# The association between vitamin D levels and dental caries: A systematic review and dose-response meta-analysis of cross-sectional studies

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Online Supplementary Material

Supplementary Tables S1–S5

**Supplementary Table S1.** Search strategy, last updated April 2023.

| Database | Search terms | Results |
|---|---|---|
| PubMed | ("vitamin D" OR "25-hydroxyvitamin D" OR cholecalciferol OR "25-hydroxyvitamin D" OR "[25(OH)D]" OR hydroxycholecalciferols OR ergocalciferols OR "25-hydroxyvitamin D2" OR dihydroxycholecalciferols OR calcitriol) AND ("oral health" OR "dental disease" OR "dental diseases" OR "dental pathology" OR "oral pathology" OR "Dental Caries" OR caries OR carious) | 438 |
| Web Of Sciences | TS=("Vitamin D" OR "Cholecalciferol" OR "Hydroxycholecalciferols " OR "Ergocalciferols" OR "25 Hydroxyvitamin D 2" OR "Dihydrotachysterol" OR "25(OH)D" OR "25-hydroxyvitamin D" ) AND TS=("oral health" OR "dental disease" OR "dental diseases" OR "dental pathology" OR "oral pathology" OR "Dental Caries" OR caries OR carious) | 329 |
| Scopus | ( TITLE-ABS-KEY ( "Vitamin D" OR "Cholecalciferol" OR "Hydroxycholecalciferols " OR "Ergocalciferols" OR "25 Hydroxyvitamin D 2" OR "Dihydrotachysterol" OR "25(OH)D" OR "25-hydroxyvitamin D" ) ) AND ( TITLE-ABS-KEY ( "oral health" OR "dental disease" OR "dental diseases" OR "dental pathology" OR "oral pathology" OR "Dental Caries" OR caries OR carious ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) OR LIMIT-TO ( DOCTYPE , "sh" ) OR LIMIT-TO ( DOCTYPE , "cp" ) ) AND ( LIMIT-TO ( SRCTYPE , "j" ) OR LIMIT-TO ( SRCTYPE , "p" ) ) | 404 |

**Supplementary Table S2.** List of excluded articles.

| No | Title (References) | Reason for exclusion |
|---|---|---|
| 1 | A cross-sectional study on the association between oral health and vitamin D levels in methadone maintenance treatment program of Iranian population [1]. | Not eligible inclusion criteria |
| 2 | Association of serum Vitamin D and salivary calcium and phosphorus levels in 3-11-year-old schoolchildren with dental caries [2]. | Insufficient data |
| 3 | Association of vitamin D and dental caries in children in Basra [3]. | Insufficient data |
| 4 | Correlation between the level of 25(OH)D3 in blood, the content of antimicrobial peptides in oral fluid, and dental caries intensity in young individuals [4]. | Insufficient data |
| 5 | Correlation of Hypovitaminosis D with Socioeconomic Status and Dental Caries in Children [5]. | Insufficient data |
| 6 | Evaluation of the Relationship between Serum Level of Vitamin D and Decayed, Missing, and Filled Teeth (DMFT) in Young Women in Semnan, Iran (2018-2019) [6]. | Insufficient data |
| 7 | Impact of Vitamin D on development of early childhood caries [7]. | Insufficient data |
| 8 | Oral Health in Breast Cancer Women with Vitamin D Deficiency: A Machine Learning Study [8]. | Not eligible inclusion criteria |
| 9 | Oral health in young women having a low calcium and vitamin D nutritional status [9]. | Insufficient data |
| 10 | Relationship between serum 25-hydroxyvitamin D levels and experience of dental caries according to calcium intake in Korean adolescents [10]. | Not eligible inclusion criteria |
| 11 | Serum 25-hydroxyvitamin D levels are associated with dental caries experience in Korean adolescents: The 2010~2014 Korean National Health and Nutrition Examination Surveys [11]. | Duplicate study |
| 12 | Serum Levels of Vitamin D and Dental Caries in 7-Year-Old Children in Porto Metropolitan Area [12]. | Duplicate study |
| 13 | Suboptimal Serum Vitamin D Associated with Early Childhood Caries in Special Health Care Needs Children [13]. | Not eligible inclusion criteria |
| 14 | The relationship between vitamin D and calcium serum levels with dental caries in 6-12 years old children [14]. | Insufficient data |

| | | |
|---|---|---|
| 15 | Vitamin D Status and Its Influence on the Health of Preschool Children in Hangzhou [15]. | Insufficient data |
| 16 | Vitamin D, oral health, and disease characteristics in juvenile idiopathic arthritis: a multicenter cross-sectional study [16]. | Not eligible inclusion criteria |

**Supplementary Table S3.** Quality Assessment of Included Articles (Modified Newcastle-Ottawa Quality Assessment Scale)

| | Selection | | | | Comparability | Outcome | | Score |
|---|---|---|---|---|---|---|---|---|
| **Author/year (Refrences)** | **Representativeness of the cases** | **Sample size** | **Non-Response rate** | **Ascertainment of the exposure** | **Comparability** | **Assessment of the outcome** | **Statistical test** | **Max: 9** |
| Akinkugbe/2019 [17] | * | * | | * | ** | ** | * | 8 |
| Bener/2013 [18] | * | * | | * | | ** | * | 6 |
| Cátia Carvalho/2021 [19] | * | | | * | | ** | * | 5 |
| Choi/2018 [20] | * | * | | * | ** | ** | * | 8 |
| Herzog/2016 [21] | * | * | | * | ** | ** | * | 8 |
| Herzog/2022 [22] | * | * | | * | ** | ** | * | 8 |
| Kim/2018 [23] | * | * | | * | * | ** | * | 7 |
| Kühnisch/2015 [24] | * | * | | * | * | ** | * | 7 |
| Pu/2023 [25] | * | * | | * | * | ** | * | 7 |
| Qin/2022 [26] | | | | * | | ** | * | 4 |
| Rigo/2023 [27] | * | * | | * | * | ** | * | 7 |
| Schrot/2016 [28] | * | * | | * | * | ** | * | 7 |
| Zhou/2020 [29] | * | * | | * | * | ** | * | 7 |

**Supplementary Table S4.** The GRADE quality of evidence

| Certainty assessment | | | | | | | № of patients | | Effect | | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **№ of studies** | **Study design** | **Risk of bias** | **Inconsistency** | **Indirectness** | **Imprecision** | **Other considerations** | **case** | **Participants** | **Relative (95% CI)** | **Absolute (95% CI)** | | |
| **Dental caries** | | | | | | | | | | | | |
| 16 | observational studies | Not serious | Not serious [a] | Serious [b] | Not serious [c] | Dose-response gradient | 13436 | 29883 | **OR 1.41** (1.18 to 1.68) | **1 fewer per 1,000** (from 2 fewer to 1 fewer) | ⊕⊕◯◯ low | IMPORTANT |

**CI:** confidence interval; **OR:** odds ratio

**Explanations**

a. Not serious inconsistency since in the subgroup of children, the heterogeneity was 0.0% and the result of the analysis did not change; OR of 1.15 (1.08, 1.23). Not downgraded

b. Serious indirectness since most studies have been conducted in children and adolescents. Downgraded

c. Not serious imprecision since the 95% included the null value and the bound were >1.10. Not downgraded

**Supplementary Table S5.** The association of different vitamin D levels on dental caries forms the nonlinear dose-response meta-analysis (odds ratio and 95% confidence interval).

| **Vitamin D level (nmol/l)** | **12.5 (ref)** | **25** | **50** | **75** | **100** | **125** | **150** | **162.5** | **GRADE** |
|---|---|---|---|---|---|---|---|---|---|
| **Dental caries** | 1 | 0.97 (0.90, 1.06) | 0.91 (0.74, 1.12) | 0.83 (0.66, 1.05) | 0.74 (0.59, 0.93) | 0.66 (0.50, 0.85) | 0.58 (0.41, 0.82) | 0.54 (0.37, 0.81) | low |

## References


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