months	54 (77.14%)	17 (31.48%)	37 (68.51%)			
Gender						
MALE	31 (44.28%)	12 (38.70%)	19 (61.29%)	1.60	0.002	0.58-4.3
FEMALE	39 (55.71%)	11 (28.20%)	28 (71.79%)			
Low birth weight						
YES	8 (11.42%)	1 (12.5%)	7 (87.5%)	0.25	0.221	0.02-2.24
NO	62 (88.57%)	22 (35.48%)	40 (64.51%)			
Exclusive breast feeding						
YES	4 (5.71%)	0 (0%)	4 (100%)	0.62	0.272	0.18-3.2
NO	66 (94.28%)	23 (34.84%)	43 (65.15%)			
Malnutrition						
MAM	54 (77.14%)	20 (37.03%)	34 (62.96%)	0.980	0.983	0.21-4.5
SAM	16 (22.85%)	3 (18.75%)	13 (81.25%)			
Socio-economic status						
LOWER	62 (88.57%)	20 (32.25%)	42 (67.74%)	0.541	0.014	0.16-1.77
UPPER	8 (11.42%)	3 (37.5%)	5 (62.5%)			
Cross ventilation						
PRESENT	42 (60%)	11 (26.19%)	31 (73.80%)	0.47	0.007	0.17-1.3
ABSENT	28 (40%)	12 (42.85%)	16 (57.14%)			

MAM- Moderate acute malnutrition, SAM- Severe acute malnutrition

DISCUSSION:

On the basis of results of Vitamin D level it has been divided into three categories namely, deficient, insufficient, and sufficient. Average Vitamin D levels were 25.98ng/dl. Out of 70 children with lower respiratory tract infections 28.57% (n=20) children, had deficient levels (<20ng/ml) of vitamin D, 38.57% (n=27) had insufficient levels (21-29ng/ml), while 32.86% (n=23) patients had sufficient (>30ng/ml) vitamin D levels. Vitamin D, or the "sunshine vitamin" is not just a vitamin; it is also a prohormone with numerous functions in the body. Prohormone refers to a group of fat-soluble secosteroids. The two major forms are vitamin D2, or ergocalciferol, and vitamin D3, or cholecalciferol^(12,13). Vitamin D2 (ergocalciferol) and vitamin D3 (cholecalciferol) can be ingested from different types of food, or they can be synthesized through exposure to ultraviolet radiation B (UVB)⁽¹⁴⁾. Skin synthesis usually contributes 80 to 90 % of an individual's vitamin D, but it depends on several factors⁽¹⁵⁾. In the present study, 58.57% (n=41) children had birth weight between 1.5-2.5 kgs having lower respiratory tract infections, while 41.42% (n=29) had weight >2.5kgs had lower respiratory tract infections. Mean birth weight was 2.74 kgs. The children having low birth weight were

58.51% (n=41). They had vitamin D deficiency in 87.5% (n=7), as compared to normal birth weight children who had 64.71% (n=40) vitamin D deficiency (p value- 0.221, OR-0.25, 95% CI-0.02-2.24). Present study, found that low birth weight children, had more vitamin D deficiency suffered from lower respiratory tract infections, as compared to normal birth weight children. But the correlation was not statistically significant. Similar study done by Karatekin et al⁽¹⁶⁾ in 2009 in Istanbul, Turkey, showed that the prevalence of Vitamin D deficiency in children having low birth weight was 87.5% (n=25). In the present study, 77.15% (n=54) had moderate acute malnutrition (MAM), whereas 22.85% (n=16) had severe acute malnutrition (SAM), with lower respiratory tract infections. Grellety E and Golden MH⁽¹⁷⁾ in 2016, surveyed globally and showed that in (n=1832) total 24.4% children had malnutrition. Out of them 75.6% were having moderate acute malnutrition whereas, 24.4% had severe acute malnutrition. These findings are similar to the present study. In the study group, 75.71% were fully immunized while, 24.29% were partially immunized, with lower respiratory infections (LRTI). Biloglav et al⁽¹⁸⁾ in 2008, in India, noticed 84.7% children had incomplete immunization, with lower respiratory tract infections. In the present study, 38.57% children who had lower respiratory tract infections had insufficient Vitamin D levels, 28.57% had deficient in Vitamin D levels, whereas 32.86% (n=23) had sufficient levels of Vitamin D. This data is statistically highly significant (p value-0.004). Mean vitamin D level was 25.98ng/ml (±9.09) in the study group. There is a direct correlation of Vitamin D deficiency and insufficiency with lower respiratory tract infections (LRTI) in the study group. Similar study conducted by Salimpour⁽¹²⁾ hypothesized a link between Vitamin D and pneumonia, while he found that 47.3% (n=200) children also had history of LRTI. In the present study, 62.5% children of age group of 6-12 months were found deficient in vitamin D levels, while 37.5% had normal vitamin D levels. In the age group between 12-60 months, out of 54 children, 68.51% had deficiency of vitamin D, while 31.48% had normal serum vitamin D levels. There is a strong correlation between age and serum vitamin D levels, as the age increases there are more chances of vitamin D deficiency with lower respiratory tract infections. The data is statistically highly significant (p value-0.044) In the present study, 71.79% females had deficient vitamin D levels, while 28.20% (n=11) had normal vitamin D levels. 61.29% males had serum vitamin D deficiency, while 38.70% had normal vitamin D levels with lower respiratory tract infections.

CONCLUSION:

On the basis of this study, we conclude that vitamin D deficiency is associated with LRTI. However, 65% patients had either deficient or insufficient levels of Vitamin D, therefore supplementation of Vitamin D in each child and a need of measuring the levels of vitamin D prior to any supplementation is advisable. Vitamin D deficiency is common in children with LRTI especially among exclusively breastfed babies and 65% children who were born preterm and not received supplements of vitamin D and among lower socio economic class. Vitamin D deficiency is also common in children with recurrent LRTI. Early recognition and treatment of vitamin D deficiency can prevent morbidity associated with rickets and possibly frequent LRTI.

Recommendations:

All children with LRTI should be assessed for their vitamin D levels, as vitamin D deficiency increases the chances of LRTI amongst them. Study strongly recommends early supplementation of vitamin D according to Recommended Daily Allowance (RDA), to all children to prevent vitamin D deficiency, as it makes them prone to LRTI, which is an important cause of under five (U5) mortality.

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Ethical approval:

The study was approved by the Institutional Ethics Committee of RDGMU Ujjain (MP)

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