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The Evolution and Expansion of the Nutraceutical and Functional Foods Market in India: A Comprehensive Survey

Lokesh Liladhar Prajapati*[1], Prajwal Bansode[2], Atharva Patole[3], Vishal Shelke[4], Rohan Ghige[5], Ms. Shraddha Dingare[6], Ms Rucha Pusegaonkar[7]

TMV's Lokmanya Tilak Institute of Pharmaceutical Science's Pune, Maharashtra, India.

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ABSTRACT

From disease to wellness — Evolution of Indian health care system Indian health care system is undergoing a transformation from disease centric approach to wellness. This article reviews the present status and future scope of nutraceuticals and functional foods with its global market projected to reach USD 18 billion by 2025. The evolution of nutraceuticals and functional foods has traversed through three stages namely — Ayurveda and traditional foods, the nutrition supplement and modernization phase, and the third phase of globalization and technology-based evolution. Various issues which are addressed in this article includes - Evolution of nutraceuticals and functional foods and regulations made on them - Food Safety and Standards Authority of India (FSSAI) guidelines — Traceability for health claims to be in place by 2025 - Role of nutraceuticals in non-communicable diseases (NCDs) and nano-technology in drug delivery - Emerging trends like use of artificial intelligence (AI) in nutritional approaches — Need for better Nutri vigilance, authenticity and combating counterfeit products.

Keywords: Antioxidants, Bioavailability, FSSAI, Functional Foods, Nanotechnology.

1. INTRODUCTION

The Indian healthcare sector is undergoing a metamorphosis with the evolution of the current health care system from curative in nature to a more preventive form of delivering healthcare, where the nutraceutical and functional foods sector plays a pivotal role by merging traditional food-based medicine and alternate systems of medicine like Ayurveda with the modern pharmaceutical practices. This sector has passed through three epochs in the past namely the traditional era of Ayurveda, the modern era of western medicinal products initiated after independence and the contemporary era of globalization and convergence that began around 2002-2003.[1] The Food Safety and Standards Authority of India (FSSAI) was established in December 2006 to ensure the integrity of this sector. Considering the growing global trend of health and wellness along with the emerging increase in non-communicable diseases which is expected to multiply in the years ahead even more so in the post-COVID era, this sector is expected to grow to the tune of US $18 billion by 2025 and could potentially rise to US $50 billion by early 2030s. Thus, this sector could emerge to be a major sector of our economy as well as play a very important role in the country's healthcare development.[2]

2. Classification and Therapeutic Applications of Nutraceuticals and Functional Foods

In India, the taxonomy of nutraceuticals is in a rather ambiguous state with overlapping definitions and functionalities. The FSSAI in many cases classifies a nutraceutical based on the form in which it is available e.g. tablet, capsule or as a powder. However, classifying a nutraceutical based on the form may not be very productive or purposeful. Rather a nutraceutical should be classified with regard to its composition and its biochemical and physiological effect.[3] Knowledge of the taxonomy is essential for all who are involved in the practice of the nutraceutical industry and who have to deal with the doctor for incorporating nutraceuticals in a therapeutic regime.[3] [4]

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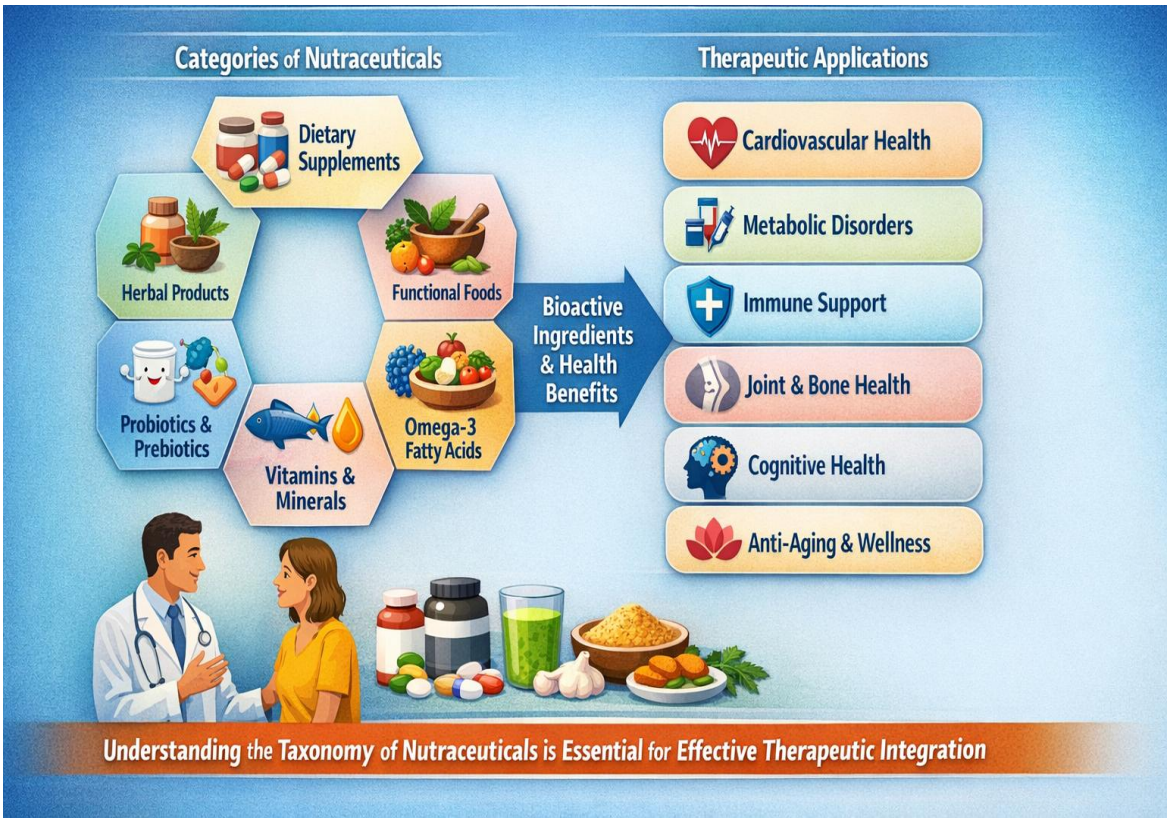

Fig No. 2: Categories of Nutraceutical and Therapeutic Applications[4]

2.1 Categorization of Dietary Supplements, Herbal Bioactive, and Functional Food Sources

Herbal bio actives is a small but very specialized segment of the Indian market given to the immense diversity of flora in India, combined with a large number of research and development organizations across the length and breadth of the country. In order to assure that the required constituent is present in specific concentrations in any particular extract, the extracts are then standardized to specific bioactive marker concentrations, like withanolides in Ashwagandha and curcuminoids in Turmeric, to that particular concentration for the stipulated period of time and thereby maintains the efficacy of the constituent on a uniform level.[6] Functional Foods and Beverages have also taken a leading market share in the sector and functional beverages currently holds a market share of about 47.9% in 2024, on account of large demand from end-user segment, due to hectic schedules, the increasing interest in convenience food and more inclined towards the fun ways of having health foods and beverages.[7]

Table No. 1.1: Regulatory Constraints Associated with Ingredient Categories.[5]

Category	Typical Ingredients	Regulatory Constraint
Health Supplements	Vitamins A, B-complex, C, D, E; Minerals (Calcium, Iron, Zinc); Proteins; Amino acids [13]	Individual nutrient content must not exceed ICMR-prescribed RDA limits.[13]
Nutraceuticals	Curcumin; Polyphenols; Flavonoids; Lycopene; Omega-3 concentrates; Plant sterols [13]	Dosages may exceed RDA levels with scientific justification and FSSAI approval.[13]
Functional Foods	Fortified cereals; Probiotic yogurt; Omega-3 enriched oils; Plant-based protein powders [16]	Must be consumed as part of a regular diet; often fortified with antioxidants or probiotics.[14]
Novel Foods	CBD; Hemp oil; Marine-derived proteins; Non-traditional botanical extracts [18]	Requires prior approval from the Food Authority with extensive safety dossiers.[15]

2.2 Clinical Significance in Chronic Disease Management and Preventive Healthcare

For example, studies involving the (onion) juice extract have shown promising efficacy in regulating postprandial blood glucose in diabetic patients, as well as being involved in reducing serum liver enzyme levels through the regulation of sulfur containing amino acids. Studies on Diabetic Cardiomyopathy (DCM) have shown that the traditional Indian diet comprising of various herbs including

cinnamon and ginger exerts beneficial effects on the heart by modulating gene expression of certain proteins involved in the SMAD/TGF- β signaling pathways[25] These properties signify nutraceuticals to be more than just "vitamins". They act as bioactive molecules affecting key cellular pathways.

Table No. 1.2: Disease-Specific Bioactive and Their Observed Physiological Effects.[25]

Disease Area	Clinically Bioactive Evaluated	Observed Physiological Effects
Diabetes Mellitus	Fenugreek (Graecum L Bitter Melon (Momordic charanti); Cinnamon	Enhances insulin sensitivity; repairs post-prandial levels,[25] -cells; reduces glucose
Cardiovascular Diseases	Garlic (Allium sativum) Omega-3 fatty acids; Hawthorn (Crataegu)	Reduces myocardial fibrosis; manages cholesterol levels; decreases oxidative stress in cardiac tissue.[25]
Inflammation	Turmeric (Curcumin); Ginger (Zingiber officinale); Green Tea (Camellia sinensis)	Modulates inflammatory markers like NF-B and COX-2; reduces joint inflammation in arthritis.[21]
Cognitive Disorders	Ashwagandha; Brahmi Bacop Omega-3	Neuroprotection against induced DNA damage; improves memory and cognitive function.[21]

2.3 Role of Probiotics, Prebiotics, and Phyto-bioactive in Promoting Longevity

The Indian nutraceuticals industry is focusing largely on the aspect of increasing life span and reducing the process of ageing as per the principles of Ayurveda that is closely linked with Rasayana therapy that deals with enhancing the nutrition of the cells in the body, revitalizing tissues and strengthening the immune system to check age related diseases.[11] Probiotics and prebiotics are very effective in improving the gut-brain axis and the immune system to address the decreased microbial diversity that occurs with ageing. The novel microbial derived polysaccharides are getting used as nano carrier for delivering anti-aging bioactive to targeted organs in the body. These traditional Rasayana herbs are now being clinically tested for their anti-ageing effects, which have led to increased telomerase activity. The convergence of traditional and clinical understanding is likely to lead to an array of clinically-tested anti-ageing products.[13]

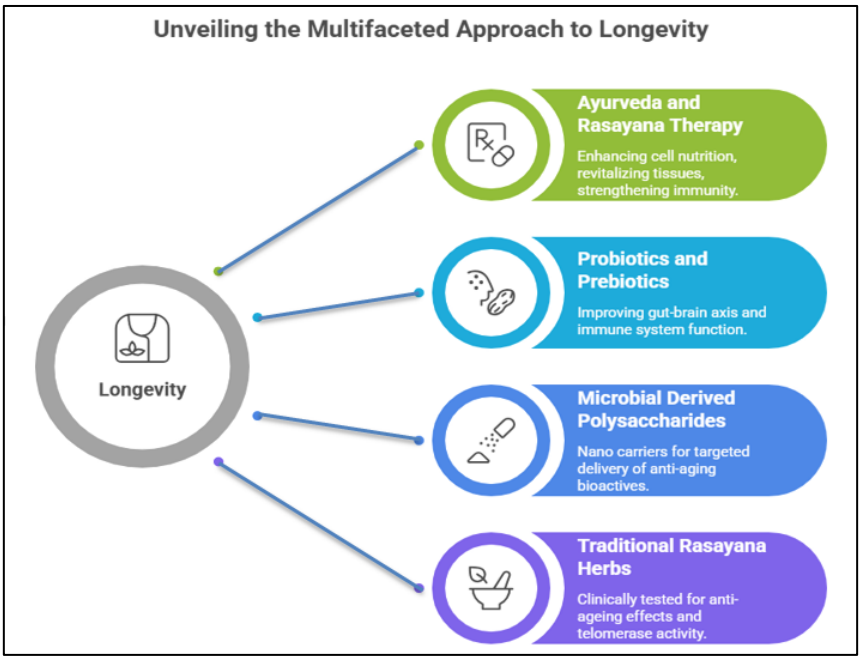

Fig No. 2.3: Unveiling the Multifaceted Approach to Longevity[13]

3. Market Dynamics and Economic Drivers of the Indian Nutraceutical Industry

The Indian nutraceutical industry is currently characterized by an extraordinary growth trajectory that positions it as a global leader in the sector. This expansion is driven by a unique confluence of economic growth, shifting demographics, and a post-pandemic shift in consumer priorities toward health and immunity.[3]

3.1 Analysis of Market Valuation, Compound Annual Growth Rates, and Global Positioning

The valuation of the Indian nutraceutical market varies across reporting agencies, reflecting the rapid evolution and diverse segmentation of the industry. However, all major reports align on the conclusion that the sector is experiencing double-digit growth.[12] [16]

Table No. 3.1: Market Valuation and Growth Forecasts from Different Industry Reports.[12] [16]

Report Source	2023-2024 Valuation (USD Billion)	2030-2031 Projected Valuation (USD Billion)	Forecasted CAGR
Markets & Data (FY2023)	11.78	51.83 (FY2031)	20.35% [12]
Grand View Research (2024)	32.14	75.81 (2033)	10.0% [16]
TechSci Research (2024)	6.11	11.55 (2030)	11.39%
TV BRICS / ANI (2024)	30.00	60.00 (2030)	13.0%
Invest India / ASSOCHAM	4.00 (2020)	18.00 (2025)	15% - 22% [1]

This growth puts the Indian industry at a 15-20% year-on-year expansion rate, significantly outpacing the global average[3] Currently, India holds approximately 1-2% of global nutraceutical sales, but its role as a manufacturing hub is expanding rapidly[7] The industry's global positioning is strengthened by the abundant availability of raw materials from the agricultural sector—one of India's largest industries—and a growing pool of skilled manpower in pharmaceutical R&D.[1] The opening of 100% Foreign Direct Investment (FDI) in the manufacturing sector has also made India an attractive destination for multinational giants like Amway, Herbalife, and Nestle, who are now competing and collaborating with major domestic players such as Himalaya, Patanjali, and Dabur.[4]

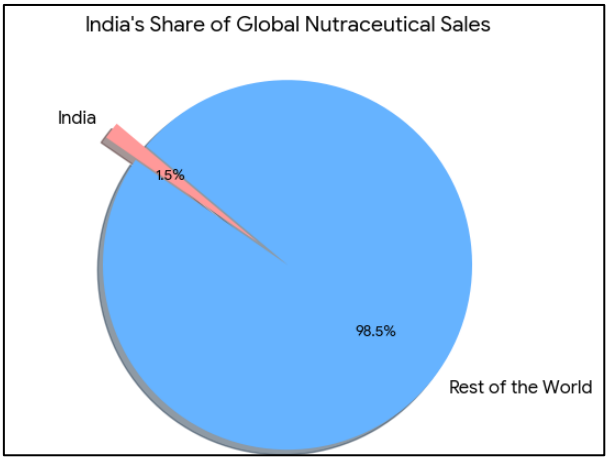

Fig No. 3.1: Socio-Economic Drivers of India's Emergence as a Global Nutraceutical Manufacturing Hub[3] [4] [7]

3.2 Socio-Economic Factors and Shifting Consumer Preferences Toward Preventive Medicine

The economic underpinnings of this market surge are found in the rising disposable income and the growing middle class in India, who are increasingly willing to spend on wellness and preventative health.[18] Beyond financial capacity, there is a fundamental socio-cultural shift; the ideology of "prevention is better than cure" has seen wider acceptance across urban and semi-urban populations.[9] This is further influenced by the high cost of medical care and a lack of deep health insurance penetration; with medical inflation at 14% in 2024, nutraceuticals are viewed as a cost-friendly alternative to hospitalization.[11]

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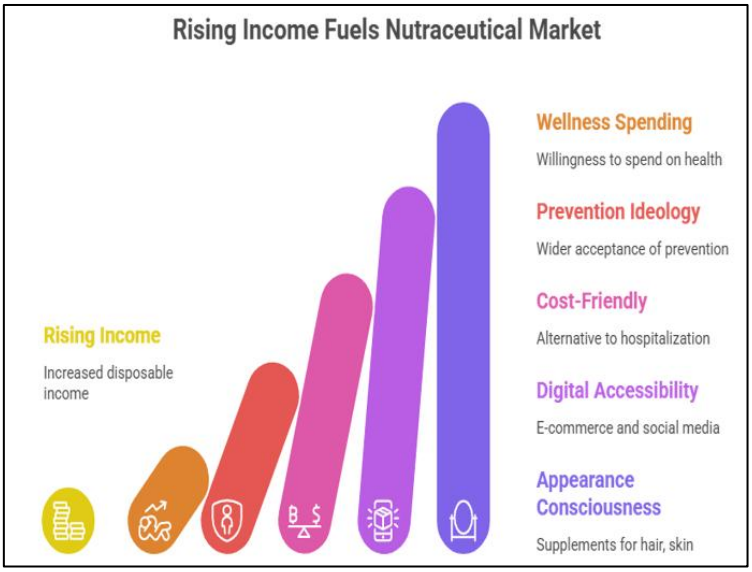

Fig No. 3.2: Rising Income Fuels Nutraceutical Market[9] [11] [18]

Consumer preferences are also being reshaped by digital accessibility. The rise of e-commerce, D2C (Direct-to-Consumer) channels, and social media marketing has made these products highly accessible[12] Approximately 49% of Indians use the internet to access health information, which directly correlates with the increased consumption of personalized vitamins and minerals. This has also led to a trend in "appearance-conscious" health, where supplements for hair, skin, and nails are trending among the youth.[18]

3.3 Impact of Lifestyle-Related Disorders and the Post-Pandemic Health Consciousness Surge

Epidemiology of lifestyle diseases in India is one of the strongest justifications for the growth of the nutrition and health industry in India. The prevalence of obesity, diabetes, hypertension and cardiovascular diseases and need for functional foods that addresses the management of these diseases is a compelling reason to push the growth of the sector. Moreover, India has a micronutrient deficiency burden of 80% which makes basic fortification and supplementation a necessity in public health.[17]

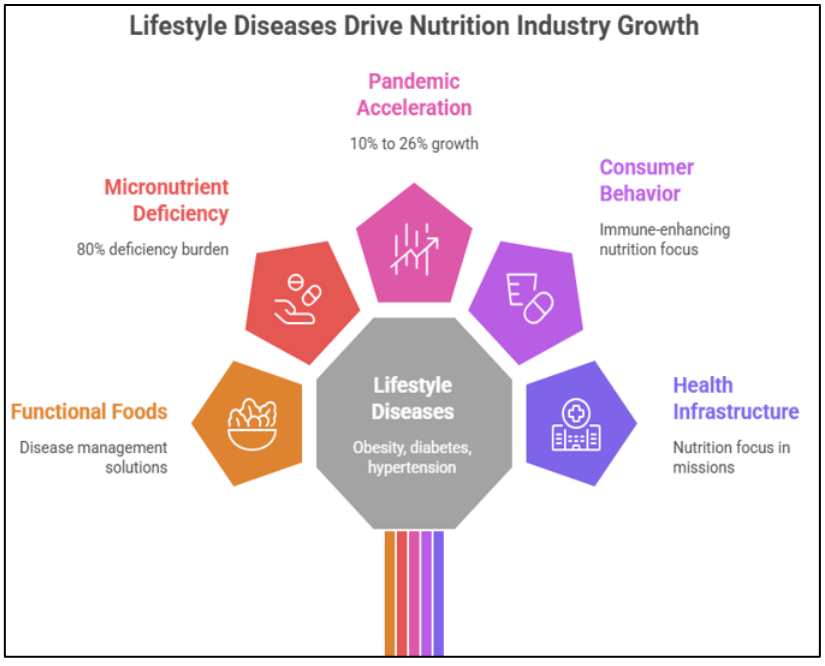

Fig No. 3.3: Lifestyle Diseases Drive Nutrition Industry Growth[17]

All of these trends are further accelerated by the COVID-19 pandemic. The growth rate for this sector had estimated at 10% prior to the pandemic, and then increased to over 26% between 2021.12, before finally settling down to between 16% and 18%. All these trends point to more permanent shifts in consumer behavior in favor of immune-enhancing nutrition and self-care, reflected most clearly in increased sales of Vitamin C, Vitamin D and Zinc supplements.[6] This learning from the pandemic will in all likelihood bring in more focus on nutrition to our health infrastructure including in health missions like Ayushman Bharat Digital Mission and the Poshan Abhiyan which is focused towards eradication of malnutrition.[22]

4. Regulatory Frameworks and Technological Innovations in Product Development

The maturation of the Indian nutraceutical industry is intrinsically linked to the evolution of its regulatory environment and the adoption of cutting-edge technologies that enhance product safety and efficacy.

4.1 The Role of the Food Safety and Standards Authority of India and Regulatory Complipance

The Food Safety and Standards Authority of India (FSSAI) is the sole authority responsible for regulating the approvals, promotions, and labeling standards for nutraceuticals in the country.[9]The transition from an unregulated market to a highly structured one was marked by the 2011 Food Safety and Standard Rules and the subsequent 2016 and 2022 Regulations.[6]

As of the 2025 regulatory regime, FSSAI compliance has become more stringent, focusing on scientific substantiation and consumer safety.[5]

Table No. 4.1: Overview of Regulatory Pillars and Key Compliance Requirements (2025)[5] [13]

Regulatory Pillar	Key Requirements in 2025
Ingredient Control	All botanical ingredients must be sourced from recognized compendia like the Indian Pharmacopoeia.[5]
Labeling	Mandatory "NOT FOR MEDICINAL USE" disclaimer; product category must be clearly declared.[13]
Claims Regulation	Specific functional claims are allowed only if scientifically proven; disease cure claims are strictly prohibited.[13]
Safety Testing	Mandatory testing for heavy metals (Pb, Cd, Hg, As), pesticide residues, aflatoxins, and microbial pathogens.[5]
Traceability	New requirement for mandatory QR codes on nutraceuticals priced above ₹1,000 for traceability.[13]

FSSAI has also proactively removed 14 ingredients—including raspberry ketone, chaga extract, and saw palmetto—from the approved list due to a lack of safe usage data.[15] This regulatory tightening is aimed at increasing consumer trust and facilitating exports by aligning Indian standards with global benchmarks like the US-FDA and EFSA.[20]

4.2 Advanced Nano-based Delivery Systems and Encapsulation Technologies for Enhanced Bioavailability

One of the most significant challenges that nutraceuticals have to contend with is low bioavailability. A lot of the plant-based polyphenols such as curcumin have poor aqueous solubility and are highly metabolized in the liver during first pass metabolism, which limits their effective delivery. The use of nanotechnology and nano-encapsulation through the use of nanocarriers like liposomes and polymeric nanoparticles can significantly preserve the bioactivity of the molecules and thereby enhance its efficacy. Hyderabad-based startup Zero Harm is enhancing the bioactivity of these molecules through a five step ‘Nano-Innovation’ process which enhances the bioavailability of the nanoparticle formed. The nano-tablets that are produced enhances the bioavailability of curcumin 20 times as compared to the food grade ingredient present in the food we consume. Other developments include lipid-based formulations of herb-based extracts such as ashwagandha among others. Several companies are also enhancing the probiotics such as Sami-Sabinsa and Akums Drugs and Biotech, among others.[26]

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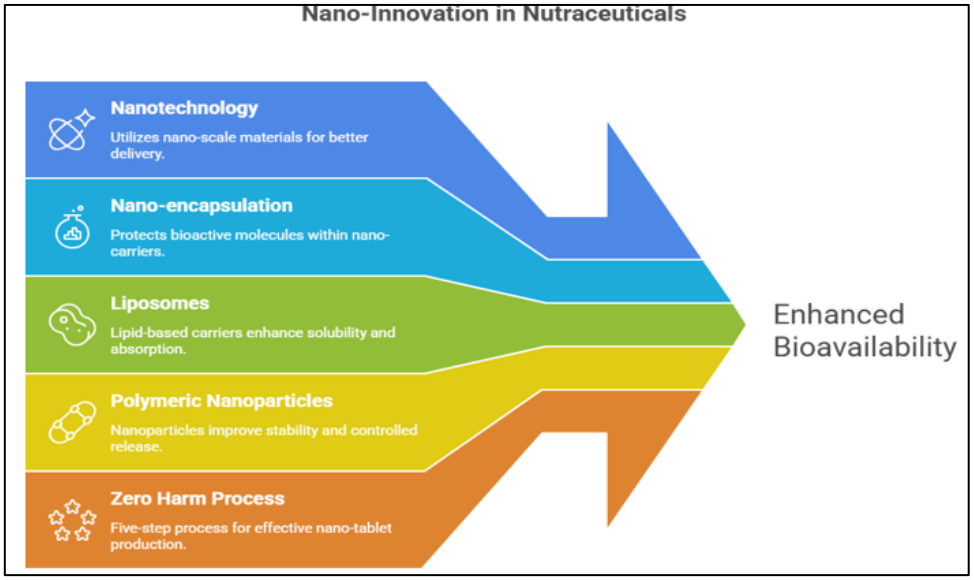

Fig No. 4.2: Nano-Innovations in Nutraceuticals[26]

4.3 Challenges in Nutri vigilance, Quality Standardization, and Combating Counterfeit Products

The Indian market though improving, still has its share of problems. Counterfeit and inferior quality drugs are still a major obstacle in the Indian pharmaceutical market. The global counterfeit drug market is of the order of USD 200 Billion. India is the source of a large number of drugs as far as innovation is concerned as well as counterfeiting. Unbranded players in the nutraceutical segment are known to indulge in mislabeling and substandard ingredients. Quality standardization in the herbal extracts is also a major cause of concern and this has to be regulated by controlling the source of the plant material and the extract ratio.[30]

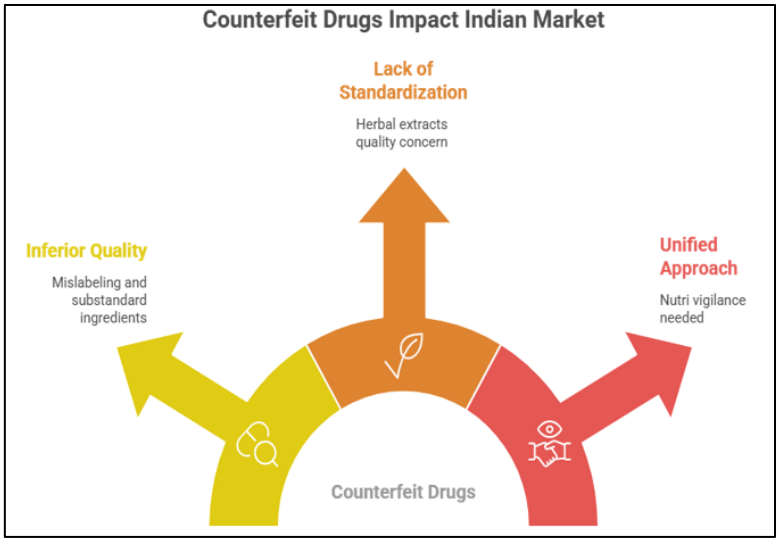

Fig No. 4.3: Counterfeit Drugs Impact Indian Market[30]

With the emergence of the concept of "Nutri vigilance" (similar to pharmacovigilance for food supplements), there is a need for a unified approach with FSSAI and PvPI to ensure that food supplements are safe for human consumption.[27]

5. CONCLUSION

While the Indian nutraceutical and functional foods sector has grown to become a multi-billion-dollar industry from a niche market, it is expected to continue on the growth trajectory at a rate that is higher than that of the global sector. The growing sector has its way to do with the planned policy of preventive health care for the whole nation. Expected to take advantage of improved

regulations, India is looking to be one of the leading nations in terms of production and consumption of such products. The sector in India is all set to deliver what is called as "hyper-personalized" nutrition that is meant to meet all the nutritional needs that are derived with the use of artificial intelligence, machine learning and the nutrigenomics which has emerged as a major sector on its own The companies in India have plans to come with nano-delivery systems and a Nutri vigilance or the vigilance on products to meet higher standards of food safety and to help in boosting consumer confidence, said a senior scientist and also added on the increasing Indian economy and the possible better health of the nation with the blending of its traditional system of Ayurveda and modern science to take up the sector and enhance the economy.

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