

Impact of untreated dental caries on nutritional status in preschool children

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ABSTRACT

Untreated dental caries causes significant clinical complications, such as infections (pulpitis, ulcers, fistulas, and abscesses) and tooth loss, which deteriorate the preschool child's quality of life at the functional, aesthetic, and psychosocial levels by compromising vital functions such as mastication and speech. This literature review aims to evaluate the relationship between this pathology and nutritional status in this population. A search was conducted up to May 17, 2024, in databases such as PubMed, Biblioteca Virtual en Salud [Virtual Health Library], EBSCOHost, Scopus, ProQuest, and ScienceDirect, following PRISMA guidelines. Of the 484 records identified, 12 studies met the inclusion criteria. The analysis of the evidence reveals that untreated dental caries is frequently associated with pain and functional limitations that alter food intake, causing dietary changes and possible nutritional deficiencies that negatively impact the child's overall growth and development.

Keywords: dental caries; nutritional status; preschool children; quality of life.

Received: May 26, 2025

Accepted: November 18, 2025

Online: March 16, 2026



Open access article

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Cite as:

Vallejos JI, Cruz MA, Roncal RJ, et al. Impact of untreated dental caries on nutritional status in preschool children. Rev Estomatol Herediana. 2026;36(1):e6527. doi:10.20453/reh.v36i1.6527

INTRODUCTION

Dental caries is one of the most prevalent conditions affecting the pediatric population; globally, it is estimated that approximately 50% of children present with at least one carious lesion (1,2). In Peru, the prevalence of dental caries in the primary dentition reached 59.1%, according to data obtained by the Ministry of Health up to 2014 (3). These figures reflect a public health problem whose origin is associated with diet, oral care, and socioeconomic factors.

The persistence of untreated dental caries leads to clinical complications such as pulpitis, ulcers, fistulas, and abscesses, which generally culminate in tooth loss. These consequences negatively impacts the patient's quality of life at the functional, esthetic, and psychosocial levels. Specifically, functional impairment may lead to speech difficulties and chewing problems, directly affecting nutrition and dietary intake (4,5).

Nutritional status is determined by the quality and quantity of nutrients in the diet, as well as by the body's adequate assimilation of these nutrients (5). This balance is susceptible to environmental, genetic, cultural, and socioeconomic factors, which may hinder the optimal utilization of ingested foods, resulting in insufficient intake or excessive nutrient consumption (6). In addition, inadequate nutrition weakens immune status and increases the risk of morbidity, affecting height and weight, and leading to delays in both physical and cognitive development (3).

Poor nutritional status may also cause oral alterations that compromise the biological, anatomical, functional, and esthetic integrity of the teeth and their supporting tissues. Such abnormalities, including enamel hypoplasia or maxillary discrepancies (dental crowding), disrupt the stomatognathic system and increase susceptibility to conditions such as dental caries and periodontal disease (7).

For these reasons, childhood malnutrition and dental caries represent widespread problems affecting both developed and developing countries. Understanding the severity of untreated dental caries is particularly relevant, as pain and severe dental deterioration may drastically alter a child's eating habits and food preferences. Therefore, this study aims to evaluate the relationship between untreated dental caries and nutritional status in preschool children through the search and analysis of scientific articles.

MATERIALS AND METHODS

PEO Question

The PEO methodology was used to formulate the research question and define the eligibility criteria. The

components were defined as follows: the population (P) corresponded to preschool children; the exposure (E) was defined as the presence of untreated dental caries; and the outcome (O) focused on nutritional status. The following clinical question served as reference: Is there a relationship between untreated dental caries and nutritional status in preschool children?

Search strategy

The search was conducted up to May 17, 2024, following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Several databases were searched, including PubMed, the Virtual Health Library (VHL), EBSCOHost, SCOPUS, ProQuest, and ScienceDirect, without restrictions regarding publication year. The English MeSH terms used were: "Preschool," "Dental Caries," "Dental Fistula," "Dental Pulp Exposure," "Periapical Abscess," "Oral Ulcer," "Child Nutrition Disorders," and "Nutritional Status." In Spanish, the following DeCS terms were used: "preescolares," "caries dental," "fistula dental," "pulpa dental expuesta," "absceso periapical," "úlceras oral," "estado nutricional," "desnutrición en los niños," and "trastornos de la nutrición infantil." These terms were combined using the Boolean operators "AND" and "OR."

The inclusion criteria comprised articles published in English and Spanish, as well as correlational, retrospective, and descriptive cross-sectional studies conducted in populations younger than 6 years of age. Letters to the editor, conference abstracts, experimental animal studies, in vitro studies, books, and theses were excluded. The final search expression was as follows: Preschool AND ("Child Nutrition Disorders" OR "Malnutrition in Children") AND ("Dental Caries" OR "Dental Fistula" OR "Dental Pulp Exposure" OR "Periapical Abscess" OR "Oral Ulcer").

Selection and eligibility process

Two researchers conducted the study selection process using the Rayyan tool to identify and eliminate duplicates. Then, they reviewed the titles and abstracts considering the PEO question and subsequently retrieved the articles. Disagreements were resolved by a third reviewer. For data extraction, a spreadsheet created in Microsoft Excel was used, containing the following information: year of publication, article title, author, country, objectives, study design, population, sample, sample characterization (sex and age), sample selection, intervention performed (study groups and materials used), results (observation time and type of assessment), and conclusions.

RESULTS

A total of 484 articles were identified across the data sources used, including PubMed (n = 123), VHL

(n = 167), EBSCOHost (n = 14), ProQuest (n = 9), Scopus (n = 160), and ScienceDirect (n = 11). During the screening process, duplicate records were removed, leaving 290 studies. Thereupon, titles and abstract were reviewed, followed by full-text assessment in the subsequent stage. Disagreements were resolved by a third reviewer, leaving 12 articles for this review, as shown in Figure 1.

Description of the studies

A review of the selected articles was performed, grouping them according to the characteristics presented in Table 1.

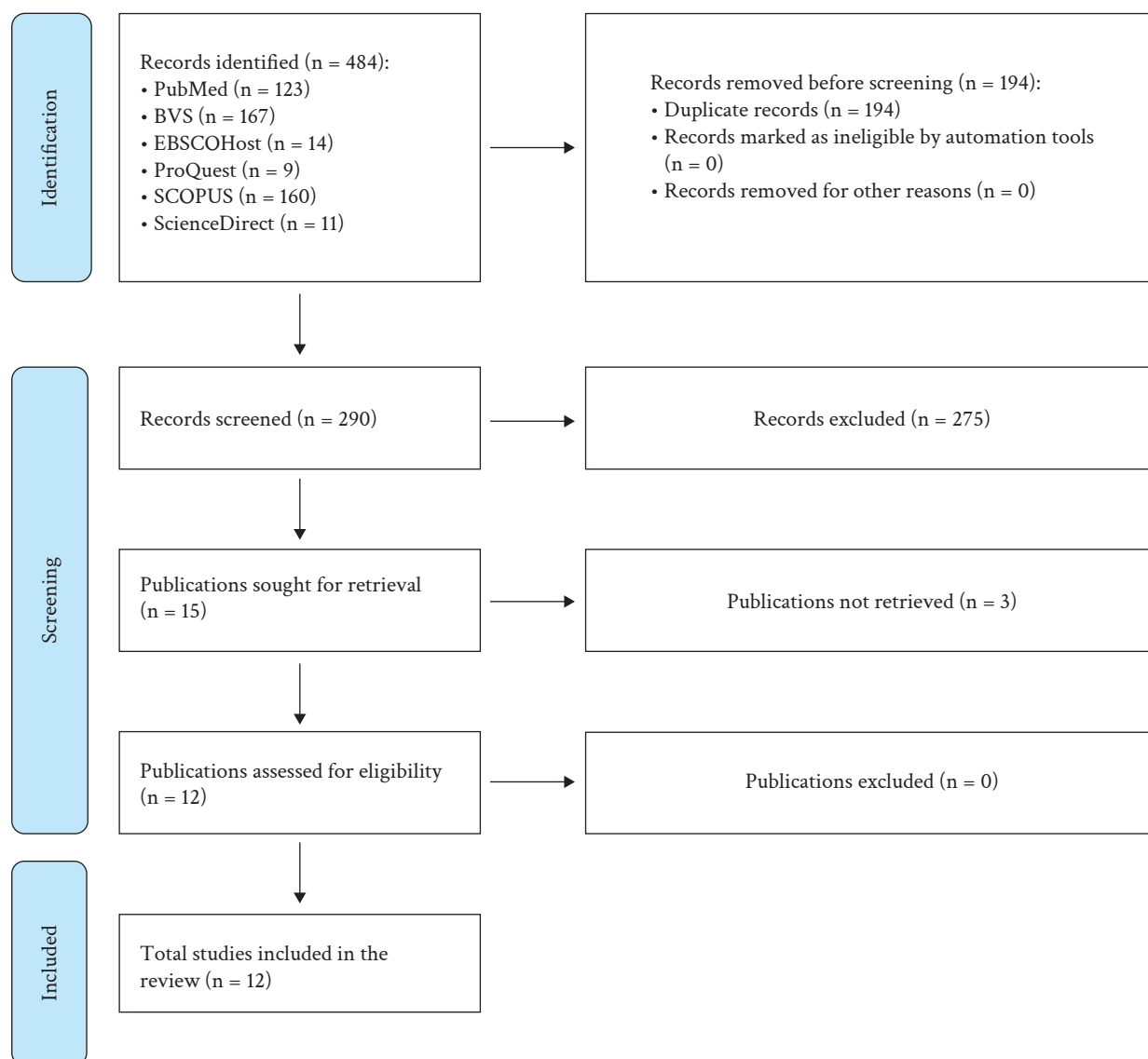


Figure 1. Identification of studies through databases and records.

According to measurement indicators

Of the included articles, the CPO-D index and ICDAS were used to assess dental caries. As for anthropometric measurements and nutritional status, these were evaluated using body mass index (BMI). In addition, in other studies, nutritional status was calculated based on Z-scores using the World Health Organization (WHO) anthropometric software.

According to study design and sampling type

The selected articles included correlational, retrospective, descriptive, and cross-sectional studies. Sampling methods were categorized as simple random sampling and systematic random sampling.

Table 1. Characteristics of the selected articles.

Authors	Year	Methodology and intervention	Sample characterization	Results
Arsad et al. (8)	2024	Cross-sectional study. The DMFT index was used for dental caries assessment. Children's growth was calculated based on Z-scores.	M = 52; F = 46; 4 years = 8; 5 years = 55; 6 years = 35	78 children (79.6%) experienced growth retardation. 17 children (17.34%) had low DMFT scores, 7 children (7.114%) had moderate scores, and 26 children (26.53%) had high scores.
Phogat et al. (9)	2023	Analytical cross-sectional study. Dental caries was recorded according to ICDAS II criteria. Nutritional status was calculated based on Z-scores using WHO anthropometric software.	M = 431; F = 437; 36–48 months = 422; 48.1–60 months = 446	The prevalence of malnutrition among study participants included stunting (15.4%), underweight (7.4%), and wasting (5.0%). The prevalence of ICDAS codes 3, 4, 5, and 6 was 8.2%, 11.2%, 13.6%, and 6.6%, respectively.
Kshetri-mayum et al. (10)	2023	Descriptive cross-sectional study. Anthropometric evaluations were performed using BMI. The DMFT index was used for dental caries.	M = 220; F = 164; 2 years = 16; 3 years = 38; 4 years = 52; 5 years = 84; 6 years = 194	The mean number of decayed teeth among 384 children aged 2–6 was 5.6 ± 2.43 . Most children with caries (74.7%) belonged to the moderate category of the decayed, extraction-indicated, and filled teeth index (dmft >7), followed by the low (16.7%) and high (8.6%) categories. Pearson correlation showed no significant association between ECC and age-adjusted BMI ($r = 0.04$; $P > 0.05$).
Guapacha et al. (11)	2023	Descriptive cross-sectional study. The DMFT index was used for dental caries, and BMI for anthropometric evaluation.	M = 64; F = 60	Risk of underweight for age was reported in 14.52% ($n = 18$). Risk of short stature was reported in 22.58% ($n = 28$). Caries analysis revealed that the sample had a "very low" index in 71% ($n = 88$), followed by "low" (11.3%, $n = 14$) and "very high" (8.9%, $n = 11$). Overweight children exhibited a higher incidence of dental caries in this study.
Olatosi et al. (12)	2022	Descriptive cross-sectional study. The DMFT index was used for dental caries assessment. Children's nutritional status was assessed using Z-scores calculated with the WHO anthropometry software.	M = 130; F = 143	Mean dmft was 3.04 ± 2.28 , and most lesions (96%) corresponded to untreated caries. Nutritional status was classified according to Z-score as severe wasting (< -3), wasting (-2 to -3), normal (-2 to $+2$), overweight ($+2$ to $+3$), and obesity ($> +3$). The highest DMFT scores were observed among combined severe wasting/wasting groups, and the lowest among children with normal weight.
Cuong et al. (13)	2022	Cross-sectional study. Caries was diagnosed according to ICDAS criteria. Nutritional status was determined according to the 2006 WHO standards.	M = 356; F = 334; 2 years = 50; 3 years = 208; 4 years = 204; 5 years = 228	Mean height and weight were similar to WHO standards for children of the same age and sex. Dental caries rates among children with stunting, underweight, wasting, and overweight/obesity were 63.5%, 61.3%, 58.3%, and 58.3%, respectively. Malnourished or underweight children had a higher proportion of dental caries.
Ndekero et al. (14)	2021	Cross-sectional study. Anthropometric assessment included actual weight and height, and Z-scores for weight-for-age, height-for-age, and weight-for-height; visible plaque index, sugar consumption index, fresh fruit intake index, and ECC (dmft index) were also determined.	M = 401; F = 430	A total of 47.7% ($n = 219$) of children had one to four decayed teeth, while 21.8% ($n = 101$) had five or more. Nutritional assessment showed a prevalence of underweight (Z-score < -2) of 4.2% [95% CI: 3.0–5.8], stunting (Z-score < -2) of 1.6% [95% CI: 0.9–2.7], and global acute malnutrition (Z-score < -2 or edema) of 29.8% [95% CI: 26.8–33.0].
Aung et al. (15)	2021	Retrospective study. ECC status was determined based on the score of missing and filled teeth due to caries. Objectively measured BMI information was obtained from the Before School Check (B4SC) program.	M = 13,869; F = 13,464	One-fourth of the study population was overweight or obese, with greater prevalence among Māori children (32.4%), Pacific children (47.1%), and those from the most deprived neighborhoods (37.3%). ECC prevalence was also higher among Māori children (59.0%), Pacific children (64.5%), those living in deprived neighborhoods (60.3%), Northland (53.5%), or non-fluoridated areas (47.0%).

BMI: Body Mass Index; M: male; F: female.

Table 1. (Continuation).

Authors	Year	Methodology and intervention	Sample characterization	Results
Fernández et al. (16)	2020	Correlational, descriptive, and cross-sectional study. Active caries categories ICDAS II 2–6 and 4–6 were used to record age and severity of caries experience. Anthropometric assessments were performed using BMI.	145 children aged 12–71 months	Caries prevalence among malnourished children was 48.2% when enamel and dentin lesions were considered. This prevalence decreased to 35.2% when only dentinal lesions were considered.
Kim et al. (17)	2020	Cross-sectional study. Caries prevalence was measured using DMFT among mothers. BMI was calculated for everyone, while nutritional status was determined according to the 2006 WHO standards.	M = 325; F = 285; 3 years = 207; 4 years = 196; 5 years = 207	As children's age increased, the rate of untreated dental caries increased. No significant differences in dft were found according to maternal educational level ($P = 0.152$), although it tended to be higher among children whose mothers had lower educational attainment ($P = 0.082$).
Parra-Coronel et al. (18)	2020	Observational, descriptive, and cross-sectional study. ICDAS criteria were used. BMI and nutritional status were determined according to the 2006 WHO standards.	M = 80; F = 62; 10–23 months (M = 35%, F = 11.3%); 24–35 months (M = 30%, F = 45.2%); 36–48 months (M = 35%, F = 43.5%)	No associations with nutritional status were observed. A relatively high prevalence of possible overweight risk was noted among girls (17.7%) and boys (23.8%). Most children (83.1%) presented advanced caries (ICDAS 3–6). Increasing age was also a positive determinant for advanced caries occurrence.
Kennedy et al. (19)	2020	Cross-sectional study. The DMFT index was used for dental caries. Preoperative anthropometric measurements were used to calculate BMI Z-scores.	M = 72; F = 78	A total of 42% were classified as “at risk of overweight” (18.7%), “overweight” (16.7%), “obesity” (5.3%), or “severe obesity” (1.3%) according to WHO BMI classifications. Only two individuals were classified as “wasted” (1.3%). No statistically significant relationship was found between BMI and the caries index.

BMI: Body Mass Index; M: male; F: female.

DISCUSSION

Untreated dental caries and nutritional status in preschool children are closely interrelated and exert a significant impact on child health and development. Research in this field is essential for developing effective prevention and treatment strategies that improve children's quality of life and establish the foundation for a healthy life course. By addressing these problems comprehensively, it may be possible to ensure that children grow up in an environment that promotes both oral health and overall well-being (8,10).

This review highlights the severity of the consequences of untreated dental caries on nutritional status among preschool children, with reports of dental caries experience demonstrating a high burden of oral disease. According to the studies analyzed (12,14,15,17), children with a higher incidence of dental caries in the primary dentition has been associated with growth retardation, risk of overweight (9,13,19), wasting, or underweight-for-height, due to systemic conditions (9,13), among other factors.

Although the studies reviewed reported similar findings, such as the association between dental caries and malnutrition or underweight status in preschool children (10,12,14,15,17), discrepancies were also observed, as other studies report an association between dental caries and obesity (9,13,16,18–20). These inconsistencies may be explained by differences in sample size. On the other hand, overweight children are more likely to experience early childhood caries; however, some studies indicate that underweight children are at greater risk of developing this disease. Additional studies suggest that preschool children with overweight and obesity are at greater risk of developing early dental caries, based on the premise that frequent consumption of sugar-containing beverages and foods, as well as snacking between meals, may constitute risk factors for both dental caries and obesity (20,21). Therefore, the available evidence suggests that inadequate dietary habits and high exposure to sugars significantly increase the prevalence of dental caries among children who already have weight problems.

Finally, during the development of this review, the principal limitation identified was the limited number of epidemiological studies on dental caries conducted in Peru using rigorous methodologies, could provide more accurate and updated data. Furthermore, the identified studies have primarily focused on dental caries itself, without examining in depth the repercussions it may generate in children, despite the critical importance of this issue. No studies employing more rigorous methodology—such as clinical trials—were found, that could demonstrate a stronger association or identify more specific and valid risk factors, both methodologically and clinically.

CONCLUSION

Untreated dental caries in preschool children is associated with nutritional status, exerting a negative impact. The reviewed studies suggests that children with dental caries tend to experience pain and discomfort during mastication, which can reduce food intake and an inadequate diet. Consequently, this may result in nutritional deficiencies that adversely affect growth and overall development, highlighting the need for further research to resolve existing discrepancies and deepen understanding of this relationship.

Conflict of interest:

The authors declare no conflict of interest.

Funding:

Self-funded.

Authorship contribution:

JIVC: conceptualization, methodology, research, formal analysis. **MECF:** conceptualization, methodology, research, validation, formal analysis, supervision, project administration, writing of the original draft, writing - review & editing. **RJRE:** conceptualization, methodology, research, validation, supervision, writing of the original draft, writing - review & editing. **ACMRA:** supervision, writing of the original draft, writing - review & editing.

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