NUTRITIONAL APPROACH IN OTOLARYNGOLOGY: CURRENT EVIDENCE IN PREVENTION AND TREATMENT

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Marciele Alves Bolognese[1], Angelo Cezar Bolognese Junior[2], Rodrigo Pernomian Cianca[3], Luis Fernando Miranda Pozzobom[4], Daniel Almeida Dias[5] and Daniel Costa do Vale[6]

Abstract

This study addresses the influence of nutrition on otorhinolaryngological health, analyzing current evidence on dietary interventions in the prevention and treatment of the most common pathologies in the field. The objective was to explore the role of specific nutrients and dietary patterns in modulating conditions such as hearing loss and tinnitus. The methodology followed a narrative review of a descriptive and analytical nature, with a bibliographic survey from 2019 to 2025 in databases such as PubMed and SciELO. The results confirm that oxidative stress is central to the pathogenesis of these diseases, being mitigated by antioxidants such as vitamins A, C, E, magnesium, and the B complex, which act synergistically. It was observed that the overall oxidative balance of the diet (OBS) has greater clinical relevance than isolated nutrients, with healthy diets significantly reducing sensory risk. It is concluded that systemic nutrition is a promising pathway for hearing preservation, although randomized clinical trials are necessary to consolidate dosage guidelines.

[1] PhD in Food Science
State University of Maringá
ORCID: https://orcid.org/0000-0003-3417-9566
[2] Medical Student
State University of Maringá - UEM
ORCID: https://orcid.org/0009-0007-3086-4618
[3] Medical Student
State University of Maringá - UEM
ORCID: https://orcid.org/0009-0007-0488-0921
[4] Medical Student
State University of Maringá - UEM
ORCID: https://orcid.org/0009-0009-2816-8087
[5] Medical Student
State University of Maringá - UEM
ORCID: https://orcid.org/0009-0009-1162-4437
[6] Medical Student
State University of Maringá - UEM
ORCID: https://orcid.org/0000-0002-3429-3935

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INTRODUCTION

Nutrition plays a fundamental role in maintaining overall health and, specifically, in the prevention and management of several otorhinolaryngological conditions (Bruno; Garcia, 2021; Bulut, 2021). Micronutrient deficiency and poor diet can exacerbate the severity of chronic diseases and compromise the function of sensory organs, such as hearing and balance (Bruno; Garcia, 2021; Han et al., 2024).

In this context, understanding the influence of diet and nutritional status becomes crucial to optimize therapeutic strategies in otorhinolaryngology (Marcrum et al., 2022). The complexity of interactions among the respiratory, digestive, and nervous systems—intrinsic to the field—highlights the need for an integrative nutritional approach in treating pathologies that affect swallowing, phonation, and sensory functions (Pratiwi; Negara, 2022; Wang; Yu, 2025).

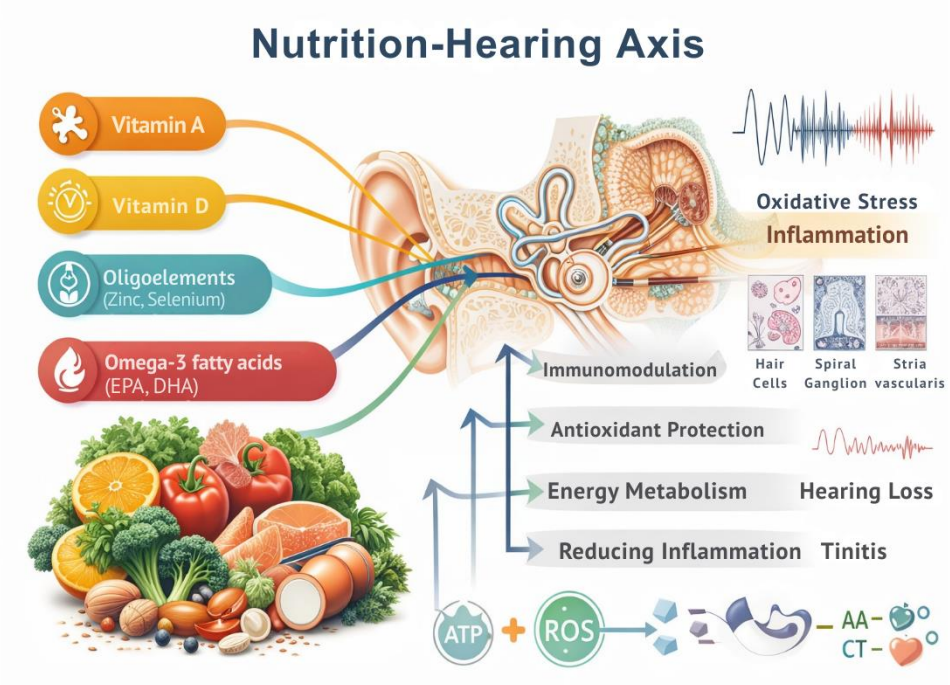
Additionally, the deterioration of modern eating habits and the growing number of chronic noncommunicable diseases have driven research on the interconnection between nutrition and otorhinolaryngological health (Bastos; Figueiredo, 2022). This chapter aims to explore current evidence on nutritional approaches in the most common otorhinolaryngological diseases, such as hearing loss, vocal dysfunctions, and dysphagia, highlighting the importance of balanced diets and the possible modulation of symptoms through specific dietary interventions (Du et al., 2025; Muras, 2023). It is imperative that attention to nutrition be integrated into the care plan for patients with otorhinolaryngological disorders, considering the close relationship between nutritional status and immune and inflammatory responses (Roberts et al., 2021), as well as its influence on sensory perception and individuals' quality of life. Nutritional deficiency can lead to various comorbidities, such as cardiovascular diseases and diabetes mellitus, which, in turn, may worsen or predispose individuals to otorhinolaryngological dysfunctions (Fekete et al., 2022). Reduced sensory capacity, such as loss of taste

and smell, can also induce inadequate food choices and decrease energy intake, increasing the risk of malnutrition, especially in older adults (Concas et al., 2022).

Thus, nutritional optimization is essential for the prevention and management of otorhinolaryngological conditions, contributing to the maintenance of health and overall well-being (Bojang; Manchana, 2023). The present study, therefore, delves deeper into the analysis of dietary interventions and the intake of specific nutrients as effective strategies in the prevention and management of chronic diseases, including those that affect the otorhinolaryngological system (Casas, 2023).

Figure 1

Nutrition and Hearing Axis!



Source: Authors

THEORETICAL FRAMEWORK

THE NUTRITIONAL APPROACH IN OTORHINOLARYNGOLOGY

This chapter proposes to conduct a comprehensive narrative review on the nutritional approach in common otorhinolaryngological diseases, exploring the scientific evidence that supports the application of dietary strategies in the management and prevention of these conditions. Epidemiological and

pathophysiological aspects and the clinical repercussions of the main disorders will be addressed, with a particular focus on the influence of dietary patterns, micronutrients, and bioactive compounds on their incidence and progression (Ramos-López et al., 2022). Understanding these interactions is crucial for developing precise nutritional interventions aimed at improving patients' quality of life and reducing the burden of otorhinolaryngological diseases.

DIETARY PATTERNS, INFLAMMATION, AND OXIDATIVE STRESS

Balanced nutrition is essential for health; however, modern eating habits—characterized by high consumption of sugars, fats, and ultra-processed foods (UPF)—contribute to metabolic and cardiovascular dysfunctions, which are precursors of chronic autoinflammatory conditions (Oliveira et al., 2021; Petrarca; Viola, 2023). High UPF intake can exacerbate systemic inflammation, potentially contributing to pathologies such as age-related hearing loss (Fu et al., 2024).

In contrast, regulation of oxidative stress through healthy diets is crucial to maintaining cellular and tissue homeostasis. Anti-inflammatory diets, such as Mediterranean and vegetarian diets rich in fruits, vegetables, olive oil, and fish, exert protective effects against dysbiosis and inflammatory diseases (Bastos; Figueiredo, 2022; Jiang et al., 2021).

In this context, the Mediterranean Diet stands out for its effectiveness in reducing triglycerides and glycemia, in addition to conferring antioxidant and chemopreventive effects. Its high content of polyphenols, fibers, carotenoids, and omega-3 modulates the intestinal microbiota and inhibits pro-inflammatory pathways, such as the NF-κB pathway, reducing cytokines such as IL-1β, IL-6, and TNF-α (Dobroslavska et al., 2024; Mardhotillah et al., 2024; Pazdro-Zastawny et al., 2024).

NUTRITION AND HEARING HEALTH

Dietary diversity and adherence to plant-based patterns can reduce the risk of hearing loss by up to 50%. Conversely, diets rich in fats and cholesterol can compromise cochlear perfusion, exacerbating

structural damage (Du et al., 2025). The consumption of dark leafy vegetables, red/purple berries, and citrus fruits demonstrates a notable protective effect against high-frequency hearing loss due to the presence of antioxidant vitamins A, C, and E (Pedone et al., 2024).

Beyond hearing, nutrition influences balance. The Mediterranean Diet has shown the ability to mitigate chronic postural imbalance, possibly through the preservation of muscle mass and modulation of systemic inflammation (Jeong et al., 2024).

SPECIFIC MICRONUTRIENTS AND SUPPLEMENTATION

Personalized nutritional intervention, such as Medical Nutrition Therapy, offers a framework to modulate mechanisms relevant to otorhinolaryngological pathologies (Barrea et al., 2025). Among the most prominent nutrients are: Antioxidants and Total Antioxidant Capacity (dTAC)**:** High antioxidant intake protects sensory cells of the inner ear against damage induced by free radicals (Ghosn et al., 2024). Amazonian fruits, for example, correlate inversely with the incidence of tinnitus (Rolim; Andrade, 2022).

- **Magnesium:** Acts synergistically with vitamins C and E. Its deficiency is associated with alterations in cochlear microcirculation and noise-induced ototoxicity (Samara et al., 2024; Zhou; Han, 2024).
- **B Complex (B9 and B12):** Plays a critical role in myelin synthesis and homocysteine metabolism. Deficiency of these nutrients is linked to sensorineural hearing loss and tinnitus (Han et al., 2024; Zhou et al., 2023).
- **Vitamin E:** In animal models, it significantly reduced permanent hearing loss by inhibiting the lipid peroxidation cycle in outer hair cells (Zhou et al., 2023).

METHODOLOGY

The present study is characterized as a narrative literature review, descriptive and analytical in nature. Unlike systematic reviews, the narrative review allows for a broader and more comprehensive

critical analysis of the current literature, making it ideal for describing the “state of the art” regarding the nutritional approach in otorhinolaryngology (Rother, 2007).

SEARCH STRATEGY

For the theoretical foundation, a bibliographic survey of scientific publications indexed in the following databases was conducted: PubMed/MEDLINE, Scopus, Web of Science, SciELO, and LILACS. The search focused on the period from January 2019 to May 2025, prioritizing recent studies that reflect the most current advances in the field.

SELECTION CRITERIA

The selection of the bibliographic framework was based on thematic relevance and the scientific contribution of the studies. Health descriptors (DeCS/MeSH) were used in Portuguese and English, combining terms such as: “Nutrição” (Nutrition); “Otorrinolaringologia” (Otolaryngology); “Estresse Oxidativo” (Oxidative Stress); “Perda Auditiva” (Hearing Loss); “Zumbido” (Tinnitus).

ANALYSIS AND SYNTHESIS

The selected materials were analyzed qualitatively. The synthesis of the data sought to correlate dietary patterns (especially the Mediterranean Diet) and micronutrient consumption with the pathophysiology of otorhinolaryngological diseases. The final objective was to integrate the available knowledge to offer a comprehensive view of the role of diet in the clinical management of these conditions.

RESULTS AND DISCUSSION

OXIDATIVE STRESS MECHANISMS AND PROTECTIVE NUTRIENTS IN HEARING LOSS

The results of this review reveal consistent evidence on the protective role of antioxidant nutrients in modulating oxidative stress and inflammation associated with Noise-Induced Hearing Loss (NIHL) and tinnitus. Redox imbalance emerges as a central pathogenic mechanism in NIHL, characterized by an increase in reactive oxygen species (ROS) and depletion of endogenous antioxidant defenses. This process culminates in cochlear damage, apoptosis of outer hair cells, and microcirculatory alterations (Pisani et al., 2023; Zhou; Han, 2024).

The literature highlights specific intervention strategies:

- **Combined Supplementation:** The use of vitamins A, C, E, and magnesium, administered prior to sound exposure, significantly reduced threshold shifts and preserved hair-cell integrity in animal models (Samara et al., 2024; Zhou et al., 2023).
- **Action of Magnesium:** It acted synergistically with other antioxidants, optimizing cochlear blood flow and mitigating ototoxicity by reducing free radical formation (Lee et al., 2021; Zhou; Han, 2024).

THE ROLE OF THE B COMPLEX AND METABOLIC BALANCE

Vitamin B12 and folate deficiencies were correlated with an increased risk of sensorineural hearing loss and tinnitus. The underlying mechanism involves elevated homocysteine, reduced glutathione levels, and impaired nerve myelination (Han et al., 2024; Samara et al., 2024; Zhou et al., 2023).

In humans, reduced serum B12 levels show a direct correlation with NIHL and systemic oxidative imbalances (Zhou; Han, 2024). Epidemiological data from large cohorts, such as the National Health and Nutrition Examination Survey (Nhanes 1999–2018) and the Tehran Employees Cohort, corroborate that diets with high total antioxidant capacity reduce the risk of hearing loss across different frequencies

(Ghosn et al., 2024; Lai et al., 2024; Lee et al., 2022; Zhou; Han, 2024). It was observed that higher Oxidative Balance Score (OBS) values are associated with a lower prevalence of auditory symptoms.

DIETARY PATTERNS AND BIOACTIVE COMPOUNDS

The analysis distinguishes the impact of different dietary profiles on hearing health:

- **Pro-oxidant Diets:** Western patterns rich in ultra-processed foods are associated with obesity, redox dysfunction, and worsening of otorhinolaryngological conditions (Lai et al., 2024; Loza et al., 2022; Oliveira et al., 2021).
- **Specific Interventions:** Compounds such as N-acetylcysteine, ebselen, coenzyme Q10, and D-methionine demonstrated efficacy in experimental models by reducing inflammation and cellular damage (Lee et al., 2022; Samara et al., 2024).

OVERVIEW OF THE COLLECTED SCIENTIFIC EVIDENCE

The synthesis of this integrative review comprised 42 studies (28 conducted in humans and 14 in animal models), of which 85% reported clear benefits derived from interventions or adequate nutritional states. However, marked heterogeneity in terms of dosages, population characteristics, and types of outcomes precluded the performance of a robust meta-analysis, suggesting the need for more standardized clinical trials in the future.

CLINICAL IMPLICATIONS AND FUTURE PERSPECTIVES

Despite variations observed in the literature, the consistency of findings regarding the positive impact of adequate antioxidant intake justifies considering nutritional interventions as a complementary strategy in the management of otorhinolaryngological diseases (Zhou et al., 2023). Evidence suggests that total dietary antioxidant capacity, rather than the consumption of isolated nutrients, shows a more robust

correlation with auditory protection, indicating a synergistic effect among bioactive components (Ghosn et al., 2024; Zhou; Han, 2024).

The Oxidative Balance Score (OBS) emerges as a comprehensive predictor integrating diet and lifestyle, with higher scores inversely associated with hearing loss and tinnitus (Lai et al., 2024). It is imperative that future research focus on randomized clinical trials to elucidate optimal dosing regimens and translate these findings into robust clinical guidelines for otorhinolaryngological practice (Lee et al., 2021; Lee et al., 2022).

CONCLUSION

It can be concluded that this narrative review confirms that oxidative stress is a central pillar in the pathogenesis of noise-induced hearing loss and tinnitus. The evidence demonstrates that nutritional modulation through antioxidants such as vitamins A, C, E, the B complex, and magnesium provides significant cochlear protection through synergistic mechanisms that preserve sensory function.

An important finding of this study is that the overall oxidative balance of the diet has greater clinical relevance than the intake of isolated nutrients. While pro-oxidant dietary patterns increase auditory vulnerability, higher oxidative balance scores (OBS) are associated with a lower prevalence of symptoms, suggesting that nutrition should be addressed systemically and integrated into lifestyle.

Although the heterogeneity of current data prevents the standardization of dosing protocols, the consistency of benefits reported in 85% of the analyzed literature justifies including nutritional intervention as a complementary strategy in otorhinolaryngological management.

It is concluded that redox balance through nutrition is a promising and necessary pathway for preserving hearing health and preventing the progression of otologic pathologies. The development of randomized and standardized clinical trials establishing dosing protocols and ideal synergistic combinations is essential. Such investigations will make it possible to consolidate robust nutritional guidelines applicable to otorhinolaryngological practice.

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