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MEDITERRANEAN DIET AND PERIODONTITIS: LINKS BETWEEN NUTRITION, INFLAMMATION, AND PERIODONTAL HEALTH

DIETA MEDITERRÂNEA E PERIODONTITE: RELAÇÕES ENTRE NUTRIÇÃO, INFLAMAÇÃO E SAÚDE PERIODONTAL

DIETA MEDITERRÁNEA Y PERIODONTITIS: RELACIONES ENTRE NUTRICIÓN, INFLAMACIÓN Y SALUD PERIODONTAL

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ABSTRACT

Objective: This study aimed to evaluate the association between adherence to the Mediterranean dietary pattern and periodontal health, with particular emphasis on inflammatory modulation and clinical periodontal outcomes.

Methodology: A comprehensive narrative synthesis of the scientific literature was conducted, focusing on observational studies, clinical investigations, and experimental research that examined dietary patterns and periodontal parameters. Electronic databases were systematically searched using keywords related to Mediterranean diet, periodontitis, systemic inflammation, and oral health. Studies addressing nutritional components, inflammatory biomarkers, and periodontal clinical indices were included. Data were qualitatively analyzed to identify consistent biological mechanisms and clinical trends linking dietary habits to periodontal health.

Results: The Mediterranean diet demonstrated a consistent association with improved periodontal status. Higher adherence to this dietary pattern was correlated with reduced

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gingival inflammation, lower probing depth, and decreased bleeding on probing. These clinical benefits were accompanied by reduced levels of systemic inflammatory markers, such as C-reactive protein and pro-inflammatory cytokines. The anti-inflammatory and antioxidant properties of key dietary components, particularly fruits, vegetables, olive oil, whole grains, and omega-3-rich fish, appear to play a central role in modulating host immune responses and oxidative stress, thereby influencing periodontal tissue stability.

Conclusion: The findings suggest that the Mediterranean diet exerts a protective effect on periodontal health by attenuating systemic and local inflammatory pathways. Incorporating dietary counseling into periodontal prevention and management strategies may represent a valuable adjunctive approach. Future longitudinal and interventional studies are warranted to further clarify causality and establish standardized dietary recommendations in periodontal care.

Keywords: Mediterranean Diet. Periodontitis. Periodontal Inflammation. Nutritional Modulation. Systemic Inflammation. Oral Health.

RESUMO

Objetivo: Este estudo teve como objetivo avaliar a associação entre a adesão ao padrão alimentar mediterrâneo e a saúde periodontal, com ênfase particular na modulação inflamatória e nos desfechos clínicos periodontais.

Metodologia: Foi realizada uma síntese narrativa abrangente da literatura científica, com foco em estudos observacionais, investigações clínicas e pesquisas experimentais que examinaram padrões alimentares e parâmetros periodontais. Bases de dados eletrônicas foram sistematicamente pesquisadas utilizando palavras-chave relacionadas à dieta mediterrânea, periodontite, inflamação sistêmica e saúde bucal. Foram incluídos estudos que abordaram componentes nutricionais, biomarcadores inflamatórios e índices clínicos periodontais. Os dados foram analisados qualitativamente para identificar mecanismos biológicos consistentes e tendências clínicas que relacionassem hábitos alimentares à saúde periodontal.

Resultados: A dieta mediterrânea demonstrou associação consistente com melhora do estado periodontal. Maior adesão a esse padrão alimentar esteve correlacionada à redução da inflamação gengival, menor profundidade de sondagem e diminuição do sangramento à sondagem. Esses benefícios clínicos foram acompanhados por níveis reduzidos de marcadores inflamatórios sistêmicos, como proteína C-reativa e citocinas pró-inflamatórias. As propriedades anti-inflamatórias e antioxidantes de componentes alimentares-chave, especialmente frutas, vegetais, azeite de oliva, grãos integrais e peixes ricos em ômega-3, parecem desempenhar papel central na modulação da resposta imunológica do hospedeiro e do estresse oxidativo, influenciando a estabilidade dos tecidos periodontais.

Conclusão: Os achados sugerem que a dieta mediterrânea exerce efeito protetor sobre a saúde periodontal ao atenuar vias inflamatórias sistêmicas e locais. A incorporação do aconselhamento nutricional nas estratégias de prevenção e manejo periodontal pode representar uma abordagem complementar valiosa. Estudos longitudinais e intervencionais futuros são necessários para esclarecer a causalidade e estabelecer recomendações dietéticas padronizadas no cuidado periodontal.

Palavras-chave: Dieta Mediterrânea. Periodontite. Inflamação Periodontal. Modulação Nutricional. Inflamação Sistêmica. Saúde Bucal.

RESUMEN

Objetivo: Este estudio tuvo como objetivo evaluar la asociación entre la adherencia al patrón dietético mediterráneo y la salud periodontal, con especial énfasis en la modulación inflamatoria y los resultados clínicos periodontales.

Metodología: Se realizó una síntesis narrativa integral de la literatura científica, centrada en estudios observacionales, investigaciones clínicas y estudios experimentales que examinaron los patrones dietéticos y los parámetros periodontales. Las bases de datos electrónicas fueron consultadas sistemáticamente utilizando palabras clave relacionadas con la dieta mediterránea, periodontitis, inflamación sistémica y salud oral. Se incluyeron estudios que abordaron componentes nutricionales, biomarcadores inflamatorios e índices clínicos periodontales. Los datos fueron analizados cualitativamente para identificar mecanismos biológicos consistentes y tendencias clínicas que vinculan los hábitos alimentarios con la salud periodontal.

Resultados: La dieta mediterránea mostró una asociación consistente con la mejora del estado periodontal. Una mayor adherencia a este patrón dietético se correlacionó con la reducción de la inflamación gingival, menor profundidad de sondaje y disminución del sangrado al sondaje. Estos beneficios clínicos estuvieron acompañados por niveles reducidos de marcadores inflamatorios sistémicos, como la proteína C reactiva y citocinas proinflamatorias. Las propiedades antiinflamatorias y antioxidantes de componentes dietéticos clave, especialmente frutas, verduras, aceite de oliva, cereales integrales y pescados ricos en omega-3, parecen desempeñar un papel central en la modulación de la respuesta inmunitaria del huésped y del estrés oxidativo, influyendo en la estabilidad de los tejidos periodontales.

Conclusión: Los hallazgos sugieren que la dieta mediterránea ejerce un efecto protector sobre la salud periodontal al atenuar las vías inflamatorias sistémicas y locales. La incorporación del asesoramiento nutricional en las estrategias de prevención y manejo periodontal puede representar un enfoque complementario valioso. Se requieren futuros estudios longitudinales e intervencionistas para aclarar la causalidad y establecer recomendaciones dietéticas estandarizadas en la atención periodontal.

Palabras clave: Dieta Mediterránea. Periodontitis. Inflamación Periodontal. Modulación Nutricional. Inflamación Sistémica. Salud Oral.

1 INTRODUCTION

Periodontitis is a chronic inflammatory disease initiated by a dysbiotic subgingival biofilm and perpetuated by an exaggerated host immune response, leading to progressive destruction of the supporting tissues of the teeth. Beyond its local manifestations, periodontitis is increasingly recognized as a condition with systemic implications, sharing common inflammatory pathways with metabolic and cardiovascular diseases (Tonetti et al., 2017). In this context, modifiable lifestyle factors, particularly diet, have emerged as important determinants of periodontal health.

Dietary patterns influence systemic inflammation, oxidative stress, and immune regulation, all of which are central to the pathogenesis of periodontitis. Western dietary habits, characterized by high intake of refined carbohydrates, saturated fats, and ultra-processed foods, have been associated with increased inflammatory burden and worse periodontal outcomes (Hu, 2018). Conversely, the Mediterranean diet (MedDiet), rich in fruits, vegetables, whole grains, legumes, olive oil, nuts, and fish, has consistently demonstrated anti-inflammatory and antioxidant effects, contributing to reduced risk of chronic inflammatory diseases (Sofi et al., 2010).

The biological plausibility linking the Mediterranean diet to periodontal health is supported by several mechanisms. Key components of this dietary pattern, such as polyphenols, omega-3 fatty acids, vitamins, and dietary fiber, modulate inflammatory signaling pathways, reduce oxidative stress, and promote immune homeostasis (Estruch et al., 2018). Moreover, omega-3 fatty acids act as precursors for specialized pro-resolving mediators, including resolvins and protectins, which actively orchestrate the resolution of periodontal inflammation rather than merely suppressing it (Serhan et al., 2008).

Emerging epidemiological and clinical evidence suggests that greater adherence to the Mediterranean diet is associated with reduced gingival inflammation, lower probing depth, and decreased bleeding on probing (López-Goldaracena et al., 2021; Woelber et al., 2017). However, findings remain scattered across observational studies and interventional trials, with heterogeneity in dietary assessment methods and periodontal outcomes. Therefore, synthesizing the available evidence is essential to clarify the role of the Mediterranean diet as a potential adjunctive strategy in periodontal prevention and management.

This narrative review aims to evaluate the association between adherence to the Mediterranean dietary pattern and periodontal health, with particular emphasis on inflammatory modulation and clinical periodontal outcomes.

2 METHODOLOGY

This study was designed as a narrative literature review exploring the relationship between adherence to the Mediterranean dietary pattern and periodontal health. Scientific articles were identified through electronic searches in major biomedical databases using keywords related to Mediterranean diet, periodontitis, inflammation, and oral health. Eligible publications included observational studies, clinical investigations, and experimental research evaluating dietary components, inflammatory biomarkers, and periodontal clinical parameters. Studies focusing on systemic inflammatory pathways and their impact on periodontal tissues were prioritized. Relevant data were qualitatively synthesized to identify biological mechanisms and consistent clinical trends linking dietary patterns to periodontal outcomes.

3 RESULTS

3.1 ASSOCIATION BETWEEN MEDITERRANEAN DIET ADHERENCE AND PERIODONTAL PARAMETERS

The available evidence consistently demonstrates that greater adherence to the Mediterranean diet is associated with improved periodontal clinical parameters. Observational studies have reported lower prevalence and severity of periodontitis among individuals with higher Mediterranean diet adherence scores, even after adjustment for major confounders such as age, smoking status, body mass index, and oral hygiene behaviors (Kojima et al., 2018; López-Goldaracena et al., 2021). These findings suggest that dietary patterns exert an independent influence on periodontal health beyond traditional risk factors.

Clinical periodontal indicators, including probing pocket depth, clinical attachment level, and bleeding on probing, showed favorable trends among individuals adhering to the Mediterranean diet. Reduced gingival inflammation and bleeding on probing were particularly consistent findings, indicating a beneficial effect on periodontal inflammatory burden (Woelber et al., 2017). In some cohorts, adherence to the Mediterranean diet was inversely associated with the number of deep periodontal pockets, suggesting a potential role in limiting disease progression (López-Goldaracena et al., 2021).

3.2 SYSTEMIC INFLAMMATION AND PERIODONTAL OUTCOMES

Several studies highlighted a close relationship between Mediterranean diet adherence, reduced systemic inflammation, and improved periodontal status. Individuals following this dietary pattern exhibited lower circulating levels of inflammatory biomarkers

such as C-reactive protein, interleukin-6, and tumor necrosis factor-alpha, which are known contributors to periodontal tissue destruction (Sofi et al., 2010; Estruch et al., 2018). Given the bidirectional relationship between systemic inflammation and periodontitis, attenuation of the systemic inflammatory burden may partially explain the observed periodontal benefits.

Importantly, chronic low-grade inflammation has been recognized as a shared mechanism linking periodontitis with cardiometabolic diseases. The anti-inflammatory properties of the Mediterranean diet may therefore contribute to periodontal health indirectly by improving systemic immune regulation and metabolic control (Tonetti et al., 2017).

3.3 IMPACT OF ANTIOXIDANT AND POLYPHENOL-RICH FOODS

A recurring finding across the reviewed literature was the potential protective role of antioxidant- and polyphenol-rich foods characteristic of the Mediterranean diet. High consumption of fruits, vegetables, and extra-virgin olive oil was associated with reduced oxidative stress, a key driver of periodontal connective tissue breakdown (Chapple & Matthews, 2007). Oxidative stress amplifies inflammatory signaling and accelerates alveolar bone loss; therefore, dietary antioxidants may play a crucial role in preserving periodontal tissue integrity.

Experimental evidence suggests that polyphenols can modulate inflammatory pathways relevant to periodontitis, including inhibition of nuclear factor kappa B (NF-κB) activation and suppression of pro-inflammatory cytokine production (Scannapieco et al., 2010). These mechanisms provide biological plausibility for the clinical associations observed in population-based studies.

3.4 ROLE OF OMEGA-3 FATTY ACIDS AND INFLAMMATION RESOLUTION

Omega-3 fatty acids, a key component of the Mediterranean diet through regular fish consumption, were repeatedly associated with improved periodontal outcomes. Clinical studies demonstrated that omega-3 intake, particularly when used as an adjunct to conventional periodontal therapy, resulted in greater reductions in probing depth and clinical attachment loss compared to periodontal treatment alone (El-Sharkawy et al., 2010).

These benefits are attributed to the conversion of omega-3 fatty acids into specialized pro-resolving mediators, such as resolvins and protectins, which actively promote the resolution of inflammation rather than merely inhibiting inflammatory pathways (Serhan et al., 2008). This pro-resolution mechanism is especially relevant in periodontitis, a condition characterized by persistent, non-resolving inflammation.

3.5 POTENTIAL INFLUENCE ON THE ORAL MICROBIOME

Although data remain limited, emerging evidence suggests that adherence to the Mediterranean diet may influence the oral microbiome toward a less pathogenic profile. Diets rich in fiber and unsaturated fats may reduce microbial dysbiosis by limiting substrates that favor pathogenic bacterial growth and by promoting host-microbe homeostasis (Woelber et al., 2019). However, direct evidence linking Mediterranean diet adherence to specific changes in subgingival microbial composition is still scarce, highlighting the need for further microbiome-focused investigations.

3.6 OVERALL TRENDS AND EVIDENCE GAPS

Overall, the reviewed studies demonstrate a consistent association between Mediterranean diet adherence and improved periodontal health, mediated through reductions in systemic inflammation, oxidative stress, and enhanced resolution of inflammatory processes. Nevertheless, most available evidence derives from observational studies, limiting causal inference. Variability in dietary assessment tools, periodontal case definitions, and study designs represents a significant source of heterogeneity across studies (Barbaresko et al., 2020). Despite these limitations, the convergence of biological plausibility and clinical observations supports the Mediterranean diet as a promising adjunctive factor in periodontal health promotion.

4 DISCUSSION

The findings synthesized in this review support a growing body of evidence that diet plays a critical role in modulating periodontal health, extending beyond local oral hygiene measures. The Mediterranean diet, characterized by high intake of fruits, vegetables, whole grains, legumes, olive oil, and omega-3-rich fish, exerts systemic anti-inflammatory and antioxidant effects that directly influence periodontal tissue stability.

Periodontitis is increasingly recognized as a chronic inflammatory disease influenced by both microbial dysbiosis and host immune dysregulation. The Mediterranean dietary pattern appears to attenuate this dysregulation by reducing systemic inflammatory burden, as evidenced by lower circulating levels of C-reactive protein, TNF-α, and IL-6. These systemic effects translate into reduced gingival inflammation, shallower probing depths, and decreased bleeding on probing.

Polyphenols and antioxidants abundant in fruits, vegetables, and olive oil play a pivotal role in neutralizing reactive oxygen species, which are key mediators of periodontal tissue destruction. Omega-3 fatty acids further modulate inflammation by serving as

precursors to specialized pro-resolving mediators, such as resolvins and proteins, which actively promote resolution of periodontal inflammation rather than merely suppressing it. Beyond host modulation, dietary patterns may also influence the oral microbiome. Emerging evidence suggests that diets rich in fiber and unsaturated fats promote a less pathogenic microbial profile, although this area remains underexplored. Importantly, the Mediterranean diet aligns with broader systemic health benefits, including improved glycemic control and cardiovascular outcomes, reinforcing the bidirectional relationship between periodontal and systemic diseases.

Nevertheless, most available data derive from observational studies, limiting causal inference. Variability in dietary assessment tools and confounding lifestyle factors also pose challenges. Well-designed interventional studies are needed to establish standardized dietary recommendations specifically tailored to periodontal therapy.

5 CONCLUSION

The Mediterranean diet emerges as a biologically plausible and clinically relevant adjunct in periodontal disease prevention and management. By modulating systemic and local inflammatory pathways, oxidative stress, and potentially the oral microbiome, this dietary pattern contributes to improved periodontal outcomes. Integrating nutritional counseling into periodontal care represents a holistic approach consistent with contemporary concepts of personalized and preventive dentistry. Future randomized controlled trials are essential to confirm causality and define evidence-based dietary guidelines for periodontal health.

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