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Original article

Assessment of Serum 25-Hydroxyvitamin D and Calcium Levels in Dental Clinic Attendees in Sabratha City, Libya

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Vitamin D, Calcium, Dental Patients.

ABSTRACT

Vitamin D plays a central role in calcium regulation and oral health, yet deficiency remains widespread in many regions, including North Africa, despite abundant sunlight. Limited data are available regarding vitamin D status among dental patients in Libya. This study aimed to assess serum vitamin D and calcium levels among patients attending a dental clinic in Sabratha City, Libya, and to examine differences by age, gender, and vitamin D category. A descriptive analytical cross-sectional design was implemented from September to November, during which serum 25-hydroxyvitamin D and calcium were measured, and demographic data were recorded. Data were analyzed using IBM SPSS Statistics version 21, applying descriptive statistics, independent-samples t-tests, and one-way ANOVA with significance set at $p < 0.05$. Participants ranged in age from 6 to 50 years, with a mean of 20.83 ± 11.22 years. Serum vitamin D levels showed considerable variation, ranging from 3 to 53.8 ng/mL, with a mean of 22.51 ± 10.67 ng/mL; deficiency was identified in 47.2% of patients, insufficiency in 30.6%, and sufficiency in 22.2%. Serum calcium concentrations ranged from 8.3 to 10.1 mg/dL, with a mean of 9.11 ± 0.43 mg/dL. No statistically significant differences in vitamin D or calcium were found between males and females, between age groups, or across vitamin D categories. In conclusion, a notable proportion of dental clinic attendees had low vitamin D levels, whereas serum calcium levels remained within normal limits across all groups. These findings provide useful baseline biochemical information for this population and highlight the broad presence of suboptimal vitamin D levels in the region.

Introduction

Vitamin D is a fat-soluble secosteroid hormone that plays a central role in calcium and phosphate homeostasis, skeletal mineralization, and musculoskeletal health. Its active metabolite, 1,25-dihydroxyvitamin D, enhances intestinal absorption of calcium and phosphate and modulates bone remodeling, immune function, and cellular differentiation. Deficiency or insufficiency of vitamin D is therefore associated not only with rickets and osteomalacia, but also with a broad spectrum of extra-skeletal outcomes, including increased risk of respiratory infections, autoimmune disease, cardiometabolic disorders, and overall mortality [1–3]. Despite abundant sunshine in many regions, vitamin D deficiency is now widely recognized as a global public health problem [4].

Epidemiological surveys indicate that low serum 25-hydroxyvitamin D [25(OH)D] concentrations are highly prevalent across Europe and North America, with estimates suggesting that 25–50% of adults have levels below commonly accepted sufficiency thresholds [4–6]. Even higher rates have been reported in Africa, Asia, and the Middle East, where cultural clothing practices, limited outdoor exposure, darker skin pigmentation, and lack of food fortification contribute to low vitamin D status [7–9]. In Middle Eastern and North African populations, studies have documented vitamin D deficiency or insufficiency in 30–90% of children and adults, including in countries with year-round sunlight [8–10]. The Endocrine Society and other expert groups typically define vitamin D deficiency as serum 25(OH)D <20 ng/mL, insufficiency as 20–29 ng/mL, and sufficiency as ≥30 ng/mL, cut-offs that are commonly used in clinical and research settings [6,11].

In the context of oral health, vitamin D has attracted increasing interest due to its role in tooth development, alveolar bone metabolism, and modulation of innate and adaptive immune responses within the oral cavity [12–14]. Several studies have reported associations between low serum 25(OH)D concentrations and increased risk of dental caries, especially in children, as well as with periodontal disease, tooth loss, and altered oral microbial ecology [12,15–18]. Vitamin D and calcium act synergistically in maintaining mineralized tissues; disturbances in this axis during tooth formation or throughout life may predispose to enamel defects, demineralization, and inflammation of periodontal structures [13,15]. Nonetheless, most available data have focused on pediatric or specific high-risk cohorts, and relatively few reports have

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examined vitamin D status among general dental clinic attendees, particularly in North African settings. Libya and neighboring countries share many of the recognized risk factors for hypovitaminosis D, including high ambient temperatures limiting outdoor exposure, traditional dress that reduces skin exposure, and limited systematic vitamin D food fortification [8,9]. However, published data on vitamin D and calcium status among Libyan patients, and especially among those presenting to dental services, remain scarce. Understanding the distribution of vitamin D levels and related biochemical parameters in this population may help to identify an at-risk group that routinely interfaces with the health system through dental care. In this context, the present study aimed to evaluate serum vitamin D levels and calcium status among patients attending a dental clinic in Sabratha City, Libya, and to describe their distribution according to age group, sex, and vitamin D category. A secondary objective was to explore whether serum calcium differed significantly across vitamin D strata or between age groups and sexes, using standard analytical methods.

Methods

Study Design and Setting

A descriptive analytical study was conducted in Sabratha City, Libya, over a three-month period extending from September to November. The study was carried out at a dental outpatient clinic that serves a wide range of pediatric and adult patients. This setting provided an appropriate clinical environment for evaluating serum vitamin D and calcium levels among individuals seeking dental care.

Study Population and Sampling

The study population consisted of patients who attended the clinic during the study period and agreed to participate. Eligible participants included patients of any sex, aged above five years, who had been referred for laboratory testing of serum vitamin D and calcium. Individuals aged five years or younger, as well as those with known endocrine disorders, renal insufficiency, or metabolic bone disease, were excluded. Patients who had taken vitamin D or calcium supplements within the previous three months were also not considered for inclusion. Ultimately, a total of 36 patients met the eligibility criteria and were enrolled in the study through a convenience sampling approach based on clinic attendance.

Data Collection Procedure

Demographic data, including age and sex, were recorded for each participant. Venous blood samples were obtained by trained laboratory personnel under aseptic conditions. Serum vitamin D concentrations (25-hydroxyvitamin D) were measured using chemiluminescent immunoassay, while serum calcium levels were determined using automated photometric analysis. All laboratory analyses were performed at an accredited clinical laboratory in Sabratha following standardized internal quality-control procedures.

Variable Definition

- **Vitamin D status was categorized into:**
  - Deficient: <20 ng/mL
  - Insufficient: 20–30 ng/mL
  - Sufficient: >30 ng/mL
- **Serum calcium** levels were analyzed as a continuous variable measured in mg/dL.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics version 21. Descriptive statistics, including mean, standard deviation, minimum, and maximum, were calculated for age, vitamin D, and serum calcium. Inferential statistics included independent-samples t-tests to assess gender-based differences, and one-way ANOVA to examine differences in serum calcium across the three vitamin D categories. A p-value < 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from adult participants and from parents or guardians of minors. Data confidentiality and privacy were fully maintained in accordance with ethical research standards.

Results

The study population consisted of 36 patients, of whom females represented approximately two-thirds of the sample (69.4%), while males accounted for 30.6%. Age distribution showed that 44.4% of participants were 18 years or younger, whereas 55.6% were aged 19 years and above. Vitamin D assessment revealed that nearly half of the patients (47.2%) had deficient levels (<20 ng/mL), while 30.6% demonstrated insufficient levels (20–30 ng/mL). Only 22.2% of the sample achieved sufficient vitamin D concentrations (>30 ng/mL), indicating a predominance of low vitamin D status among dental clinic attendees, as Table 1.

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Table 1. Demographic Characteristics and Vitamin D Categories Among Patients Attending the Dental Clinic

Items		Frequency	Percent (%)
Gender	Male	11	30.6
	Female	25	69.4
Age Group	≤ 18	16	44.4
	≥ 19	20	55.6
Level Vit. D	<20	17	47.2
	20-30	11	30.6
	>30	8	22.2

This study showed that patient age ranged from 6 to 50 years, with a mean of 20.83 ± 11.22 years, indicating a broad age distribution among participants. Serum vitamin D levels ranged from 3 to 53.8 ng/mL, with a mean of 22.51 ± 10.67 ng/mL, showing wide variability across the sample. Serum calcium values ranged from 8.3 to 10.1 mg/dL, with a mean of 9.11 ± 0.43 mg/dL, reflecting limited variation within the observed measurements as Table 2.

Table 2. Distribution of Age, Serum Vitamin D Levels, and Serum Calcium Among Patients Attending the Dental Clinic

Items	Max	Min	Mean	SD
Age	50	6	20.83	11.22
Vit. D	53.8	3	22.51	10.67
Ca	10.1	8.3	9.11	0.43

Comparison between males and females showed that females had a wider age range (6–50 years) and a slightly higher mean age (21.76 ± 12.16) than males (mean 18.73 ± 8.89), though the difference was not statistically significant (p = 0.463). Vitamin D levels demonstrated similar mean values in males (22.84 ± 6.77) and females (22.37 ± 12.11), with no significant difference between groups (p = 0.906). Serum calcium values were marginally higher in males (mean 9.26 ± 0.32 mg/dL) than in females (mean 9.04 ± 0.46 mg/dL), but this difference also did not reach statistical significance (p = 0.153), indicating no meaningful gender-based variation in biochemical measurements as Table 3.

Table 3. Distribution of Age, Serum Vitamin D Levels, and Serum Calcium by Gender

Items	Male				Female				p-values
	Max	Min	Mean	SD	Max	Min	Mean	SD	
Age	32.00	8.00	18.73	8.89	50.00	6.00	21.76	12.16	0.463
Vit. D	32.30	12.40	22.84	6.77	53.80	3.00	22.37	12.11	0.906
Ca	9.90	8.80	9.26	0.32	10.10	8.30	9.04	0.46	0.153

Analysis of differences in the various parameters across study groups using the Independent Samples Test.

Serum calcium levels across vitamin D categories showed a mean of 9.05 ± 0.48 mg/dL in the deficient group (<20 ng/mL), 9.13 ± 0.36 mg/dL in the insufficient group (20–30 ng/mL), and 9.21 ± 0.43 mg/dL in the sufficient group (>30 ng/mL). Serum calcium remained stable across categories, and these differences were not statistically significant (ANOVA p = 0.670), as shown in Table 4.

Table 4. Serum Calcium Measurements Across Vitamin D Level Categories

level Vit. D	Ca				p-values
	Max	Min	Mean	SD	
<20	10.10	8.30	9.05	0.48	0.670
20-30	9.90	8.70	9.13	0.36	
>30	9.90	8.60	9.21	0.43	

Analysis of differences in the various parameters across study groups using the ANOVA

When comparing biochemical characteristics across age groups, vitamin D levels showed similar mean values between participants aged ≤18 years (22.93 ± 9.90 ng/mL) and those aged ≥19 years (22.19 ± 11.49 ng/mL), with no significant difference observed (p = 0.840). Serum calcium levels were slightly higher in the

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younger group (9.26 ± 0.47 mg/dL) compared with adults (8.99 ± 0.36 mg/dL), although this difference approached but did not reach statistical significance (p = 0.063), as shown in Table 5.

Table 5. Age-Group Differences in Vitamin D Levels and Serum Calcium Values

Items	<18 yr				>19 yr				p-values
	Max	Min	Mean	SD	Max	Min	Mean	SD	
Vit. D	45.40	7.60	22.93	9.90	53.80	3.00	22.19	11.49	0.840
Ca	10.10	8.70	9.26	.47	9.50	8.30	8.99	0.36	0.063

Analysis of differences in the various parameters across study groups using the Independent Samples Test.

Discussion

This descriptive analytical study of patients attending a dental clinic in Sabratha City, Libya, demonstrated a clear burden of low vitamin D status in the presence of generally normal serum calcium values. A considerable proportion of participants had vitamin D deficiency, and many others exhibited insufficiency, whereas only a minority achieved serum 25(OH)D concentrations within the sufficient range. These findings are consistent with reports from other Middle Eastern and North African populations, where vitamin D insufficiency and deficiency are widely documented in both pediatric and adult groups despite abundant sunlight [8–10,19]. The average vitamin D concentration observed in this cohort was comparable to values reported in regional surveys, underscoring the ongoing challenge of achieving adequate vitamin D status in sun-rich but lifestyle-constrained environments [8,9,19].

In contrast to the marked variability in vitamin D concentrations, serum calcium levels in this study were tightly clustered within the physiological reference range. When calcium values were examined across vitamin D categories, mean concentrations showed only small differences, and statistical testing indicated no significant variation between groups. Similarly, comparisons between age groups and sexes revealed no significant differences in calcium levels, although younger participants tended to have slightly higher mean values than adults. These patterns are in line with the well-recognized capacity of endocrine regulatory systems—particularly parathyroid hormone and active vitamin D metabolites—to maintain serum calcium within a narrow range, even in the setting of low or fluctuating 25(OH)D concentrations [2,11,20].

Gender-based analyses in the present work showed that females constituted the majority of attendees and had a somewhat higher mean age than males, but there were no statistically significant differences between males and females in vitamin D or calcium levels. This absence of sex differences contrasts with some larger regional studies that have reported higher rates of vitamin D deficiency among women, often attributed to more extensive body covering and lower outdoor activity [9,21]. The discrepancy may reflect the relatively small sample size, the specific clinic-based population, and the inclusion of both children and adults in the present cohort. Nonetheless, the consistently high prevalence of low vitamin D status in both males and females suggests that deficiency is a shared concern among dental patients in this setting rather than one confined to a single sex.

Although the current study did not directly evaluate dental outcomes such as caries experience or periodontal status, its findings align with a broader literature that links hypovitaminosis D to adverse oral health outcomes. Previous investigations have reported associations between low serum 25(OH)D concentrations and increased risk of early childhood caries, enamel hypoplasia, periodontal pocketing, and tooth loss [12,15–18,22]. Vitamin D is believed to influence oral health through effects on tooth mineralization, alveolar bone density, immune modulation, and antimicrobial peptides such as cathelicidin and defensins [13,16,22]. In this context, the high proportion of patients with deficient or insufficient vitamin D levels observed in the present study may be of clinical relevance, and future research in Libyan dental populations should investigate whether these biochemical abnormalities translate into measurable differences in caries burden, periodontal disease, or tooth retention.

The lack of a significant association between vitamin D categories and serum calcium in this cohort does not diminish the potential systemic and oral implications of chronic low vitamin D status. Several studies have shown that vitamin D deficiency can persist for prolonged periods while laboratory calcium remains within normal limits, particularly in mild-to-moderate deficiency, with compensatory elevations in parathyroid hormone and adjustments in bone turnover [2,11,20]. In the context of oral health, the cumulative impact of suboptimal vitamin D on bone quality, immune competence, and enamel integrity may become evident over time, even in the absence of overt hypocalcemia. The present findings therefore support the idea that reliance solely on serum calcium as a screening tool would underestimate the prevalence of vitamin D–related risk in dental patients.

This study has a few limitations, most notably the relatively small sample size. Nevertheless, these limitations do not diminish the value of the findings, which provide useful preliminary data on vitamin D and calcium status among dental patients and highlight the need for larger, multi-center studies.

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Conclusion

This study identified a high prevalence of low vitamin D status among patients attending a dental clinic in Sabratha City, Libya, while serum calcium levels remained within normal physiological limits across all examined groups. No significant differences in vitamin D or calcium values were observed by gender, age group, or vitamin D category. These findings provide baseline biochemical data for this patient population and contribute to the existing evidence regarding vitamin D and calcium status in the region.

Acknowledgments

Nil.

Conflicts of Interest

The authors declare no conflicts of interest.

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