IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 23, Issue 5 Ser. 8 (May. 2024), PP 09-15
www.iosrjournals.org

The Impact Of Nutrition On Paediatric Dental Health: A Focus On Vitamin D And Persistent Primary Teeth – A Questionnaire Study

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Abstract
Vitamin D deficiency is increasingly recognized as a critical factor influencing paediatric dental health, particularly affecting the development and health of primary teeth. This deficiency can lead to delayed tooth

eruption and enamel defects, which are significant concerns in paediatric dental care. Persistent primary teeth, often linked to inadequate Vitamin D levels, pose challenges not only for dental alignment but also indicate potential systemic health issues. This study leverages a comprehensive survey conducted through the Tamil Nadu Dental Association Network, involving 316 dentists, to evaluate their awareness, practices, and approaches regarding Vitamin D supplementation in paediatric patients.

The survey revealed substantial gaps in dentists' familiarity with the impact of Vitamin D on paediatric dental health, with only 39% of respondents reporting familiarity with its nutritional impact. Additionally, a significant discrepancy was noted in routine practices such as the discussion of Vitamin D importance with parents (16.7% always discuss) and screening for Vitamin D deficiency (22.7% routinely screen), highlighting a lack of proactive management in addressing Vitamin D related dental issues. The findings also exposed the prevalence of non-scientific beliefs influencing Vitamin D supplementation practices among dental professionals.

Given the critical role of Vitamin D in dental development and health, the study underscores the need for enhanced educational programs and standardized practices among dentists. Recommendations include developing comprehensive training modules focused on the latest research and guidelines, implementing standardized screening protocols, and improving communication strategies to ensure effective patient education and compliance. This paper calls for collaborative efforts between dental associations and health organizations to promote evidence-based practices that optimize paediatric dental health outcomes and address nutritional deficiencies that can significantly impact children's dental and overall health.

Date of Submission: 11-05-2024 Date of Acceptance: 21-05-2024

I. Introduction

Vitamin D deficiency is a widespread issue that has significant implications for paediatric dental health, affecting oral development and the overall health outcomes of children, especially in the context of persistent primary teeth. Despite increased awareness of the critical role Vitamin D plays in maintaining overall health, deficiencies remain prevalent, influenced by a complex interplay of social, cultural, and geographical factors. Such deficiencies can manifest as various dental issues across different age groups, including delayed tooth eruption and enamel defects in primary teeth, which are significant markers of broader systemic health issues [1].

Persistent primary teeth, also known as retained deciduous teeth, present unique challenges in dental care and may serve as indicators of underlying systemic issues, such as nutritional deficiencies like that of Vitamin D. These teeth often do not exfoliate at the expected time, leading to potential complications in the alignment and spacing of the succeeding permanent teeth. Vitamin D's crucial role in osteoclastic activity, which is responsible for the root resorption of primary teeth, is a key factor in facilitating the normal eruption of permanent teeth. Deficiencies in Vitamin D can therefore disrupt this process, leading to the retention of primary teeth beyond their normal lifespan [2].

The delay in the chronological eruption of permanent teeth due to Vitamin D deficiency is multifactorial but significant, as the mineral plays a vital role in the development and mineralization of the dental matrix and bone structure. This interaction underscores the importance of Vitamin D in dental and skeletal health, where its sufficiency is crucial for the prevention of dental deformities and the promotion of timely tooth eruption [3].

Understanding the nutritional impacts, particularly that of Vitamin D, on paediatric dental health is critical for dentists and healthcare professionals specializing in paediatric dentistry. These conditions not only jeopardize oral health but also pose broader systemic health risks, potentially leading to more severe health consequences. Fortunately, these conditions are amenable to intervention, providing opportunities for reversal and prevention through judicious dietary and lifestyle modifications [4].

Acknowledging the critical importance of addressing Vitamin D deficiency within dental care, it becomes essential to delineate the responsibilities incumbent upon dental professionals, families, and the broader healthcare system in both preventing and managing such deficiencies, especially within the context of persistent primary teeth. Prioritizing Vitamin D supplementation within dental health initiatives, akin to established vaccination programs, holds promise for significantly enhancing oral health outcomes among children with persistent primary teeth and facilitating permanent tooth eruption at the stipulated chronological eruption sequence. This study endeavours to augment the awareness of dentists regarding the impact of Vitamin D deficiency on persistent primary teeth, aiming to empower dentists with knowledge and strategies to effectively tackle this issue within their practice [5].

By further comprehending the specific challenges and implications of Vitamin D deficiency within the dental care domain, dental professionals can assume a proactive stance in identifying and redressing this issue, ultimately fostering the promotion of optimal dental health outcomes among children.

II. Material And Methods

The study employed the Tamil Nadu Dental Association Network to reach out to dentists across the region. A total of 800 dentists were invited to participate in the study. Dentists were provided with an online questionnaire aimed at assessing their awareness of vitamin D supplementation in paediatric dental care.

The questionnaire comprised the following questions designed to gauge dentists' perspectives and practices regarding vitamin D supplementation for paediatric patients:

1: Are you familiar with the impact of nutrition on paediatric dental health, specifically concerning Vitamin D?
a) Yes
b) No

2: Rate your level of awareness about the relationship between Vitamin D deficiency and persistent primary tooth in paediatric patients.
a) Low
b) Moderate
c) High

3: How often do you discuss vitamin D intake and its importance for dental health with parents/guardians?
a) Always
b) Rarely
c) Never

4: Do you routinely screen for vitamin D deficiency in paediatric patients with Persistent Primary Teeth?
a) Yes
b) No

5: Which method do you prefer for vitamin D supplementation?
a) Three drops orally once daily (400 IU/day)
b) Eight drops orally once daily (1000 IU/day)
c) One vial (300,000 IU) orally once a month
d) One vial (300,000 IU) intramuscularly every two months

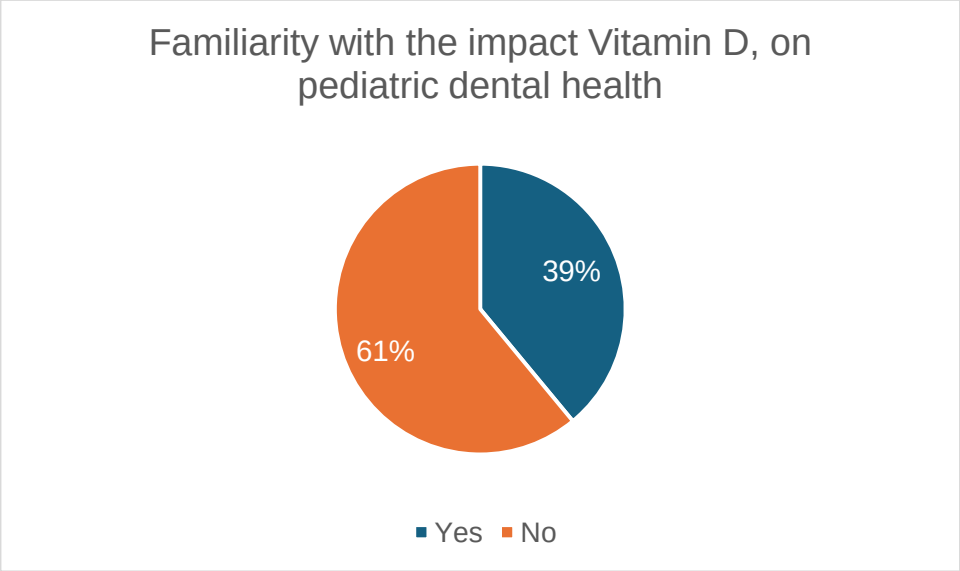
6: In your dental practice, do you encounter common non-scientific beliefs influencing vitamin D intake? Please select any applicable beliefs:
a) Giving double dose of daily vitamin D prophylaxis in infants with delayed tooth eruption
b) Giving extra doses of vitamin D to infants with delayed walking and/or leg bowing

III. Results:

Out of 800 dentists contacted, 316 completed the questionnaire, revealing a diverse range of practices and awareness levels regarding Vitamin D supplementation in paediatric dental care. The detailed response analysis includes:

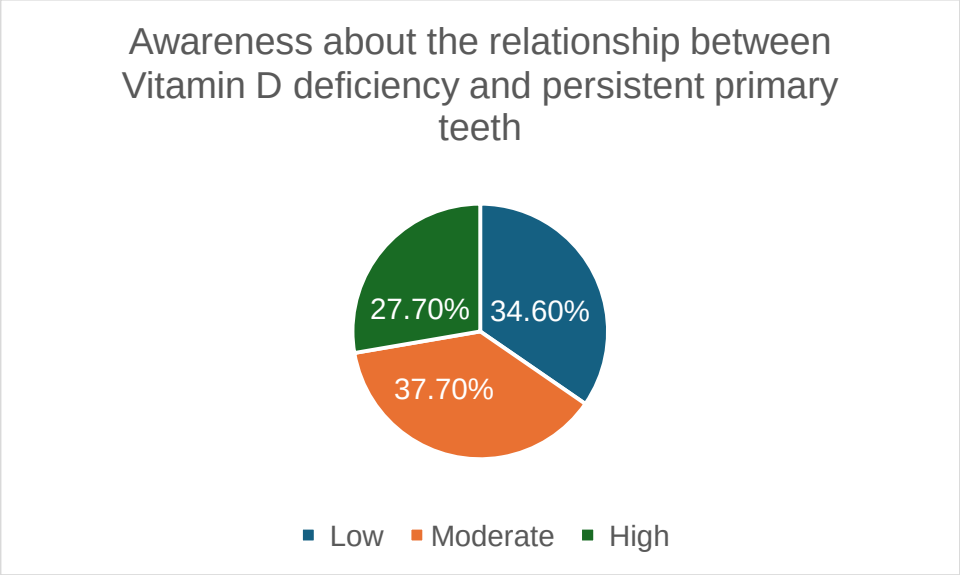
1: Familiarity with the impact of nutrition, specifically Vitamin D, on paediatric dental health:

- 123 dentists (39%) reported being familiar with the impact of nutrition, specifically Vitamin D, on paediatric dental health.
- 193 dentists (61%) reported not being familiar with the impact of nutrition, specifically Vitamin D, on paediatric dental health.



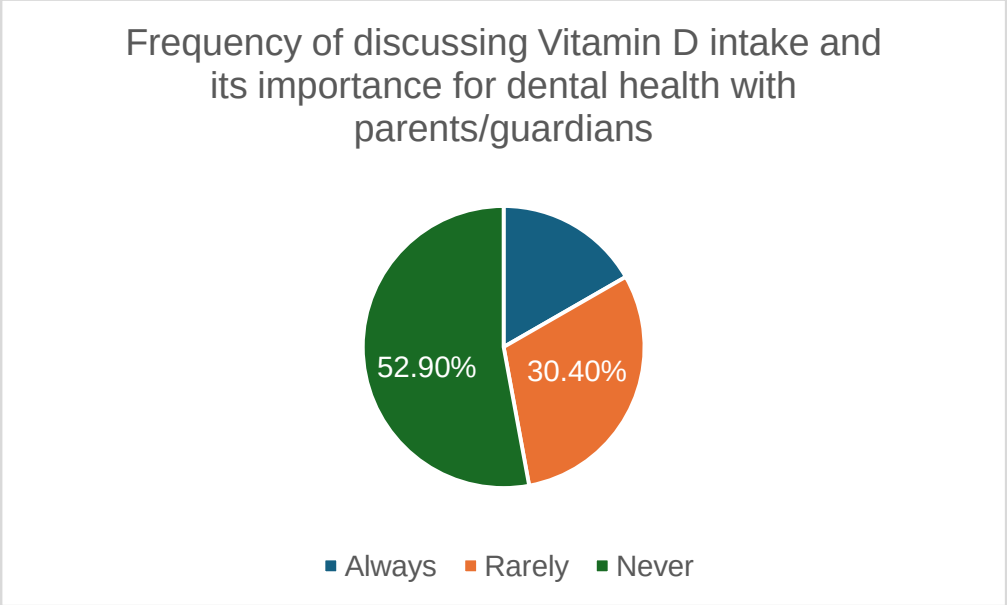
2: Level of awareness about the relationship between Vitamin D deficiency and persistent primary teeth:

- 109 dentists (34.6%) reported having a high level of awareness about the relationship between Vitamin D deficiency and persistent primary teeth.
- 119 dentists (37.7%) reported having a moderate level of awareness.
- 88 dentists (27.7%) reported having a low level of awareness.



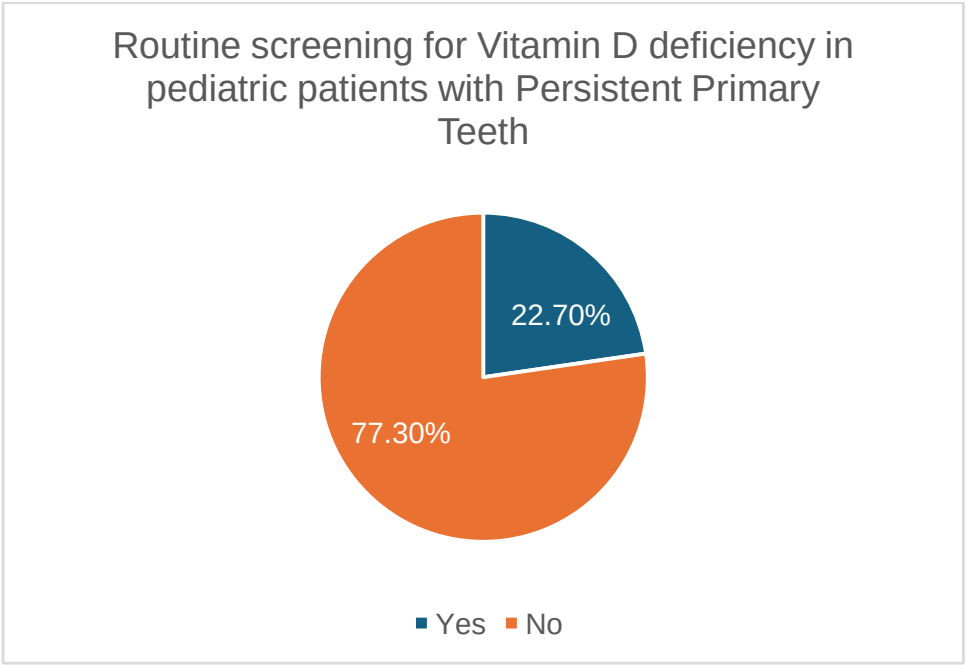
3: Frequency of discussing Vitamin D intake and its importance for dental health with parents/guardians:

- 53 dentists (16.7%) reported always discussing Vitamin D intake and its importance for dental health with parents/guardians.
- 96 dentists (30.4%) reported rarely discussing Vitamin D intake.
- 167 dentists (52.9%) reported never discussing Vitamin D intake.



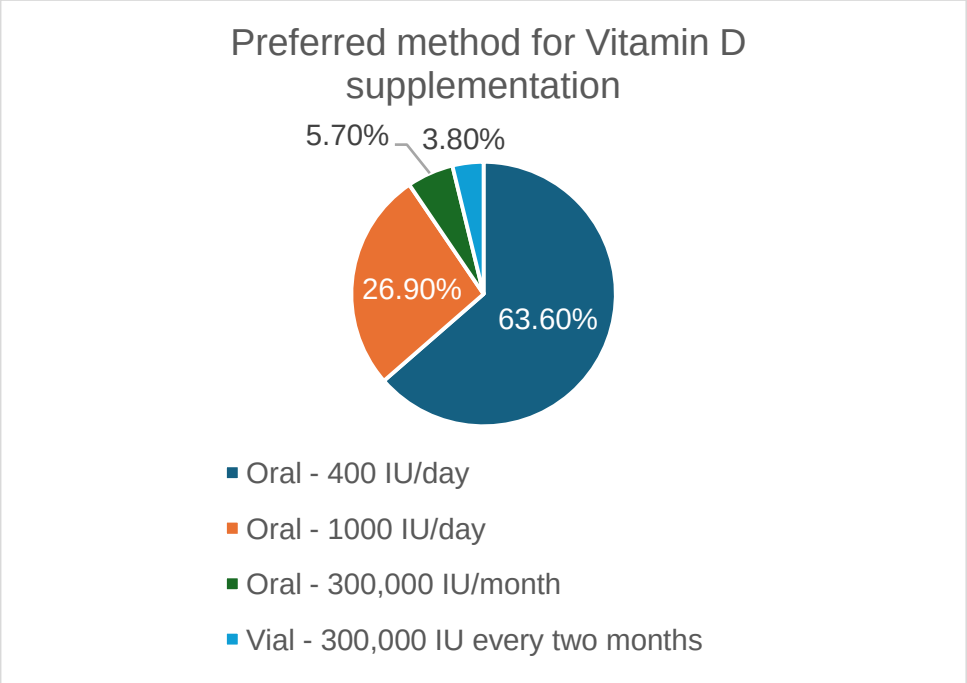
4: Routine screening for Vitamin D deficiency in paediatric patients with Persistent Primary Teeth:

- 72 dentists (22.7%) reported that they routinely screen for Vitamin D deficiency in paediatric patients with persistent primary teeth.
- 244 dentists (77.3%) reported that they do not routinely screen for Vitamin D deficiency.



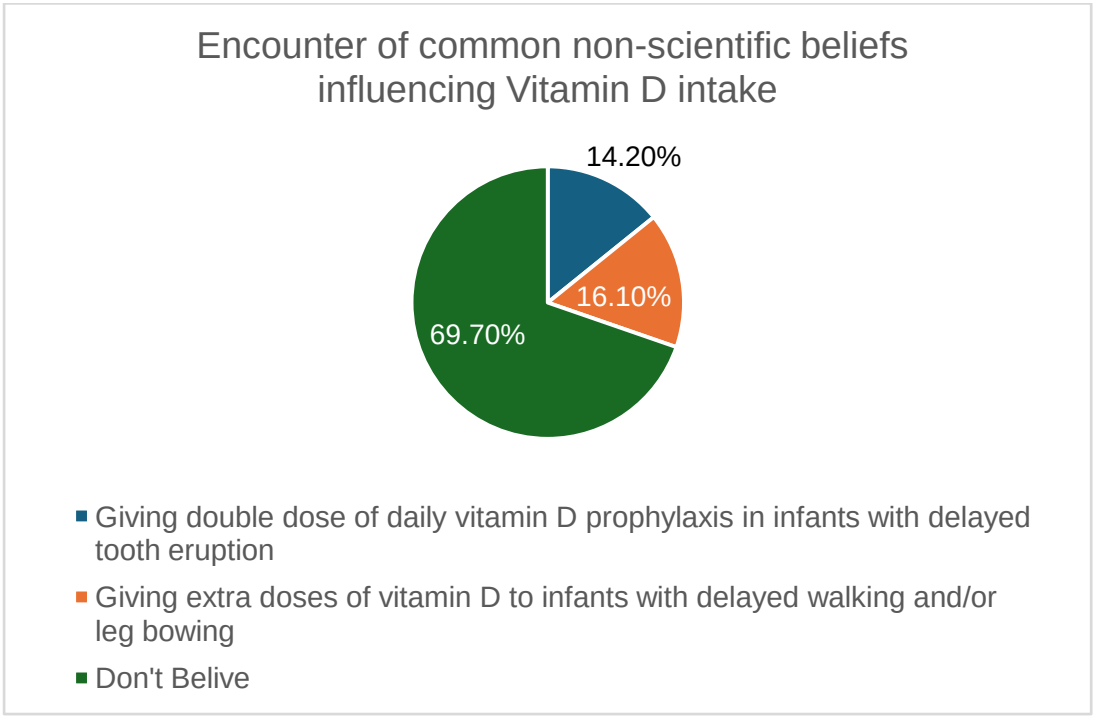
5: Preferred method for Vitamin D supplementation:

- 201 dentists (63.6%) prefer administering three drops orally once daily at 400 IU/day.
- 85 dentists (26.9%) prefer administering eight drops orally once daily at 1000 IU/day.
- 18 dentists (5.7%) prefer administering one vial (300,000 IU) orally once a month.
- 12 dentists (3.8%) prefer administering one vial (300,000 IU) intramuscularly every two months.



6: Encounter of common non-scientific beliefs influencing Vitamin D intake:

- 45 dentists (14.2%) encounter beliefs about giving a double dose of daily vitamin D prophylaxis in infants with delayed tooth eruption.
- 51 dentists (16.1%) encounter beliefs about giving extra doses of Vitamin D to infants with delayed walking and/or leg bowing.



IV. Discussion

Diet and nutrition are the important factors in the promotion and maintenance of good health. Nutrition plays an important role to establish and sustain the structure and function of the body. American Dietetic Association states that nutrition is an integral component of oral health.

Eruption is a complex process that can be influenced by the number of factors. Delayed eruption is the first appearance of the teeth in the oral cavity at a much later time than what is normally expected. If there is a failure an erupting tooth to unite with the mucosa, it will lead to a delay in the breakdown of the mucosa and thus cause a barrier to emergence. The average time of eruption of lower primary incisor is 6 months [6]. A standard deviation of 6 months for primary dentition is considered normal. Studies conducted on the Indian population show a delayed eruption pattern of primary teeth. Variations for delayed eruption have been attributed to nutrition, socioeconomic status, climate, and environmental factors. Eruption of first primary tooth in the oral cavity teeth at the age of 6–10 months is an important event in a child's development [7][8].

There is vast literature on the genetic, endocrine disturbances, and nutritional deficiencies such as protein malnutrition as the etiological factors of delayed eruption. Vitamin D has shown to affect the enamel and dentin formation and has also been considered a risk factor for delayed eruption of teeth [9]. The survey results reveal a concerning gap in both the familiarity with and the proactive management of Vitamin D's role in paediatric dental health among dentists. Although a majority recognize the importance of Vitamin D, there is a significant discrepancy in how it is discussed and implemented in clinical practice. This disparity suggests a need for robust educational programs aimed at enhancing understanding and compliance with evidence-based Vitamin D supplementation guidelines.

The low frequency of discussions regarding Vitamin D with parents and the even lower rates of routine screening for Vitamin D deficiency highlight a substantial oversight in paediatric dental care. These findings underscore the need for educational interventions that not only focus on the benefits and requirements of Vitamin D but also on practical implementation strategies in clinical settings. Improving communication skills and strategies among dentists can enhance the frequency and quality of these discussions, thereby ensuring better patient education and compliance.

Vitamin D3 plays a major role in the regulation of mineral homeostasis and effects on bone metabolism. It plays a role in the regulation of early stage of human ostesblast differentiation in human bone marrow, stromal cell cultures and clonal cell lines derived from human trabecular bone .It has direct effects on osteoblastic function and can modulate osteoblastic proliferation and osteoblast production of type I collagen, ALP and osteocalcin facilitating tooth eruption [10][11][12] . To effectively address these issues, it is recommended that dental associations and health organizations collaborate to develop comprehensive training modules and continuing education programs. These programs should focus on the latest research and guidelines related to Vitamin D's impact on paediatric dental health. Additionally, creating standardized screening protocols can help ensure that all paediatric patients are appropriately assessed for Vitamin D deficiency, leading to timely and effective interventions. Moreover, the presence of non-scientific beliefs influencing Vitamin D intake calls for targeted educational efforts to correct misconceptions and promote a more scientific approach to supplementation practices. Addressing these beliefs is crucial, as they can lead to inappropriate supplementation practices, potentially resulting in suboptimal treatment or even Vitamin D toxicity.

V. Conclusion

This study highlights a critical need for enhanced education and standardized practices concerning Vitamin D supplementation among dentists to optimize paediatric dental health outcomes. By addressing the gaps in knowledge and practice identified through this survey, the dental community can better serve the paediatric population, ensuring that nutritional deficiencies do not compromise dental and overall health outcomes. Collaborative educational efforts and the implementation of standardized guidelines are crucial steps towards improving the management of Vitamin D deficiency in paediatric dental care.

The early identification of persistent primary teeth is crucial to mitigate and address eruption disturbances resulting from nutritional deficiencies such as vitamin D deficiency, which can lead to alterations in eruption sequence and ultimately result in discrepancies in arch length and tooth material Overall, dentists serve as key frontline healthcare providers in identifying and managing eruption disturbances associated with vitamin D deficiency, promoting early intervention and optimal oral health for their patients.

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