

## The expanding nutraceutical market: a critical review

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**Received:** 11 April 2025

**Revised:** 02 December 2025

**Accepted:** 03 December 2025

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### ABSTRACT

The global nutraceutical industry is expanding rapidly, driven by growing emphasis on preventive healthcare, lifestyle modification, and consumer preference for natural therapeutic options. Derived from the convergence of “nutrition” and “pharmaceutical,” nutraceuticals bridge food and medicine, offering potential benefits in health promotion and disease prevention; however, concerns regarding their safety, efficacy, standardization, and regulatory oversight persist. Traditional systems such as Ayurveda and Traditional Chinese Medicine provide conceptual foundations for many modern nutraceutical formulations. This narrative review examines key distinctions between nutraceuticals and pharmaceuticals, evaluates the benefits and limitations of synthetic and herbal nutraceuticals, and analyzes regulatory frameworks across India, the United States, and Europe. Findings indicate that while nutraceuticals offer accessibility, affordability, and preventive health advantages, they face challenges related to product variability, adulteration, and unsubstantiated health claims. Regulatory mechanisms remain inconsistent globally, with oversight by FSSAI in India, the FDA under DSHEA in the U.S., and EFSA in Europe. Current market trends highlight growing demand for personalized, plant-based, and clean-label products, with the Indian nutraceutical sector projected to grow at a CAGR of nearly 10% through 2030. Sustainable advancement of the industry requires robust scientific validation, harmonized regulation, and ethical marketing to ensure efficacy, safety, and consumer trust.

**Keywords:** Nutraceuticals, Pharmaceuticals, Regulation, Preventive health, India, Market trends

### INTRODUCTION

The global nutraceutical industry has expanded rapidly in recent years, driven by increasing emphasis on preventive healthcare, rising prevalence of chronic non-communicable diseases, and growing consumer preference for natural therapeutic alternatives. Nutraceuticals—products positioned between food and medicine—include dietary supplements, functional foods, and bioactive compounds derived from natural or synthetic sources.<sup>1,2</sup> Traditional medical systems such as Ayurveda and Traditional Chinese Medicine have further contributed to this growth by emphasizing food-based therapeutics and

holistic health approaches.<sup>3</sup> However, the sector’s swift expansion has raised concerns regarding product standardization, unverified health claims, adulteration, and variability in evidence-based efficacy. Regulatory oversight remains inconsistent across regions, with frameworks governed by the Food Safety and Standards Authority of India (FSSAI), the U.S. Food and Drug Administration under the Dietary Supplement Health and Education Act (DSHEA), and the European Food Safety Authority (EFSA).<sup>4-6</sup>

Despite regulatory and scientific challenges, the global nutraceutical market is projected to exceed USD 650

billion by 2030, reflecting sustained consumer demand and the increasing integration of nutraceuticals into preventive and complementary healthcare.<sup>7</sup> This review aims to clarify the distinctions between nutraceuticals and pharmaceuticals, evaluate the benefits and risks of both synthetic and herbal nutraceuticals, and critically examine regulatory frameworks in India, the United States, and Europe. It further highlights emerging trends and future perspectives, with particular attention to the rapidly evolving Indian nutraceutical sector.

## TRADITIONAL KNOWLEDGE OF NUTRIENTS AND NUTRACEUTICALS

Traditional health systems like Ayurveda and Traditional Chinese Medicine have long recognized the therapeutic benefits of certain foods and herbs.<sup>8</sup> In India, substances such as turmeric and ashwagandha have been used for centuries to maintain health and treat illnesses. Modern nutraceuticals build on this traditional knowledge but often prioritize commercialization over empirical validation.

## NUTRACEUTICALS VERSUS PHARMACEUTICALS

Pharmaceutical products undergo extensive clinical testing and regulatory approval processes, ensuring their efficacy and safety. Nutraceuticals, often marketed as dietary supplements, are not subjected to equivalent rigorous evaluation.<sup>9</sup> This regulatory gap allows for products with unsubstantiated health claims to enter the market.

**Table 1: Key differences between nutraceuticals and pharmaceuticals.**

Aspect	Nutraceuticals	Pharmaceuticals
<b>Regulation</b>	Variable, generally less strict	Highly regulated
<b>Clinical trials</b>	Rarely mandatory	Mandatory and extensive
<b>Health claims</b>	Broad and general	Specific and disease-targeted
<b>Regulatory authorities</b>	FSSAI (India), FDA (US) as food products	FDA (US), ema (Europe) as drugs
<b>Safety monitoring</b>	Limited	Ongoing post-market surveillance

## IMPORTANCE OF NUTRACEUTICALS AND MARKET DEMAND

The global rise in lifestyle-related diseases has heightened the appeal of nutraceuticals, which are perceived as preventive rather than therapeutic interventions.<sup>10</sup> The COVID-19 pandemic accelerated consumer interest in immunity-boosting supplements, particularly in emerging markets like India.<sup>11</sup> Despite their potential, nutraceuticals'

unregulated proliferation raises serious public health concerns.

## SYNTHETIC VERSUS HERBAL NUTRACEUTICALS

Nutraceuticals can be naturally sourced or synthetically produced. Herbal nutraceuticals include compounds such as curcumin and resveratrol, whereas synthetic ones may involve isolated vitamins or engineered molecules.<sup>12</sup> Although herbal products are often perceived as safer, they may be susceptible to contamination and quality variability.<sup>13</sup> Synthetic products offer dosing consistency but may provoke side effects similar to pharmaceutical agents.

**Table 2: Examples of synthetic and herbal nutraceuticals.**

Type	Example	Source
<b>Herbal</b>	Curcumin	Turmeric ( <i>curcuma longa</i> )
<b>Herbal</b>	Resveratrol	Grapes ( <i>vitis vinifera</i> )
<b>Synthetic</b>	Coenzyme Q10	Fermentation or chemical synthesis
<b>Synthetic</b>	Omega-3 fatty acids	Microalgae and engineered yeasts

## CLASSIFICATION OF NUTRACEUTICALS

Nutraceuticals are broadly categorized based on their function and origin. Functional foods include everyday food items enriched with health-promoting components, such as fortified cereals designed to enhance nutritional value. Dietary supplements encompass concentrated forms of vitamins, minerals, amino acids, and other bioactive substances intended to support overall health or address specific deficiencies. Medicinal foods are formulated to meet distinct dietary requirements associated with particular medical conditions and are typically used under medical supervision. Another emerging category, pharmaceuticals, refers to genetically engineered crops or livestock capable of producing therapeutic agents, representing the convergence of biotechnology and nutrition in developing novel health interventions.<sup>14</sup> Innovations in microbiome modulation, adaptogens, and cognitive enhancers have further diversified the market.

## ADVANTAGES OF NUTRACEUTICALS

Nutraceuticals offer several benefits, including accessibility, affordability, and the potential for preventive health care.<sup>15</sup> In underserved areas, they may bridge gaps in formal healthcare systems.

## DISADVANTAGES OF NUTRACEUTICALS

Despite these advantages, nutraceuticals present risks related to product variability, contamination, misleading claims, and unproven therapeutic efficacy.<sup>16</sup> Their

uncontrolled use can also result in adverse drug interactions. Table 3 summarises both the advantages and disadvantages.

**Table 3: Advantages and disadvantages of nutraceuticals.**

Advantages	Disadvantages
Prevention of chronic diseases	Lack of standardization
Easy accessibility	Risk of adulteration
Affordability	Exaggerated health claims
Non-invasive supplementation	Potential for harmful interactions

## REGULATORY FRAMEWORK FOR NUTRACEUTICALS

Globally, regulatory oversight for nutraceuticals is fragmented. In India, FSSAI govern these products under the Food Safety and Standards Act, 2006.<sup>17</sup> In the United States, the FDA regulates them under the Dietary Supplement Health and Education Act (DSHEA) of 1994. Europe relies on EFSA to assess health claims and ensure consumer protection.<sup>18</sup>

## LABELLING REQUIREMENTS FOR COSMETIC PRODUCTS WITH NUTRACEUTICAL CLAIMS

Cosmetic products containing nutraceutical ingredients are required to comply with specific labelling standards to ensure consumer safety and transparency. These labels must include a complete ingredient list, clear instructions for intended usage, and appropriate warning statements for potential adverse effects or contraindications. Additionally, essential product identifiers such as batch and lot numbers, manufacturing and expiry dates, and detailed information about the manufacturer must be provided. For products delivering active nutraceutical components, the label should also specify nutrient content and dosage recommendations to guide safe and effective use. Such labelling ensures consumer transparency and aligns with regulatory expectations.

## CURRENT TRENDS AND FUTURE PERSPECTIVES

Current market trends emphasize plant-based, personalized, and clean-label nutraceuticals.<sup>19</sup> The Indian market, in particular, is experiencing a surge driven by urbanization and increasing health awareness. Emerging technologies such as nanotechnology and personalized nutrition platforms are expected to enhance product efficacy and consumer targeting.<sup>20</sup>

The future of the nutraceutical industry hinges on stronger regulatory frameworks, scientific validation, and ethical marketing. Collaboration among researchers,

manufacturers, and policymakers will be vital for sustainable growth.

**Table 4: Country-wise regulatory differences.**

Country	Regulatory authority	Regulation details
India	FSSAI	Governed under food safety and standards act
United states	FDA	Regulated by DSHEA as dietary supplements
European union	EFSA	Health claims under regulation 1924/2006
Japan	MHLW	Foods for specified health uses (FOSHU)

**Table 5: Forecasted growth rates of the nutraceutical market.**

Region	Estimated CAGR (2024-2030)	Key growth drivers
North America	6.5%	Aging population, preventive healthcare
Europe	5.8%	Regulatory support, aging demographics
Asia-pacific	8.2%	Rising incomes, health consciousness
India	10.0%	Government support, urbanization

## CONCLUSION

The nutraceutical industry embodies both opportunity and risk. While offering pathways to preventive health, the industry's unchecked expansion without rigorous scientific validation and appropriate regulation could undermine public trust. Balancing innovation with consumer safety, evidence-based claims, and regulatory harmonization will be crucial for the sustainable evolution of the global and Indian nutraceutical markets.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: Not required*

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**Cite this article as:** Batta A, Singh S, Prasad A. The expanding nutraceutical market: a critical review. *Int J Basic Clin Pharmacol* 2026;15:392-5.