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NUTRICEUTICALS: PREVENTION OR MARKETING?

Khakimova M.O.

Assistant, Department of Medical Prevention, ASMI

ABSTRACT

This review article examines the phenomenon of nutraceuticals from the perspective of medical prevention and evidence-based medicine. It analyzes current scientific data on the biological efficacy, safety, and preventive potential of nutraceuticals for various nutrition-dependent and chronic non-communicable diseases. Particular attention is paid to distinguishing between the concepts of "nutraceuticals," "dietary supplements," and "functional foods," as well as the problem of insufficient regulation and standardization of these products. The results of clinical and epidemiological studies demonstrating both the potential preventive effects of individual nutraceuticals and the lack of evidence for many widely advertised products are discussed. It is shown that aggressive marketing often outpaces scientific evidence of effectiveness, creating inflated expectations among the public. The study concludes that a critical, scientifically based approach to the use of nutraceuticals in preventive health care is necessary.

Keywords

nutraceuticals, preventive health care, dietary supplements, functional foods, evidence-based medicine, health marketing, nutritional factors, disease prevention, food safety, public health.

НУТРИЦЕВТИКИ: ПРОФИЛАКТИКА ИЛИ МАРКЕТИНГ?

АННОТАЦИЯ

В обзорной статье рассматривается феномен нутрицевтиков с позиций медицинской профилактики и доказательной медицины. Проанализированы современные научные данные о биологической эффективности, безопасности и профилактическом потенциале нутрицевтиков при различных алиментарно-зависимых и хронических неинфекционных заболеваниях. Особое внимание уделено разграничению понятий «нутрицевтики», «биологически активные добавки» и «функциональные продукты питания», а также проблеме недостаточной регуляции и стандартизации данной продукции. Обсуждаются результаты клинических и эпидемиологических исследований, демонстрирующие как потенциальные профилактические эффекты отдельных нутрицевтиков, так и отсутствие доказательной базы для многих широко рекламируемых средств. Показано, что агрессивный маркетинг нередко опережает научные доказательства эффективности, формируя у населения завышенные ожидания. Сделан вывод о необходимости критического, научно обоснованного подхода к использованию нутрицевтиков в системе медицинской профилактики.

Ключевые слова

нутрицевтики, медицинская профилактика, биологически активные добавки, функциональное питание, доказательная медицина, маркетинг здоровья, алиментарные

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факторы, профилактика заболеваний, безопасность питания, общественное здравоохранение.

RELEVANCE

The rapid expansion of the nutraceutical market has become a notable phenomenon in modern healthcare and public health, positioning nutraceuticals at the intersection of nutrition, preventive medicine, and commercial marketing. Global sales of nutraceutical products continue to grow steadily, driven by increasing public interest in disease prevention, healthy aging, and self-care practices. However, this growth has occurred alongside considerable scientific debate regarding the actual preventive value, safety, and evidence base of many nutraceuticals currently available on the market [3].

From a preventive medicine perspective, nutraceuticals are often promoted as convenient and effective tools for reducing the risk of chronic non-communicable diseases, correcting micronutrient deficiencies, and supporting metabolic and immune health. Nevertheless, the scientific evidence supporting these claims remains heterogeneous. While certain nutraceutical components, such as omega-3 fatty acids, vitamin D, and specific probiotics, have demonstrated preventive benefits in well-designed studies, many commercially popular products lack robust clinical validation. This discrepancy raises concerns about the substitution of evidence-based preventive strategies with marketing-driven consumption.

The relevance of this review lies in the need to critically assess nutraceuticals within the framework of evidence-based prevention. Systematizing current research allows for differentiation between scientifically justified preventive applications and products primarily supported by marketing narratives. Such analysis is essential for informing healthcare professionals, guiding public health recommendations, and protecting consumers from ineffective or potentially misleading health claims [1].

MATERIALS AND METHODS

This review was conducted using a narrative-analytical methodology to evaluate the role of nutraceuticals in disease prevention and to distinguish evidence-based applications from marketing-driven claims. A comprehensive literature search was performed across international scientific databases, including PubMed, Scopus, Web of Science, and Google Scholar. The search strategy incorporated keywords such as nutraceuticals, dietary supplements, functional foods, preventive medicine, evidence-based nutrition, and health marketing.

Peer-reviewed original studies, systematic reviews, meta-analyses, and regulatory or consensus documents published primarily over the last 15–20 years were considered eligible for inclusion. Priority was given to randomized controlled trials, high-quality observational studies, and authoritative reviews that evaluated preventive effects, safety profiles, and clinical outcomes associated with nutraceutical use. Publications focusing solely on product promotion or lacking methodological transparency were excluded.

The selection process involved initial screening of titles and abstracts, followed by full-text assessment for relevance and scientific rigor. Data extraction focused on nutraceutical composition, claimed preventive benefits, study design, population characteristics, and outcome measures. Qualitative comparative analysis was applied to identify consistent evidence, gaps in knowledge, and discrepancies between scientific findings and marketing claims. The results were synthesized within the conceptual framework of preventive medicine to support balanced and critical interpretation.

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RESULTS AND DISCUSSION

The analysis of contemporary literature reveals that **nutraceuticals occupy an increasingly prominent position in preventive health discourse**, despite substantial variability in their scientific substantiation. The global nutraceutical market exceeded **USD 450 billion in 2023** and continues to grow annually by **7–9%**, largely driven by consumer demand for non-pharmacological prevention strategies [1]. This rapid expansion has occurred in parallel with intensified marketing efforts, often presenting nutraceuticals as effective alternatives to evidence-based preventive interventions.

A key finding across reviewed studies is that **the scientific evidence supporting nutraceutical efficacy is highly heterogeneous**. While certain compounds—such as omega-3 fatty acids, vitamin D, folate, and specific probiotics—demonstrate preventive potential in defined populations, a significant proportion of marketed nutraceuticals lack robust clinical validation [2]. Meta-analyses indicate that **only 20–30% of commercially available nutraceutical products are supported by moderate to high-quality evidence**, whereas the remainder rely on mechanistic assumptions, small observational studies, or extrapolated data [3].

The distinction between nutraceuticals, dietary supplements, and functional foods remains inconsistently defined across regulatory frameworks. This ambiguity contributes to **overestimation of preventive benefits by consumers**. Surveys show that **over 60% of users believe nutraceuticals can prevent or treat chronic diseases**, despite limited supporting evidence [4]. Such perceptions are strongly influenced by health-related marketing claims rather than by medical recommendations, raising concerns from a preventive medicine standpoint.

Evidence from population studies suggests that **nutraceutical consumption is more common among individuals with higher health awareness**, yet paradoxically does not always correlate with healthier lifestyle behaviors. Several cohort studies report that **regular nutraceutical users may exhibit lower adherence to dietary guidelines**, potentially substituting supplements for balanced nutrition [5]. This phenomenon, often referred to as "nutritional compensation," undermines the core principles of primary prevention.

Clinical trial data further illustrate that **preventive effects of nutraceuticals are often modest and context-dependent**. For example, omega-3 supplementation has been associated with a **10–15% reduction in cardiovascular events** in high-risk populations but shows minimal benefit in low-risk groups [6]. Similarly, vitamin D supplementation reduces fracture risk primarily in individuals with confirmed deficiency, while routine supplementation in the general population yields inconsistent outcomes [7]. These findings emphasize that **nutraceutical efficacy is population-specific rather than universal**.

Safety considerations represent another critical aspect of the nutraceutical debate. Although commonly perceived as "natural and safe," nutraceuticals are not risk-free. Adverse effects, drug–nutrient interactions, and excessive intake have been documented, particularly with fat-soluble vitamins and herbal products [8]. Studies indicate that **up to 15% of adverse supplement-related events involve interactions with prescribed medications**, highlighting the need for medical supervision [9].

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The reviewed evidence demonstrates that **nutraceuticals cannot be regarded as a homogeneous or universally effective preventive tool**. While selected products show scientifically justified benefits, widespread and unsupervised use—often driven by marketing narratives—poses risks of misinformation and misplaced preventive priorities. These findings underline the necessity of integrating nutraceutical use within an evidence-based preventive framework rather than positioning it as an independent or alternative strategy [10].

A critical theme emerging from the literature is the **dominant role of marketing in shaping public perceptions of nutraceutical efficacy**. Marketing strategies frequently emphasize "natural origin," "immune support," and "anti-aging effects," often without clear reference to clinical endpoints or population-specific indications [11]. Content analyses of advertising materials show that **over 70% of nutraceutical advertisements use vague or non-quantifiable health claims**, which are difficult to verify scientifically [12]. Such claims significantly influence consumer behavior, particularly in populations with limited access to professional nutritional counseling.

Comparative studies reveal a substantial **gap between scientific evidence and commercial messaging**. While randomized controlled trials typically report **small to moderate effect sizes**, marketing narratives often imply broad preventive or therapeutic benefits. For instance, antioxidant supplements are widely promoted for cancer prevention, despite large meta-analyses demonstrating **no significant reduction in cancer incidence** and, in some cases, increased mortality associated with high-dose supplementation [3,6]. This discrepancy raises concerns about the substitution of evidence-based prevention strategies with commercially driven supplement use.

Regulatory frameworks play a decisive role in enabling or restricting such practices. In many regions, nutraceuticals are regulated as food products rather than medicinal agents, allowing market entry without rigorous pre-marketing efficacy trials [4]. Reviews of regulatory policies indicate that **less than 25% of countries require pre-market clinical evidence for health claims on nutraceuticals**, contributing to heterogeneous product quality and inconsistent consumer protection [13]. This regulatory gap reinforces the preventive medicine concern that population-level use may outpace scientific validation.

Economic analyses further illustrate the public health implications of nutraceutical marketing. Household expenditure surveys demonstrate that **annual spending on nutraceuticals exceeds expenditures on fresh fruits and vegetables in some populations**, particularly in urban settings [1]. This shift in resource allocation may paradoxically undermine dietary quality, as consumers invest in supplements rather than nutrient-dense foods. From a preventive perspective, this represents a misalignment between scientifically supported nutrition strategies and consumer behavior.

The phenomenon of "health halos" associated with nutraceuticals also warrants attention. Behavioral studies show that individuals consuming supplements often perceive themselves as engaging in sufficient preventive behavior, which may reduce motivation for lifestyle modifications such as physical activity or dietary improvement [5]. This cognitive bias is associated with **lower adherence to primary prevention recommendations**, highlighting an indirect negative effect of uncritical nutraceutical use.

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Nevertheless, the literature also identifies contexts in which nutraceuticals may provide **legitimate preventive value**. Targeted supplementation in populations with documented deficiencies, increased physiological needs, or limited dietary access has demonstrated measurable benefits [7,8]. These findings support a **selective, indication-based approach** rather than generalized consumption. Preventive effectiveness appears highest when nutraceutical use is integrated into comprehensive lifestyle interventions rather than employed as a standalone measure [10].

Part 2 of the analysis underscores that **marketing dynamics substantially influence nutraceutical consumption patterns**, often overshadowing scientific nuance. This imbalance challenges preventive medicine frameworks, which prioritize population-level benefit, cost-effectiveness, and evidence-based guidance. Addressing this issue requires stronger regulatory oversight, improved health literacy, and clearer communication of scientific evidence to both healthcare professionals and the public [14].

The integration of nutraceuticals into the system of medical prevention requires a **clear conceptual and practical distinction between evidence-based preventive use and marketing-driven consumption**. The reviewed literature consistently indicates that nutraceuticals can contribute to disease prevention **only under specific conditions**, including documented nutrient deficiencies, increased physiological demands, or clearly defined risk groups [7]. In such contexts, nutraceuticals function as supportive tools rather than primary preventive interventions.

From the perspective of preventive medicine, **the effectiveness of nutraceuticals is highly dependent on appropriate indication, dosage, and duration of use**. Studies demonstrate that targeted supplementation strategies yield significantly better outcomes than generalized use. For example, iron, iodine, and folate supplementation programs implemented in deficient populations have resulted in **reductions of deficiency-related disorders by 30–60%**, whereas indiscriminate supplementation shows minimal or no population-level benefit [8]. These findings reinforce the principle that **nutraceuticals should complement, not replace, balanced nutrition and lifestyle modification**.

Another critical issue concerns **safety and long-term use**. While nutraceuticals are often perceived as harmless, evidence indicates that chronic high-dose supplementation may lead to adverse outcomes. Meta-analyses reveal that excessive intake of fat-soluble vitamins and certain antioxidants is associated with **increased all-cause mortality or organ-specific toxicity** in some populations [3,6]. Moreover, nutraceutical–drug interactions remain underrecognized in clinical practice, despite evidence that **up to one in six supplement users simultaneously take prescription medications** [9]. These findings highlight the necessity of medical supervision and risk assessment in preventive use.

In contrast to evidence-based prevention, **marketing-driven nutraceutical consumption prioritizes consumer appeal over scientific validation**. Health claims are frequently framed in preventive language without reference to clinical endpoints, absolute risk reduction, or population specificity [11]. This practice blurs the boundary between health promotion and commercial persuasion, potentially undermining public trust in preventive medicine. Preventive frameworks emphasize population benefit, cost-effectiveness, and risk minimization, whereas marketing strategies focus on individual consumption and perceived wellness [12].

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Importantly, the literature supports a **regulatory and educational approach** to resolving this tension. Strengthening evidence requirements for health claims, improving labeling transparency, and enhancing professional education on nutraceutical use have been shown to improve rational consumption patterns [13]. Public health interventions aimed at improving nutritional literacy reduce reliance on supplements as "shortcut solutions" and promote adherence to dietary guidelines [5].

The reviewed evidence confirms that **nutraceuticals occupy a dual role within modern health systems**, functioning either as legitimate preventive adjuncts or as products driven primarily by marketing narratives. Their preventive value is real but limited, context-dependent, and subordinate to established lifestyle-based interventions. **Distinguishing prevention from marketing is therefore a central task for preventive medicine**, requiring critical appraisal, regulatory oversight, and evidence-based guidance to ensure that nutraceutical use supports, rather than distorts, public health objectives [10–14].

CONCLUSIONS

Nutraceuticals have become an increasingly visible component of contemporary health and prevention practices, positioned at the intersection of nutrition, preventive medicine, and commercial interests. The analysis presented in this review demonstrates that nutraceuticals cannot be regarded as a homogeneous or universally effective tool for disease prevention. Their preventive potential is highly variable and depends on the specific compound, target population, baseline nutritional status, and conditions of use.

Evidence indicates that nutraceuticals may provide measurable preventive benefits primarily in well-defined contexts, such as correction of documented micronutrient deficiencies, support of vulnerable population groups, or supplementation under increased physiological demands. In these situations, nutraceuticals function as adjuncts to, rather than substitutes for, established preventive strategies based on balanced nutrition, healthy lifestyle behaviors, and medical supervision. Conversely, indiscriminate or generalized use of nutraceuticals in the absence of clear indications shows limited efficacy and may divert attention from more effective primary prevention measures.

A central conclusion of this review is the substantial discrepancy between scientific evidence and marketing-driven claims surrounding nutraceuticals. Aggressive promotion often exaggerates preventive benefits and minimizes potential risks, contributing to unrealistic expectations among consumers. This dynamic poses challenges for preventive medicine, as it may encourage reliance on supplements while undermining adherence to evidence-based dietary and lifestyle recommendations.

Safety considerations further underscore the need for caution. Although widely perceived as safe, nutraceuticals are not free from adverse effects, particularly when used in excessive doses or in combination with pharmacological treatments. Long-term unsupervised consumption increases the risk of nutrient imbalance and drug–nutrient interactions.

In conclusion, nutraceuticals should be integrated into preventive medicine through a critical, evidence-based, and regulation-supported approach. Clear clinical indications, professional

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guidance, and improved public nutritional literacy are essential to ensure that nutraceutical use contributes meaningfully to disease prevention rather than serving primarily as a product of health-related marketing.

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