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# Comparison and Evaluation of Vitamin D Levels in Children with and Without Caries

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## Abstract

**Aim:** To compare and evaluate vitamin D level in children with and without caries.

**Materials and Methods:** A total of 30 children between the age 4 and 7 years were selected for the study. The Sample was divided into group 1 (15) children with caries and group 2 (15) without caries control group .Caries status of the children was recorded using deft index. Blood samples for serum vitamin D were taken and the data collected were compiled and subjected to appropriate statistical analysis.

**Results:** Experimental group showed mean serum vitamin D level of 13.5mg/mL and control group showed mean serum vitamin D level of 21.0 mg/mL.

**Conclusion:** A deficiency in mean serum vitamin d levels may be implicated as a risk factor for incidence of dental caries.

**Keywords:** Children, Vitamin D Deficiency, Incidence.

## Introduction

Vitamin D plays an important role in maintaining musculoskeletal and dental health through regulation of the absorption of calcium and phosphorus in the small intestine.[1.2] Excessive vitamin D induces overgrowth of cement, causes excessive cellular proliferation with cells invading the marrow space of the jaw bone, thickens the inner part of dentin, and results in pulp stones [3,4]

The interaction of 1,25-dihydroxyvitamin D with the vitamin D receptor increases the efficiency of absorption of intestinal calcium by up to 40% and phosphorus up to 80%.[5,6] Vitamin D deficiency is defined as a 25-hydroxyvitamin D (25[OH] D) level of less than 20 ng/mL.[7,8]

There are many causes of vitamin D deficiency, including heritable disorders like obesity,[9] dark skin[10] and acquired disorders like lack of sunlight, drugs,[11] and malabsorption. Higher serum levels of 25-hydroxy vitamin D [25(OH)D] above 30 nm/mL are associated with improved oral health outcomes.[12]

Vitamin D also shows an immunological role, as it can induce the formation of antimicrobial peptides, such as cathelicidin and defensins. Salivary antimicrobial peptides concentrations Showed large differences between individuals, with a Significantly higher level of salivary defensins in children with no caries. [13,14] The secretion rate and quality Of the saliva are important in caries development and Also in remineralization. Saliva is key factor to maintain the integrity of the teeth as well as the soft tissues of Oral cavity[15, 16,17]Despite the fact that vitamin D deficiency and SECC are common conditions worldwide, very Few studies have been done to establish the correlation between vitamin D deficiency and SECC[18,19,20]

Vitamin D deficiency causes discontinous lamina dura in primary and permanent teeth, Incomplete calcification of dentin,[21,22]Delayed tooth eruption,Spontaneous periapical abscess without etiological factors, such as dental caries, abrasion, tooth fracture, and tooth trauma. [23,] In addition, because vitamin D is involved in tooth development, vitamin D deficiency leaves teeth vulnerable to dental caries due to tooth enamel defects[24]

The aim of this study was to compare and evaluate vitamin D level in children with and without caries.

**Materials and Methods**

A double-blind, prospective, randomized study, involving 30 children aged four to seven years, was performed at National Dental college and Hospital, Derabassi, Punjab. The study was conducted after obtaining written informed consent from the parent/guardian and after obtaining institutional ethical clearance. Two groups of 15 children each were included in the study, and were classified under the case group and the control group; the distribution of these groups was as follows.

The case group: This group comprised of 15 children aged between 4 and 7 years with multiple decayed teeth who were selected from the Outpatient Department of Pedodontics and Preventive Dentistry, NDC Dental College, Derabassi, Mohali, Punjab, India.

The control group: The control group comprised of 15 children aged between 4 and 7 years with no caries teeth who were selected from the Outpatient Department of Pediatrics, NDC Dental College, Derabassi, Mohali, Punjab, India

Inclusion criteria for the case group

1. Healthy chil- dren between 4 and 7 years of age with no chronic medical illness.

2. Presence of SECC pathology.

Inclusion criteria for the control group:

1. Healthy children between 4 and 7 years of age with no chronic medical illness.

2. Patients who present with no frank cavitated lesions upon visual examination (deft 0).

Since all patients were selected at National Dental College, they all belonged to the same socioeconomic status. For each child of case and control groups, following data were collected.

Recording of dental caries status: Oral examination of each child was done to record the total number of deft. Examination of all the children in both the groups was conducted by one investigator using proper light and with the help of probe/explorer and mouth mirror after proper drying of the teeth. Caries status of the children was recorded using deft index.

The dental caries status for both the groups was noted in a proforma attached. A designed questionnaire was prepared to determine child s' medical history ,oral health, eating habits, parent's oral health, and socioeconomic status, and was filled by parents of children of both the case and the control groups. A venous blood sample (approximately 2.5 mL) was obtained after taking consent from the parents, by a technician from the clinical

pathology laboratory for the estimation of serum 25(OH) vitamin D. All the data collected were compiled and subjected to statistical analysis using mean, paired t-test, and compilation of the result was done

**Results**

A total of 30 children were recruited and divided into two groups of 15 children with Caries (case group) and 15 children with no caries (control group). Comparison of the demographic profile of case and control groups was done. Both groups showed no difference in terms of age and male/female ratio (Table 1). Age, sex, deft score, and serum 25(OH) vitamin D levels in the case group were collected.

Table 1: Socio-demographic data of children in the study

| Socio Demographic Factors | Group A | Group B |
|---|---|---|
| Age(years) | 4.4±1.1 | 4.1±0.9 |
| Sex(male/female) | 10/5 | 11/4 |
| Deft score | 8.4 ± 1.3 | 0 |

The mean levels of serum 25(OH) vitamin D levels were compared between case (group A) and control groups (group B) and there was a statistically significant difference with a p-value of <0.0001 (Graph 1). Association of vitamin D deficiency and Deft was examined. There was no particular trend of vitamin D level in children with no caries.In the case group, 15 children had serum 25 (OH) vitamin D levels in deficiency range (<20 ng/mL), (Table 2). Age, sex, deft score, and serum 25(OH) vitamin D levels in the control group were collected. In the control group, 6 children had serum 25(OH) vitamin D levels in deficiency range (<20 ng/mL), while 9 had level in sufficient range (>20 ng/mL)

(Table 3)

Comparison of the vitamin D levels between case and control groups was done. The comparison of mean vitamin D levels between case and control groups was also done. The case group has a mean serum 25(OH) vitamin D level of 13.5 ng/mL (3.2 SD, 95% confidence interval of 10.5–13.8)(graph 2) and the control group has a mean serum 25(OH) vitamin D level of 21.0 ng/mL (2.75 SD, 95% confidence interval of 18.56–21.65) (Table 4 and graph 3).

Table 2: Deft status and vitamin D levels in group A

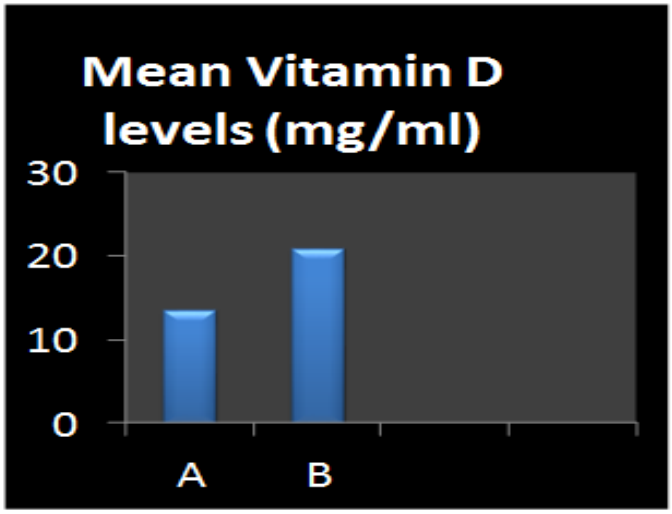
| *Age (years)* | *Sex* | *Deft status* | *Serum 25(OH) vitamin D (ng/dL)* |
|---|---|---|---|
| 5 | M | 9 | 10.1 |
| 6 | M | 8 | 16.4 |
| 4 | M | 7 | 15.1 |
| 5 | M | 8 | 13.5 |
| 7 | M | 9 | 7.7 |
| 4 | F | 11 | 15.2 |
| 5 | F | 7 | 17.8 |
| 6 | M | 8 | 16.1 |
| 5 | M | 8 | 17.6 |
| 5 | M | 8 | 15.5 |
| 6 | F | 9 | 7.8 |
| 4 | F | 10 | 12.8 |
| 5 | M | 10 | 11.1 |
| 6 | F | 8 | 12.1 |
| 5 | M | 10 | 14 |

Table 3: Deft status and vitamin D levels in case control group B

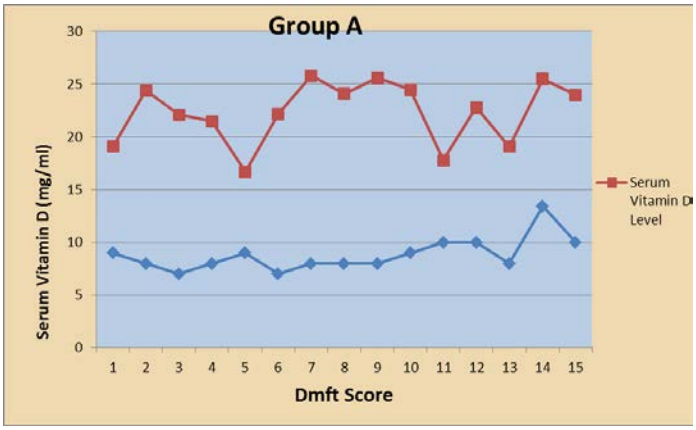
| Age (years) | Sex | Deft status | Serum 25(OH) vitamin D (ng/dL) |
|---|---|---|---|
| 6 | M | 0 | 24.8 |
| 5 | M | 0 | 21.4 |
| 6 | M | 0 | 26 |
| 7 | F | 0 | 27 |
| 5 | F | 0 | 22.5 |
| 4 | F | 0 | 20.1 |
| 5 | M | 0 | 19.6 |
| 6 | M | 0 | 18.1 |
| 5 | M | 0 | 21.0 |
| 5 | F | 0 | 18 |
| 6 | M | 0 | 20.5 |
| 6 | M | 0 | 19.5 |
| 4 | M | 0 | 20.1 |
| 5 | M | 0 | 18.6 |
| 7 | M | 0 | 18.5 |

Table 4: Comparison of mean vitamin D levels between case and control groups

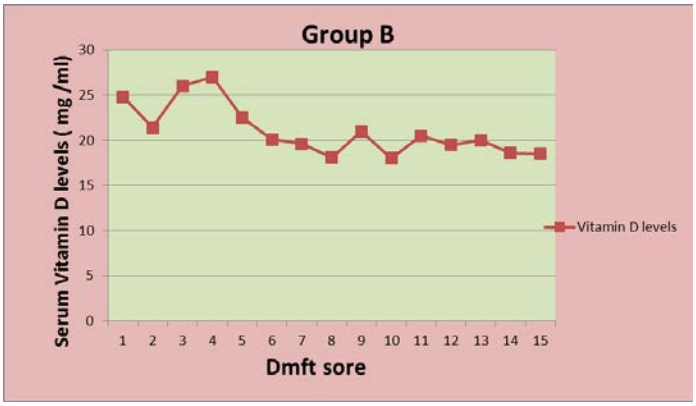
| Group | Mean vitamin D levels (ng/mL) | SD | p-value |
|---|---|---|---|
| Case | 13.5 | 3.2 | <0.0001 |
| Control | 21.0 | 2.75 | |




Graph 1 Mean vitamin D levels in case group A and control group B




Graph 2: Vitamin D Levels In The Group A ; Showing Correlation Between Levels Of Vitamin D And Dmft Score




Graph 3: Vitamin D levels in the Group B

**Discussion**

Research on vitamin D supplementation and dental caries began with a study by Mellan et al, who reported that intake of vitamin D in children considerably reduced dental caries and hypoplasia Vitamin D helps in the absorption of calcium and phosphorus from the intestine and both calcium and phosphorus help in the mineralization of the teeth.

Vitamin D deficiency in utero is found to be associated with enamel hypoplasia because of the metabolic insult to ameloblasts[25].Enamel hypoplasia results from defective amelogenesis and is clinically diagnosed by the absence of enamel and by pitting, grooves, or irregularities of enamel. These defects increase the risk of early colonization by cariogenic bacteria, resulting in caries[26].Vitamin D also

has an immunological function. It induces the expression of antibacterial proteins like cathelicidin and defensins.

The defensins and cathelicidin have multiple antimicrobial activity against gram-negative and gram-positive bacteria and Candida albicans and are effective in vitro against oral microorganisms, such as Streptococcus mutans, Porphyromonas gingivalis, and Actinobacillus actinomycetemcomitans. Vitamin D prevents infection by regulating B-cell proliferation and immunoglobulin production. [27]

Vitamin D is essential for the maintenance and utilization of a specific pool of calcium required for normal fluid and electrolyte of the saliva of the parotid gland. Low salivary flow rate and high viscosity are associated with high dental caries risk. Various caries-protective factors, such as calcium, inorganic phosphate, pH-increasing substances, and antimicrobial agents are present in saliva. Hence, vitamin D deficiency is an important environmental factor in predisposition to dental caries.

The prevalence of vitamin D deficiency is 50 to 90% in the Indian subcon- tinent and is due to low dietary calcium along with dark skin color and indoor lifestyle. Vitamin D deficiency is due to several reasons like low dietary intake, decreased cutaneous synthesis (because of social and religion-based practice of burkha, seasonal changes , fear of cancer in sunlight, and keeping the child indoor, and dark pigmen- tation of the skin), high rate of exclusive breast feeding, and deficiency of vitamin D in mother. In this study, we found statistically significant difference between mean levels of vitamin D in case and control groups.

In our study, the prevalence was more, but this high prevalence could be due to the fact that majority of other studies were done in Caucasian population with fair skin and more conversion of cholesterol into vitamin D in skin in contrast to dark skin individuals (Indian) where decreased conversion takes place. Schroth et al[28] did a pilot study comparing the difference in vitamin D levels in children with SECC and without SECC. Schroth et al multiple regression analysis showed that SECC, low milk consumption, and winter season were significantly associated with lower 25(OH)D con- centrations. In this study, significant correlation between vitamin D levels and SECC (p-value 0.0001) is also found. This means that children with lower values of serum vitamin D have more severe dental caries as assessed by deft score.

Herzog et al[29] found no significant association between vitamin D levels and caries experience. In this study, there is statistically significant difference between mean vitamin D levels of children with SECC and children with no caries. Significant correlation between vitamin D levels and SECC was also found. However, this studyhad certain limitations.

This was a Single-center study with small sample size. Therefore, There is a need for large multicenter studies. But our study, which is the first of its kind in Punjab, can be a data base for future studies. Another limitation is that our study was a Cross-sectional study and therefore, Prospective studies needed to see the beneficial effect of Vitamin D supplements.

**Conclusion**

Our results showed that vitamin D deficiency is an important risk factor both for incidence of dental caries and for its severity in children.In India where despite adequate sunlight vitamin D deficiency is highly prevalent, this is an important modifiable risk factor for dental caries in children. Hence, by supplementing vitamin D in children and preventing the deficiency of vitamin D, dental caries may be prevented.

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