

Vitamin D Deficiency and Acute Otitis Media among Children Visiting a Tertiary Care Centre in Eastern Nepal

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ABSTRACT

Background

There have been various studies to draw out the association between acute otitis media (AOM) and vitamin D deficiency but the results are conflicting.

Objective

To explore the relationship between vitamin D deficiency and acute otitis media.

Method

The comparative cross-sectional study was conducted in which children aged five to fifteen years were included. Sixty children diagnosed with acute otitis media were kept in group A while 60 children diagnosed with conditions other than acute otitis media were included in Group B. Then the Vitamin D level was sent in both the groups and compared.

Result

Fifty-four participants in group A had an insufficient level of Vitamin D while six participants had a sufficient level of Vitamin D and none had an excess level of Vitamin D while in Group B, fiftytwo participants had an insufficient level of Vitamin D while eight participants had a sufficient level of Vitamin D. The mean vitamin D of the cases was 22.12 ± 7.896 ng/ml, and that of the controls was 22.58 ± 7.056 ng/ml for the controls ($p = 0.737$).

Conclusion

Both the children with acute otitis media and without acute otitis media had lower levels of Vitamin D in similar proportions. Therefore, we can conclude that there is no association between Vitamin D level and acute otitis media.

KEY WORDS

Acute otitis media, Children, Vitamin D

INTRODUCTION

Acute Otitis media (AOM) is the inflammation of the middle ear within 48 hours with characteristic signs and symptoms like earache, fever, and a red, dull, bulging, immobile tympanic membrane (TM).^{1,2} It is the most common bacterial infection among children and the most frequent reason for outpatient antibiotic therapy.³ Upper respiratory tract infection (URTI) and AOM are closely linked; 29-50% of all cases of URTI develop into AOM.⁴ Recent studies indicate that low plasma vitamin D concentrations are related to increased incidence of respiratory infections.⁵⁻⁸ During a bacterial infection, macrophages convert 25-vitamin D into 1,25 OH vitamin D, which directly induces the expression of genes encoding for antimicrobial peptides, particularly cathelicidin which plays a central role in host defence against respiratory tract pathogens.⁹ Consequently, Vitamin D may modulate the incidence and severity of bacterial and viral infections including AOM.¹⁰

Despite the high prevalence of AOM in the pediatric population, no studies have been conducted in Nepal on the association of Vitamin D deficiency with AOM. Most of the researches are from the developed world and thus do not truly represent the prevalence and patterns of AOM in the developing world. Also, various studies have tried to draw out the association between them but the results are still debatable.¹¹⁻¹⁴

This study was therefore conducted to compare the association of Vitamin D deficiency in patients with AOM with those without AOM presenting to Ear, Nose, and Throat (ENT) Out Patient Department (OPD) of BP Koirala Institute of Health Sciences (BPKIHS).

METHODS

It was a comparative cross-sectional study conducted in ENT OPD, BPKIHS from September 1st, 2018 to August 31st, 2019. A total of 120 patients were purposively allocated into two groups A and B. Sixty children diagnosed with acute otitis media after clinical and otoscopic examination were kept in group A. While 60 children diagnosed with conditions other than acute otitis media after clinical and otoscopic examination were included in Group B. The diagnosis was confirmed by one of the senior faculty members and then the Vitamin D level was sent in both the groups. Blood samples were taken from the cases and controls to evaluate the level of vitamin D measured by Chemiluminescence Immunoassay (CLIA). Vitamin D level of < 30 ng/ml was considered insufficient, 30 to 100 ng/ml was regarded as sufficient, and > 100 ng/ml was considered excess.

Prior to the conduction of the study, ethical clearance was obtained from the Institutional Review Board (IRB) of BPKIHS and before enrolment, informed consent was taken from the guardians. Children aged five to fifteen

years diagnosed as AOM accompanied by parents or legal guardians were included in the study. However, those with conditions favoring an attack of AOM like severe atopy, acquired or congenital immunodeficiency, cleft palate, craniofacial abnormalities, obstructive sleep apnoea syndrome, and syndromic babies e.g., Down's syndrome were excluded from the study.

The collected data was checked thoroughly for completeness and then edited and coded first. The master chart was prepared in Microsoft Excel and data was then transferred into Statistical Package for Social Sciences (SPSS) Version 11.5. Descriptive statistics like mean, percentage, standard deviation, etc were used to describe the characteristics of collected data. Bivariate analysis (chi-square test) was used to see the association between Vitamin D and otitis media. Significance was assessed at a 95% confidence interval i.e. p-value less than 0.05.

RESULTS

A total of 120 participants were enrolled in this study out of which 60 were included in Group A and 60 in group B. None of them were lost to follow-up.

In comparing group A and group B, the mean age in group A was 8.113 while that in group B was 9.45. A maximum number of participants in group A belonged to age five and that in group B belonged to age five and eight years. Applying Independent T-test, the p-value was found to be 0.024 which was statistically significant.

In both Group A and Group B, almost half were males and half were females. Applying the chi-square test the p-value was found to be 0.714 which was statistically non-significant.

Among participants in Group A, 54 participants had an insufficient level of Vitamin D while six participants had a sufficient level of Vitamin D and none had an excess level of Vitamin D. The average level of Vitamin D was 22.12 ± 7.896 ng/ml. Among participants in Group B, 52 participants had an insufficient level of Vitamin D while eight participants had a sufficient level of Vitamin D. The average level of Vitamin D was 22.58 ± 7.056 ng/ml. Applying independent T-test, the p-value was found to be 0.737 which was statistically non-significant.

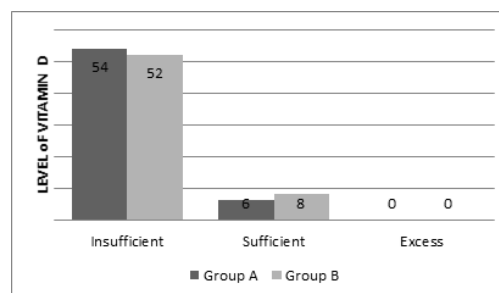


Figure 1. Vitamin D level in Group A versus Group B

DISCUSSION

AOM is a very common disease among children. Various aetiologies and risk factors have been studied for its causation, vitamin D deficiency being one of them. However, there have been conflicting results among various studies in the past. It has been suggested that vitamin D plays a significant role in the immune system by increasing the conversion of immature monocytes to mature macrophages and thus promoting phagocytosis, bactericidal activity, chemotaxis and production of TGF B from other monocyte-like cells. Furthermore, Vitamin D also increases synthesis of bactericidal agents like endogenous defense genes and cathelicidin. Hence, in cases of vitamin D deficiency tendency to infection rises.^{15,16} However, there have been conflicting results regarding effect of vitamin D level in AOM among various studies in the past. Thus we conducted this study to evaluate association between these two.

In our study, AOM was more prevalent among children aged five years and this finding was statistically significant. Similar results were seen in that of a prospective study conducted by Simões et al. in which the prevalence of AOM and otitis media with effusion (OME) was highest in children under the age of six years and steadily declined as children got older. A systemic review analyzing 59 studies found that in children less than six years old the prevalence of otitis media was found to be 9.2% in Nigeria, 10% in Egypt, 6.7% in China, 9.2% in India, 9.1% in Iran and 5.1 to 7.8% in Russia.¹⁷ Contrastingly, Maharjan et al. reported that the maximum number of children with acute otitis media belonged to the age group 13 to 15 years.¹⁸

Our result regarding sex was similar to the result of Teele et al. who found that the risk of single or multiple episodes of AOM was higher in males than females.¹⁹ Zakzouk et al. diagnosed 100 patients with AOM, among which 57 were males and 43 were females.²⁰ However, the results were not statistically significant. However, contrasting results were observed in a cross-sectional study conducted in Bangladesh where girls were relatively more sufferer affected by AOM than boys (6.6% vs 4.5%).²¹

In agreement with our results, Park et al. also concluded that there is no relation between vitamin D deficiency and AOM.¹¹ However, in a study by Marchisio et al. patients with AOM had lower levels of Vitamin D in comparison with patients without AOM.¹² Similarly, Thronton et al. also found out that Vitamin D deficiency was associated with an increased risk of gastrointestinal and ear infections. However, in our study children in both groups had insufficient levels of Vitamin D contradicting their findings.¹³ Another study conducted by Elemraid et al. brought surprising showed contradictory results in comparison to ours where participants with

AOM had higher levels of Vitamin D than controls.¹⁴ In our study, nearly ninety percent of the children had an insufficient level of Vitamin D. This result is similar to a study conducted in the Kavrepalanchowk district of Nepal in 2015 where they found that nearly ninety percent of the children had insufficient Vitamin D level and four percent among them had severe Vitamin D deficiency.²² There have been several studies conducted in Turkey, the Middle East and India where they have found that Vitamin D deficiency is found in nearly fifty percent of the children.²³ This result is no different from ours.

There may be several reasons for the low vitamin D level in our study. The participants chosen were children between the age group five to fifteen years. These children are mostly school going children who and stay indoors most of the time and their exposure to sunlight may be relatively low. Similarly, Nepal being a poor country, a large number of the population lies below the poverty line. Due to poverty most children cannot get an adequate supply of nutrients needed for them. Besides these, there are other factors like wearing full-sleeved clothes, and chronic gastrointestinal disease leading to defective absorption of Vitamin D, which may add to Vitamin D deficiency. Similarly, children who visit our centre have relatively increased pigmentation which also may have contributed to hypovitaminosis D.

Since the level of Vitamin D in both groups was insufficient, it could not be inferred that a decrease in vitamin D level is associated with AOM. Despite decreased Vitamin D level, since children were asymptomatic for any other condition, there may be a need for the "sufficient" level of Vitamin D to be re-evaluated.

Limitations of our study include a small sample size, single centre study, selection bias and, the possibility of several confounding factors like sunlight exposure, geographical structure, cultural values and nutritional intake. Further studies taking all these factors into account are needed in the future. Additionally, our study did not include children less than five years of age as they may be uncooperative to blood withdrawal. So, further studies including children less than five years of age are also needed.

CONCLUSION

Among the paediatric age group five to fifteen years, we found that the disease is more common in early childhood and the episodes decrease as age increases. Both the children with AOM and without AOM had lower levels of Vitamin D in similar proportions. Therefore, we can conclude that there is no association between Vitamin D level and Acute Otitis Media.

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