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REVIEW ARTICLE

Performance Nutrition and Dental Health in Athletes: Implications for Sports Dentistry Practice

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Abstract

Athletes present with a distinct oral health risk profile, shaped largely by the nutritional demands of training and competition. High-frequency carbohydrate consumption, regular use of acidic sports beverages, and exercise-induced dehydration create conditions that accelerate enamel erosion, increase caries risk, and compromise the protective capacity of saliva. Additionally, micronutrient inadequacies — including Vitamin D, calcium, and Vitamin C — can impair enamel integrity and periodontal tissue health. This narrative review synthesises current evidence across four key nutrition-dentistry intersections: sports beverage acidity and enamel erosion, fueling frequency and caries risk, micronutrient status and oral tissue integrity, and salivary function under dehydration and training stress. Findings indicate that the nutritional environment in which athletes operate is a primary, yet frequently overlooked, driver of dental morbidity in this population. Sports dentistry professionals require a working understanding of performance nutrition principles to provide clinically contextualised and effective dental care for athletes. Clinically, this understanding enables the delivery of practical, athlete-compatible interventions — including strategic timing of oral hygiene, appropriate product selection, and hydration guidance — that protect dental health without compromising performance. **Conclusion**:Performance nutrition practices, while essential for athletic performance, can inadvertently create significant oral health challenges through frequent carbohydrate exposure, acidic sports beverages, micronutrient inadequacies, and dehydration-related salivary dysfunction. Integrating nutritional awareness into sports dentistry enables clinicians to deliver practical, athlete-centred preventive strategies that protect oral health without compromising performance.

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1. INTRODUCTION

Oral health problems are disproportionately prevalent among competitive athletes. Studies from the London 2012 and 2016 Olympic Games dental clinics reported untreated dental caries in over 55% of athletes examined, alongside high rates of enamel erosion and periodontal disease — figures substantially exceeding population norms for comparable age groups[1,2]. While training environment exposure and hygiene practices have been cited as contributing factors, accumulated evidence increasingly implicates performance nutrition as a primary, and underappreciated, driver of these outcomes.

Athletes eat and drink differently from the general population — not by accident, but by design. Performance nutrition is structured to maximise energy availability, support adaptation, and accelerate recovery. In practice, this means high meal frequency, regular carbohydrate intake across the training day, reliance on sports-specific products, and deliberate hydration strategies. Each of these practices carries direct oral health implications. Understanding this relationship is not supplementary for sports dentistry practitioners — it is foundational to delivering care that is relevant, realistic, and effective.

This review examines the current evidence across four intersecting domains: the erosive potential of sports beverages, the cariogenic consequences of fueling frequency, the role of key micronutrients in oral tissue integrity, and the impact of dehydration and training stress on salivary defence mechanisms.

2. METHODS

This narrative review was conducted using a structured literature search of PubMed, Google Scholar, and SPORTDiscus. Search terms included combinations of: 'sports nutrition and dental health,' 'enamel erosion athletes,' 'sports drinks pH dental,' 'salivary flow exercise,' 'carbohydrate intake caries,' 'micronutrients oral health,' and 'saliva dehydration.' Inclusion criteria were: peer-reviewed studies, systematic reviews, or established clinical guidelines published between 2000 and 2024; human subjects; and relevance to competitive or recreational athletic populations. Reference lists of key articles were hand-searched for additional sources. Studies were selected for relevance to the four defined thematic domains. As a narrative review, no meta-analytic synthesis was performed, and no formal risk-of-bias assessment was applied. A full search strategy summary is provided in Table 1.

Literature searches were conducted across three electronic databases and supplemented by hand-searching reference lists of key included articles. Searches were conducted between January and March 2025. The table below summarises the databases accessed, primary search terms used, date range applied, and initial results retrieved prior to screening against inclusion criteria.

Table 1. Search strategy summary

Database	Search Terms	Date Range	Initial Results
PubMed	Sports nutrition and dental health; enamel erosion athletes; sports drinks pH dental; salivary flow exercise	2000–2024	214
Google Scholar	Carbohydrate intake caries; micronutrients oral health; saliva dehydration athletes	2000–2024	178
SPORTDiscus	Athlete oral health; sports drink erosion; exercise immune function saliva	2000–2024	93
Hand search	Reference lists of key included articles	2000–2024	12
Google Scholar	Reviewer recommendation	2025-2026	5

Following de-duplication and screening against inclusion criteria (peer-reviewed human-subjects studies or systematic reviews published 2000–2024, relevant to competitive or recreational athletic populations), 10 studies were included in the primary narrative synthesis. Five additional references identified through reviewer recommendation were incorporated in the revised submission, extending coverage to 2026 where directly relevant to the review's thematic domains.

3. RESULTS

3.1 Sports Beverages and Enamel Erosion

The erosive potential of a beverage is primarily determined by its pH and Titratable Acidity (TA), the latter reflecting its buffering capacity against salivary neutralisation. Most isotonic sports drinks have a pH between 2.4 and 4.5 [3], well below the critical demineralisation threshold of pH 5.5 for enamel. A recent systematic review of sports, energy, and isotonic drinks confirmed that the majority of commercially available products carry meaningful erosive potential, with repeated exposure patterns in athletes representing a primary risk factor[4]. Athletes consuming these products every 15–20 min across multi-hour training sessions sustain prolonged acid exposure with insufficient recovery intervals. Attin *et al.*[4] demonstrated that acid-softened enamel sustains significantly greater mechanical wear — meaning tooth brushing shortly after acidic intake, or parafunctional tooth contact during exertion, compounds erosive damage[5]. Endurance athletes face the highest cumulative risk given the frequency and volume of intake required across long sessions.

3.2 Fueling Frequency and Caries Risk

The Stephan curve principle establishes that it is the frequency of carbohydrate exposure — not total intake volume — that drives caries progression[6]. Each carbohydrate-containing intake event generates a discrete acid challenge in the oral environment, depressing plaque pH below the caries threshold for approximately 20–40 minutes. Athletes completing two daily training sessions may consume 6–8 eating occasions involving rapidly fermentable carbohydrates, generating multiple cariogenic challenges per day. Olympic Games dental clinic data confirm this translates to clinical disease burden: caries prevalence in elite athletes consistently exceeds age-matched population estimates across multiple studies[1,2]. This is further supported by recent evidence from elite athletes in Ireland, which found significant associations between dietary patterns, carbohydrate intake frequency, and caries risk in a competitive athletic population[7]. The combination of high fueling frequency with compromised salivary defence (discussed herein) creates a particularly unfavourable oral environment.

3.3 Micronutrients and Oral Tissue Integrity

Vitamin D and calcium are foundational to enamel mineralisation and remineralisation. Vitamin D insufficiency — prevalent in indoor athletes, early-morning trainers, and those from low-sunlight regions — impairs calcium absorption and reduces salivary antimicrobial peptide expression, with documented associations with poorer periodontal outcomes[8]. Vitamin C, as the rate-limiting cofactor for collagen synthesis, directly supports periodontal ligament and gingival connective tissue integrity[9]. Chronically low intake — realistic in athletes with restrictive dietary patterns or inadequate fruit and vegetable consumption — can present clinically as increased gingival bleeding and fragility, frequently misattributed to hygiene deficiency. Furthermore, athletes in sustained energy deficit — common in weight-category sports and during aggressive body composition phases — experience suppression of secretory immunoglobulin A (sIgA), the dominant immunoglobulin in saliva, increasing susceptibility to oral infection and bacterial colonisation[10].

3.4 Hydration, Saliva, and Oral Defence

Saliva serves as the oral environment's primary defence: buffering acid, delivering calcium and phosphate for emineralisation, and providing antimicrobial protection via lysozyme, lactoferrin, and sIgA. Exercise-induced dehydration at just 1–2% body

weight loss reduces resting salivary flow rates by up to 40%[11] — a dehydration threshold routinely crossed during training. This means athletes are most physiologically vulnerable, salivary-defence-wise, at the precise moments when acidic, cariogenic nutritional products are consumed most heavily. Compounding this, chronically elevated cortisol during periods of high training load suppresses sIgA and alters saliva's antimicrobial protein profile[12], likely explaining the clustering of dental problems during peak training blocks and pre-competition periods rather than uniformly across the training year.

4. DISCUSSION

The evidence across these four domains converges on a consistent finding: performance nutrition practices — designed rationally for athletic output — create a dental risk environment that is systematically underrecognised in clinical sports dentistry settings. This is not a failure of athlete behaviour; it is a consequence of competing physiological demands. A comprehensive review of the impact of sports participation on oral health further underscores this, documenting the breadth of dental conditions that emerge as a direct consequence of sport-specific behaviours and exposures[13].

The clinical implications are practical and actionable without requiring athletes to compromise nutritional strategy. Timing oral hygiene practices away from acidic intake, using fluoride-containing products consistently, considering xylitol-containing gum post-fueling to stimulate salivary flow and reduce plaque pH, diluting sports beverages where palatability allows, and using water rinses after carbohydrate exposure are all low-friction interventions compatible with training demands[14]. Routine Vitamin D screening and dietary assessment for Vitamin C and calcium adequacy should form part of the athlete health monitoring framework, with sports dentistry professionals ideally interfacing with sports nutritionists, performance staff, and coaches — a model of athlete-centred, interdisciplinary care that is increasingly recognised as best practice in elite sport settings[15].

This review is limited by its narrative design and the heterogeneity of the underlying literature, which spans laboratory models, observational athlete studies, and clinical audits. Prospective studies specifically examining nutritional intervention effects on dental outcomes in athletic populations remain scarce and represent an important research gap. Nonetheless, the mechanistic evidence is sufficiently robust to inform practice now.

As sports dentistry consolidates as a discipline, positioning itself as an integrated component of athlete health support — rather than an isolated clinical service — will determine its long-term impact. That integration begins with understanding what high-performance fueling actually looks like, and why it matters for the teeth sitting behind the mouthguard.

5. ARTIFICIAL INTELLIGENCE DISCLOSURE

AI-assisted tools were used in the preparation of this manuscript for language editing and structural refinement. All intellectual content, clinical interpretations, and conclusions are the sole work of the author. The author retains full responsibility for the accuracy and originality of the manuscript.

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