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NUTRACEUTICALS: INDIA'S SCENARIO IN THE NEW AGE

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ABSTRACT

Nutraceuticals have emerged as a significant component of India's healthcare landscape, bridging traditional wisdom with modern scientific advancements. This article explores the evolution and current scenario of nutraceuticals in India, focusing on their definition, importance, and growing popularity. Examining the historical background, it traces the roots of nutraceuticals in traditional Indian medicine and highlights successful products that have shaped the industry. Further, the article examines the diverse health benefits and therapeutic effects offered by nutraceuticals, emphasizing their role in disease prevention and treatment. A comprehensive market overview elucidates the current size, growth trajectory, and key market segments driving the nutraceutical industry forward. Regulatory frameworks established by government policies and the Food Safety and Standards Authority of India ensure safety and quality standards. Additionally, insights into consumer behaviour and emerging trends provide valuable perspectives on future developments in the nutraceutical market. This article underlines the potential of nutraceuticals in enhancing healthcare outcomes and promoting holistic well-being in India.

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1. INTRODUCTION

Nutraceuticals, a combination of "nutrition" and "pharmaceuticals," are products derived from food sources that provide health benefits beyond basic nutrition [1]. In India, the nutraceutical market is booming, driven by an increasing awareness of health and wellness. Currently valued at around \$4 billion, this market is set to grow rapidly due to the rising middle class, higher disposable incomes, and an aging population that is more inclined toward health supplements [2]. The landscape in India is unique, combining traditional knowledge with modern science. People are turning to nutraceuticals not only for general health but also for managing specific conditions like diabetes, and heart diseases, and boosting immunity—an area that has gained more attention after the pandemic. India's rich biodiversity and traditional practices like Ayurveda give it a distinct edge in this sector [3]. However, the industry does face challenges, including stringent regulations, quality control issues, and a need for better consumer education. The Food Safety and Standards Authority of India (FSSAI) is actively working to streamline regulations to ensure that these products are safe and effective, although navigating the regulatory landscape can still be complex [4]. Investment in research and development is also on the rise, with Indian companies looking to innovate and create new products that appeal both locally and globally. There's a strong push towards using natural and organic ingredients, reflecting a global trend. Additionally, the digital revolution is expanding the reach of nutraceuticals, making them more accessible through e-commerce platforms across both urban and rural areas. The future of nutraceuticals in India looks very promising. With ongoing investment in R&D, supportive changes in regulations, and growing consumer awareness, the industry is poised to make a significant impact on both public health and the economy. This sector offers immense opportunities for growth and innovation, making it an exciting time for stakeholders in the Indian nutraceutical market.

1.1 IMPORTANCE AND GROWING POPULARITY

Nutraceuticals are becoming increasingly popular due to their recognized importance in promoting health and well-being. In today's fast-paced world, where people are constantly striving to maintain optimal health, nutraceuticals offer a convenient and effective solution [5]. With rising concerns about lifestyle-related diseases and the desire for preventive healthcare, consumers are turning to nutraceuticals as a proactive approach to managing their health. These products, derived from natural sources and often enriched with vitamins, minerals, and other bioactive compounds, offer a holistic approach to wellness. Moreover, as more scientific research validates the efficacy of nutraceutical ingredients in supporting various aspects of health, including immunity, cognitive function, and cardiovascular health, their popularity continues to soar [6]. The growing trend towards clean label and natural products has further increased the demand for nutraceuticals, as consumers seek safer and more sustainable alternatives to conventional medications [7].

The importance and growing popularity of nutraceuticals can be attributed to their versatility and accessibility. These products come in various forms, including dietary supplements, functional foods, and beverages, making it easy for consumers to incorporate them into their daily routines [8]. Whether it's adding a multivitamin supplement to their morning routine or opting for fortified foods and beverages, nutraceuticals offer a convenient way to bridge nutritional gaps and support overall health. The increasing prevalence of chronic health conditions, such as obesity, diabetes, and heart disease, has spurred interest in preventive healthcare strategies. Nutraceuticals, with their focus on promoting wellness and addressing underlying health issues, align well with this preventive approach. By providing targeted nutritional support, these products empower individuals to take control of their health and adopt healthier lifestyle habits.

1.2 ROLE IN INDIAN HEALTHCARE

Nutraceuticals are increasingly recognized for their significant role in Indian healthcare, offering a complementary approach to traditional medicine [9]. In a country where chronic diseases like diabetes, cardiovascular ailments, and obesity are on the rise, nutraceuticals provide a promising avenue for preventive healthcare and disease management. With a rich history of traditional medicine systems like Ayurveda, India has long embraced the concept of using natural ingredients for health and wellness [10]. Nutraceuticals build upon this heritage by combining modern scientific research with traditional knowledge to create products that address specific health concerns. Moreover, in a diverse and multicultural country like India, nutraceuticals spread to a wide range of dietary preferences and cultural practices, making them accessible to a broader population. As the healthcare system faces challenges such as rising healthcare costs and access to healthcare services, nutraceuticals offer a cost-effective and sustainable solution for promoting health and preventing diseases [11]. With their emphasis on wellness and preventive care, nutraceuticals are well poised to play an increasingly vital role in shaping the future of Indian healthcare, empowering individuals to take control of their health and well-being. The role of nutraceuticals in Indian healthcare extends beyond addressing specific health concerns to encompass broader public health initiatives [12]. With the government's emphasis on promoting health and wellness through initiatives like the National Health Policy and the Fit India Movement, nutraceuticals align well with the national agenda of preventive healthcare [13]. By encouraging healthy dietary habits and lifestyle choices, nutraceuticals have the potential to reduce the burden on the healthcare system by preventing the onset of chronic diseases and reducing healthcare costs associated with their management. As the population becomes increasingly health-conscious and seeks alternatives to conventional medications, nutraceuticals offer a natural and safe option for supporting overall health and well-being.

2. HISTORICAL BACKGROUND

The historical background of nutraceuticals traces back centuries, rooted in the practices of ancient civilizations that recognized the medicinal properties of certain foods and herbs. In India, Ayurveda, the traditional system of medicine, has long emphasized the use of natural ingredients for promoting health and treating various ailments. Ayurvedic texts dating back thousands of years mention the therapeutic properties of herbs, spices, and other botanicals, many of which are still used in nutraceuticals today [14]. Similarly, traditional Chinese medicine and other ancient healing traditions around the world have employed food-based remedies to maintain health and prevent disease [15]. Over time, as scientific understanding of nutrition and biochemistry advanced, the concept of nutraceuticals evolved, blending traditional wisdom with modern science to create products that provide specific health benefits beyond basic nutrition. Today, nutraceuticals continue to build upon this rich historical legacy, offering a bridge between ancient healing practices and contemporary healthcare, as people increasingly turn to natural and holistic approaches for maintaining their well-being [16].

This evolution continued into the 20th and 21st centuries, with significant advancements in scientific research and technology driving the development of nutraceuticals as we know them today [17]. In the mid-20th century, as nutritional science gained prominence, researchers began to identify specific vitamins, minerals, and other bioactive compounds that play crucial roles in maintaining health and preventing diseases. This led to the production of foods with nutrients like vitamin D, folic acid, and iodine to address widespread nutritional deficiencies. Concurrently, the pharmaceutical industry started exploring the therapeutic potential of natural compounds found in foods and plants, leading to the development of dietary supplements and functional foods targeted at improving specific health outcomes [18]. With growing consumer interest in preventive healthcare and alternative medicine, the market for nutraceuticals has expanded rapidly, encompassing a wide range of products, from herbal supplements to probiotics and omega-3 fatty acids. Today, nutraceuticals occupy a

prominent place in the global healthcare market, offering consumers a diverse array of options for supporting their health and well-being through natural and evidence-based approaches.

2.1 TRADITIONAL INDIAN MEDICINE AND NUTRACEUTICALS

Traditional Indian medicine, particularly Ayurveda, has deeply influenced the development and use of nutraceuticals in India. Ayurveda, which dates back thousands of years, emphasizes a comprehensive approach to health and well-being, focusing on the balance of mind, body, and spirit [19]. Central to Ayurvedic principles is the belief that food is not just sustenance but also medicine, and many of the herbs, spices, and botanicals used in Ayurvedic treatments have found their way into modern nutraceutical products [20]. These natural ingredients are valued for their therapeutic properties and are often incorporated into dietary supplements, functional foods, and herbal remedies. Ayurvedic texts provide detailed descriptions of the health benefits of various plants and herbs, as well as instructions on how to prepare and use them for medicinal purposes. Further, Ayurveda categorizes foods and herbs based on their taste, energy, and effects on the body, allowing for personalized recommendations tailored to individual constitutions or doshas [21]. This aligns closely with the philosophy behind nutraceuticals, which seek to promote wellness and prevent disease through natural and nutritional means. Traditional Indian medicine encompasses not only Ayurveda but also other ancient healing systems such as Siddha and Unani, each with its own unique principles and practices [22]. These medical traditions share a common emphasis on the importance of diet and lifestyle in maintaining health and preventing disease. For example, in Siddha medicine, which originated in South India, food is considered a potent medicine that can influence the body's humour and energy levels [23]. Similarly, Unani medicine, which traces its roots to ancient Greece and Persia, incorporates elements of Greek, Persian, and Arab medicine, placing a strong emphasis on the use of natural substances like herbs, minerals, and animal products for healing purposes [24]. The wealth of knowledge and wisdom preserved in these traditional medical systems continues to inform the development of nutraceuticals in India, serving as a valuable source of inspiration for identifying new therapeutic ingredients and formulations. Furthermore, traditional Indian medicine emphasizes the importance of balance and harmony within the body, guiding the formulation of nutraceutical products that aim to restore equilibrium and promote overall health and vitality.

2.2 SUCCESSFUL NUTRACEUTICAL PRODUCTS IN INDIA

In India, several nutraceutical products have achieved notable success, owing to diverse health needs and gaining popularity among consumers. One such product is Chyawanprash, a traditional Ayurvedic herbal jam renowned for its immune-boosting properties [25]. With a blend of herbs, spices, and natural ingredients, Chyawanprash has been embraced by generations for its ability to enhance vitality and strengthen immunity. Similarly, multivitamin supplements fortified with essential vitamins and minerals have become immensely popular, addressing nutritional deficiencies and supporting overall health and well-being [26]. Another successful nutraceutical product is herbal teas, infused with medicinal herbs like tulsi (holy basil), ginger, and turmeric, known for their antioxidant and anti-inflammatory properties [27]. These teas offer a refreshing and convenient way to incorporate Ayurvedic principles into daily life, promoting relaxation and digestive health. Additionally, functional foods like probiotic yogurt and fortified breakfast cereals have gained traction, offering convenient solutions for gut health and nutritional supplementation [28]. Moreover, Ayurvedic herbal supplements targeting specific health concerns have also found success in the Indian market. Products like ashwagandha capsules for stress relief, turmeric supplements for joint health, and Brahmi tablets for cognitive support have gained popularity for their natural efficacy and minimal side effects [29]. Further, omega-3 fatty acid supplements derived from sources like fish oil have garnered attention for their cardiovascular benefits and cognitive support, appealing to a health-conscious demographic seeking preventive healthcare solutions. Protein

supplements, particularly those derived from plant-based sources like pea protein and soy protein, have witnessed a surge in demand among fitness enthusiasts and vegetarians looking to meet their protein requirements [30]. These successful nutraceutical products highlight the diversity of offerings in the Indian market and the growing demand for natural and evidence-based solutions to support overall health and vitality. As consumer awareness continues to rise and preferences shift towards clean-label and sustainable products, the landscape of successful nutraceuticals in India is poised to expand even further, offering exciting opportunities for innovation and growth in the industry.

3. HEALTH BENEFITS AND THERAPEUTIC EFFECTS

Nutraceuticals offer a wide range of health benefits and therapeutic effects, backed by scientific research and traditional wisdom. One of the key advantages is their ability to bridge nutritional gaps and address specific deficiencies, providing essential vitamins, minerals, and other nutrients necessary for optimal health [31]. Additionally, many nutraceutical ingredients boast potent antioxidant properties, helping to combat oxidative stress and reduce inflammation in the body. For example, compounds like curcumin from turmeric, resveratrol from grapes, and catechins from green tea have been linked to various health benefits, including improved heart health, enhanced cognitive function, and reduced risk of chronic diseases like cancer and diabetes [32]. Certain nutraceuticals, such as probiotics and prebiotics, support gut health by promoting a healthy balance of beneficial bacteria in the digestive system, which can strengthen the immune system and improve digestion. Other nutraceuticals, like omega-3 fatty acids found in fish oil, have been shown to have anti-inflammatory effects, benefiting conditions such as arthritis and promoting brain health [33]. Further, adaptogenic herbs like ashwagandha and rhodiola are known for their ability to help the body adapt to stress and promote overall well-being, specific nutraceutical products that are marketed are listed in **table 1** with their health and therapeutic benefits. Nutraceuticals offer a dynamic approach to health and wellness, providing natural and evidence-based solutions to support various aspects of physical and mental well-being.

3.1 NUTRITIONAL BENEFITS

Nutraceuticals offer plenty of nutritional benefits, serving as a valuable source of essential nutrients that may be lacking in modern diets. Many nutraceutical products are fortified with vitamins, minerals, and other micronutrients, helping individuals meet their daily nutritional requirements and maintain optimal health [43]. For instance, dietary supplements provide a convenient way to supplement nutrients like vitamin D, vitamin B12, calcium, and iron, which are commonly deficient in certain populations [44]. Additionally, functional foods enriched with nutrients such as fiber, antioxidants, and omega-3 fatty acids contribute to overall dietary diversity and promote better health outcomes. Moreover, nutraceuticals derived from natural sources like fruits, vegetables, and herbs contain bioactive compounds that offer additional health benefits beyond basic nutrition [45]. These compounds, such as polyphenols, flavonoids, and carotenoids, have antioxidant, anti-inflammatory, and immune-boosting properties, supporting overall well-being and reducing the risk of chronic diseases [46]. Nutraceuticals play a crucial role in addressing specific dietary needs and health concerns. For individuals with dietary restrictions or special dietary requirements, such as vegetarians, vegans, or those with food allergies or intolerances, nutraceuticals offer alternative sources of essential nutrients that may be lacking in their diets. For example, plant-based protein supplements provide a convenient way for vegetarians and vegans to meet their protein needs, while fortified foods and beverages offer options for individuals with lactose intolerance or gluten sensitivity [47]. Nutraceuticals tailored to specific health conditions, such as joint health supplements containing glucosamine and chondroitin for arthritis or omega-3 supplements for cardiovascular health, provide targeted nutritional support to address underlying health issues. The bioavailability and absorption of nutrients

in nutraceuticals are often optimized through innovative formulations and delivery systems, ensuring that individuals can derive maximum benefit from these products.

Table 1: Specific nutraceutical products and their associated health benefits and therapeutic effects.

Nutraceutical Product	Health Benefits and Therapeutic Effects	References
UTI-ROZ (Cranberry extract and D-Mannose Tablets)	Prevents urinary tract infections (UTIs) by supporting urinary tract health and reducing UTI frequency without antimicrobial medications.	[34]
Estonia-Gold (DHA and GLA Chocolate Flavour Protein Powder)	Supports brain function, bone health, and metabolism with essential nutrients like DHA (docosahexaenoic acid) and GLA (gamma-linolenic acid).	[35]
OIKRIT (Functional Foods)	Provides essential nutrients through products like oats, fortified cereals, and nutrition bars, contributing to overall health.	[36]
YODLY (WWB Capsules for Women's Well Being)	Addresses specific health concerns faced by women, supporting women's well-being with targeted nutritional supplementation.	[37]
ADONI (Gold Immuno Booster)	Enhances the body's natural defense mechanisms with immune-boosting supplements, supporting immune health and resilience.	[38]
A2L Gold (TrueBasics Eye Shield capsules)	Supports eye health and vision with nutrients beneficial for maintaining healthy vision, contributing to overall ocular well-being.	[39]
AZODEN (Functional Oils and Fats)	Contributes to heart health and overall well-being with functional oils and fats, supporting cardiovascular health and lipid metabolism.	[40]
CALKOR-K (Calcium and Vitamin D supplements)	Supports bone health with calcium and vitamin D supplements, promoting bone strength and density, reducing the risk of osteoporosis.	[41]
LONAK-PLUS (Multivitamins and Minerals)	Provides comprehensive support for overall health with a range of essential vitamins and minerals, promoting general well-being and vitality.	[42]

3.2 DISEASE PREVENTION AND TREATMENT

Many nutraceutical ingredients possess therapeutic properties that can help prevent the onset of chronic diseases and mitigate their progression. For example, antioxidants found in fruits, vegetables, and certain nutraceutical supplements help combat oxidative stress and inflammation in the body, reducing the risk of diseases like cardiovascular disease, diabetes, and cancer [48]. Moreover, nutraceuticals rich in omega-3 fatty acids, such as

fish oil supplements, have been shown to lower blood pressure, reduce triglyceride levels, and improve overall heart health. Additionally, certain nutraceuticals have demonstrated efficacy in managing specific health conditions, such as probiotics for gastrointestinal disorders like irritable bowel syndrome (IBS) and prebiotics for promoting digestive health [49]. Adaptogenic herbs like ashwagandha and holy basil have been traditionally used in Ayurvedic medicine to help the body adapt to stress and improve resilience, offering potential benefits for mental health and well-being [50].

Nutraceuticals offer promising solutions for adjunctive therapy in conjunction with conventional medical treatments. For instance, in cancer care, certain nutraceuticals like green tea extract and curcumin have shown the potential in enhancing the efficacy of chemotherapy and reducing its side effects, such as nausea and fatigue [51]. Similarly, nutraceuticals rich in vitamins and minerals, such as vitamin D and calcium supplements, play a vital role in supporting bone health and preventing conditions like osteoporosis [52]. Moreover, nutraceuticals containing phytochemicals and bioactive compounds derived from medicinal herbs have been studied for their potential in managing conditions like arthritis, asthma, and neurodegenerative diseases. The anti-inflammatory properties of certain nutraceuticals, such as turmeric, make them valuable in managing inflammatory conditions like rheumatoid arthritis and inflammatory bowel disease. **Figure 1** depicts the various diseased conditions that can be treated with the use of nutraceutical products.

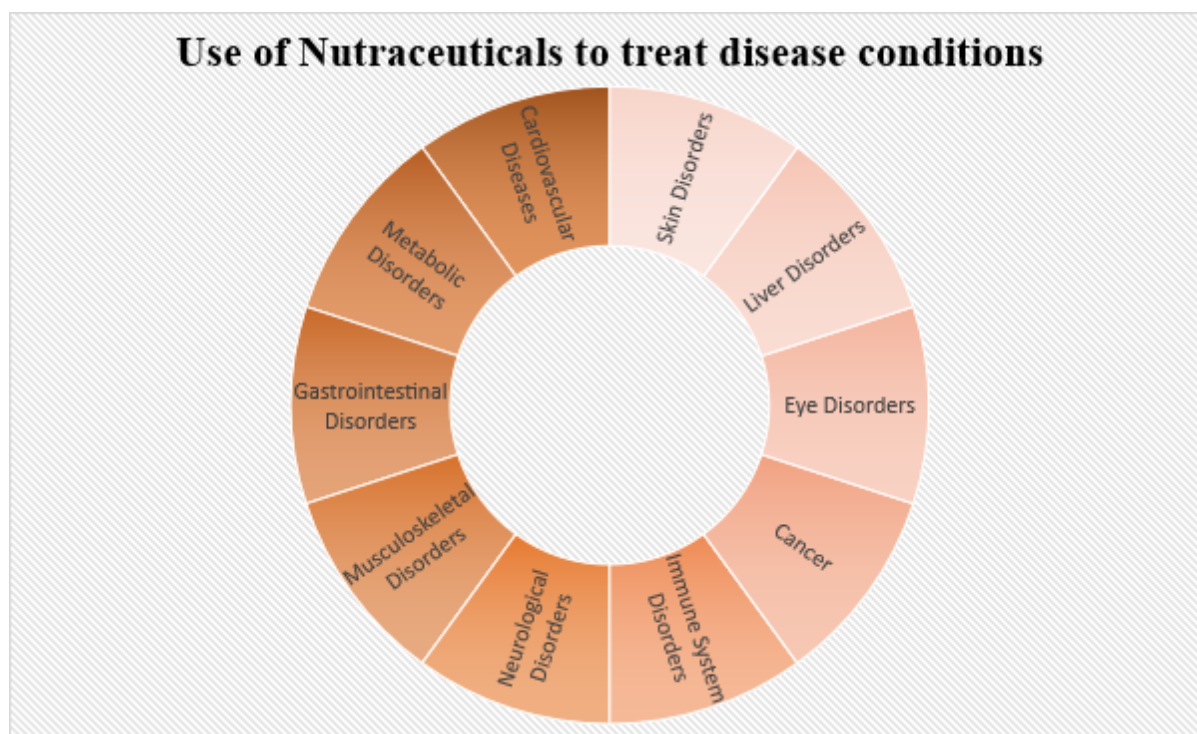


Figure 1: Specific disease conditions that can be treated with the help of nutraceuticals.

4. MARKET OVERVIEW

As lifestyles become more hectic and healthcare costs rise, people are proactively seeking natural alternatives to prevent chronic diseases and enhance overall health. This trend is further supported by a growing body of scientific research validating the benefits of nutraceuticals. The market is highly dynamic, characterized by continuous innovation and a steady influx of new products tailored to specific health concerns, such as immune support, digestive health, and cognitive function [53]. Regulatory environments are also evolving, with authorities worldwide implementing stricter standards to ensure product safety and efficacy, which, in turn, boosts consumer confidence. Major players in the industry are investing heavily in R&D and strategic

partnerships to expand their product portfolios and market reach, indicating a promising outlook for the nutraceutical sector in the coming years.

The nutraceuticals market is not only expanding in developed regions like North America and Europe but also witnessing significant growth in emerging markets across Asia-Pacific and Latin America [54]. This global expansion is driven by rising disposable incomes, urbanization, and an increasing prevalence of lifestyle-related diseases such as diabetes, obesity, and cardiovascular conditions. Additionally, the aging population in many parts of the world is contributing to the demand for products that support healthy aging and longevity. E-commerce platforms have also played a crucial role in making nutraceuticals more accessible to a broader audience, with online sales channels booming particularly in the wake of the COVID-19 pandemic [55]. The consumers are also becoming more informed and discerning, seeking products with clean labels, natural ingredients, and scientifically backed claims. This has led to a surge in demand for organic, non-GMO, and vegan nutraceutical products. Sustainability is another key trend, with companies increasingly adopting eco-friendly practices in sourcing, production, and packaging to meet consumer expectations and regulatory requirements.

4.1 CURRENT MARKET SIZE AND GROWTH

The current market size of nutraceuticals is substantial and continues to grow at a robust pace. Globally, the nutraceutical market is valued at over \$400 billion, reflecting the increasing consumer demand for health-enhancing products. In India, the nutraceutical market is estimated to be worth around \$4 billion, with projections indicating significant growth in the coming years [56]. This expansion is fueled by a rising awareness of health and wellness, coupled with a shift towards preventive healthcare. The Indian market is experiencing a compound annual growth rate (CAGR) of approximately 20%, driven by factors such as increasing disposable incomes, a growing middle-class population, and greater urbanization, as depicted through **figure 2** [57]. Additionally, the COVID-19 pandemic has heightened the focus on immunity and overall health, further accelerating the demand for nutraceuticals. Key segments contributing to this growth include dietary supplements, functional foods, and beverages fortified with vitamins, minerals, and other bioactive compounds. Companies are also investing in research and development to introduce innovative products that cater to specific health needs, such as cardiovascular health, digestive wellness, and cognitive function. As the regulatory environment in India continues to evolve, ensuring the safety and efficacy of nutraceutical products, the market is poised for continued expansion and diversification, making it a dynamic and promising sector within the health and wellness industry [58]. Urban areas, in particular, have seen a surge in demand as health-conscious consumers seek convenient and effective solutions to supplement their diets and improve their overall health. Investment from both domestic and international players is also driving the market's growth, with many companies recognizing the vast potential of the Indian nutraceutical sector. Strategic partnerships, mergers, and acquisitions are becoming commonplace as companies strive to expand their product portfolios and reach a broader consumer base. Government initiatives promoting health and wellness, coupled with a supportive regulatory framework from the FSSAI, are creating a conducive environment for market expansion [59]. The market's growth is further supported by increasing scientific research and clinical studies that validate the health benefits of various nutraceutical ingredients, boosting consumer trust and adoption. With a growing emphasis on personalized nutrition, products tailored to individual health needs and genetic profiles are emerging, offering more targeted and effective solutions.



Figure 2: Market size of Nutraceuticals in India from 2016 to 2030. As reported the nutraceutical market is expected to grow at a compound annual growth rate of 13.5% from 2024 to 2030 to reach USD 64.83 million by 2030.

4.2 KEY MARKET SEGMENTS

The nutraceutical market is broadly segmented into dietary supplements, functional foods, and functional beverages, each catering to distinct consumer needs and preferences. Dietary supplements, including vitamins, minerals, herbal products, and probiotics, remain the largest segment due to their convenience, targeted health benefits, and widespread acceptance [60]. Consumers often turn to these supplements to fill nutritional gaps, boost immunity, and support specific health conditions like joint health or mental clarity. Functional foods, which are conventional foods enhanced with additional nutrients or bioactive compounds, are gaining traction as they seamlessly integrate health benefits into daily diets [61]. Products like fortified cereals, breads, and dairy items not only offer essential nutrients but also address specific health concerns such as heart health, weight management, and digestive wellness. Functional beverages, a rapidly growing segment, include drinks like energy drinks, fortified juices, and enhanced waters. These beverages are particularly popular among busy individuals seeking quick, on-the-go health benefits [62]. The appeal lies in their ability to provide hydration along with functional ingredients that boost energy, improve mental focus, or enhance athletic performance. Across these segments, innovation is key, with companies continuously developing new formulations and delivery methods to meet evolving consumer demands for health, convenience, and sustainability [63].

Moreover, the regulatory landscape for nutraceuticals is becoming more stringent globally, which, while challenging for manufacturers, ultimately boosts consumer trust in these products. Governments and health organizations are implementing stricter guidelines to ensure the safety, efficacy, and quality of nutraceuticals, pushing companies to adhere to higher standards in their production processes. This regulatory rigor helps in weeding out subpar products and supports the credibility of genuine, high-quality nutraceuticals in the market. Innovation in the nutraceutical sector is not limited to product formulation but extends to delivery systems as well. Novel delivery methods such as gummies, soft gels, effervescent tablets, and powders are gaining popularity, providing consumers with more palatable and convenient options [64]. Additionally, advancements in biotechnology and nanotechnology are enabling the development of more effective

nutraceuticals with enhanced bioavailability and targeted delivery systems, further amplifying their health benefits.

5. REGULATORY FRAMEWORK

The regulatory framework governing nutraceuticals varies by country, with each jurisdiction implementing its own set of rules and guidelines to ensure the safety, efficacy, and quality of these products. In India, the regulatory oversight of nutraceuticals falls under the purview of the FSSAI, established under the Food Safety and Standards Act, 2006 [65]. FSSAI regulates the manufacture, distribution, labeling, and importation of nutraceuticals through a comprehensive set of standards and regulations. These regulations cover various aspects of nutraceutical production, including ingredient sourcing, manufacturing processes, packaging, and labeling requirements. FSSAI conducts regular inspections and audits of nutraceutical facilities to ensure compliance with safety and quality standards [66]. However, the regulatory landscape for nutraceuticals in India is still evolving, with ongoing efforts to streamline regulations, harmonize standards, and address emerging issues such as product claims and advertising.

5.1 FSSAI GUIDELINES AND STANDARDS

The FSSAI has established comprehensive guidelines and standards for the regulation of nutraceuticals in India, ensuring the safety, efficacy, and quality of these products. These guidelines cover various aspects of nutraceutical manufacturing, packaging, labeling, and distribution to safeguard consumer health and promote industry transparency [67]. FSSAI sets specific standards for the sourcing of ingredients, manufacturing processes, and storage conditions to ensure that nutraceuticals meet stringent quality control measures. Additionally, FSSAI mandates clear and accurate labeling of nutraceutical products, including information on ingredients, dosage, usage instructions, and potential allergens, to enable consumers to make informed choices [68]. The FSSAI conducts regular inspections and audits of nutraceutical facilities to enforce compliance with these standards and regulations, ensuring that manufacturers adhere to best practices and maintain high standards of hygiene and safety. By providing clear guidelines and standards, FSSAI plays a crucial role in ensuring the integrity of the nutraceutical industry and protecting the health and well-being of consumers across India [69]. FSSAI continually updates and revises its guidelines and standards to keep pace with scientific advancements, emerging trends, and international best practices in the nutraceutical sector. This dynamic approach allows FSSAI to adapt to evolving consumer preferences, address emerging safety concerns, and promote innovation within the industry.

These guidelines cover various aspects of nutraceutical manufacturing, including ingredient sourcing, manufacturing practices, labeling requirements, packaging standards, quality control, and adverse event reporting [70]. FSSAI mandates that nutraceutical manufacturers use only approved ingredients that meet specified quality and safety standards, and adhere to Good Manufacturing Practices (GMP) to maintain clean and hygienic facilities [71]. Clear and accurate labeling of nutraceutical products is required, providing information on ingredients, dosage, usage instructions, and potential allergens [72]. Packaging materials must also meet safety standards to prevent contamination and maintain product integrity during storage and distribution [73]. Rigorous quality control testing is mandatory to ensure that nutraceutical products meet specified standards for potency, purity, and safety, including testing for microbial contaminants and heavy metals. Nutraceutical manufacturers and distributors are required to report any adverse events or side effects associated with their products to FSSAI. These guidelines and standards aim to protect consumer health and promote transparency and accountability within the nutraceutical industry in India.

6. CONSUMER BEHAVIOUR AND TRENDS

Consumer behaviour and trends in the nutraceutical industry reflect a growing emphasis on health and wellness, driven by factors such as increasing health awareness, rising disposable incomes, and a desire for natural and preventive healthcare solutions. Today's consumers are more informed and proactive about their health, seeking products that offer additional health benefits beyond basic nutrition [74]. There is a growing preference for natural and organic ingredients, as well as products that are free from artificial additives and preservatives. Personalization is also a key trend, with consumers seeking tailored solutions to address specific health concerns or dietary preferences. This has led to an increase in demand for personalized nutrition plans, genetic testing, and customized supplement regimens. Moreover, convenience plays a significant role in consumer decision-making, with demand for on-the-go formats, such as single-serving packets and ready-to-drink beverages, continuing to rise [75]. E-commerce has emerged as a preferred channel for purchasing nutraceutical products, offering convenience, accessibility, and a wide range of options to consumers across urban and rural areas.

6.1 DEMOGRAPHIC ANALYSIS

While nutraceuticals appeal to a broad demographic spectrum, certain trends are notable. Younger consumers, particularly millennials and Generation Z, are increasingly health-conscious and seek preventive healthcare solutions [76]. They are drawn to products that offer natural ingredients, sustainability, and convenience, reflecting their values of wellness and environmental responsibility [77]. Old age populations are a significant demographic for nutraceuticals, as they often prioritize products that support healthy aging, cognitive function, and joint health. Urban populations with hectic lifestyles are attracted to functional foods and beverages that provide quick and convenient nutrition on the go. Rising disposable incomes and increasing health awareness among middle-class populations contribute to the expanding consumer base for nutraceuticals [78].

Demographic analysis also highlights regional variations in nutraceutical consumption patterns. In urban areas, where access to healthcare facilities and health information is more readily available, there tends to be higher demand for nutraceuticals. Conversely, in rural areas, where access to healthcare may be limited, there is a growing interest in nutraceuticals as a preventive healthcare option [79]. Cultural factors influence nutraceutical preferences, with traditional remedies and ingredients often gaining popularity in certain communities. For example, Ayurvedic herbs and spices are widely used in nutraceutical products in India, reflecting the country's rich cultural heritage and traditional healing practices. Gender-specific preferences may also influence nutraceutical consumption, with certain products marketed towards women's health or men's fitness goals [80].

6.2 POPULAR NUTRACEUTICAL PRODUCTS IN INDIA

India's nutraceutical market has experienced remarkable growth in recent years, propelled by a surge in health awareness and a growing emphasis on preventive healthcare. A plethora of nutraceutical brands have emerged, offering a diverse array of products tailored to meet various health needs. Among these brands, UTI-ROZ stands out for its cranberry extract and D-Mannose Tablets, designed to prevent urinary tract infections (UTIs) by supporting urinary tract health and reducing UTI frequency without antimicrobial medications [81]. Estonia-Gold provides essential nutrients in its DHA and GLA Chocolate Flavour Protein Powder, offering benefits for brain function, bone health, and metabolism [82]. OIKRIT offers functional foods like oats, fortified cereals, and nutrition bars, contributing to overall health with their essential nutrient content. YODLY focuses on women's well-being with products like WWB (Women's Well Being) Capsules, addressing specific health concerns faced by women [83]. ADONI specializes in immune-boosting supplements such as Gold Immuno

Booster, enhancing the body's natural defense mechanisms [84]. A2L Gold supports eye health with TrueBasics Eye Shield capsules containing beneficial nutrients for maintaining healthy vision. AZODEN specializes in functional oils and fats, contributing to heart health and overall well-being. CALKOR-K prioritizes bone health with its calcium and vitamin D supplements, while LONAK-PLUS offers a comprehensive range of multivitamins and minerals for overall health support [85]. These nutraceutical brands as mentioned in **table 2** exemplify the growing diversity and sophistication of India's nutraceutical market, catering to the evolving health needs and preferences of consumers across the country.

Table 2: Overview of Nutraceutical Products Available in India

Category	Product	Brand	Description	References
Multivitamins	Multivitamin Capsules	Himalaya Wellness	Contains essential vitamins and minerals for overall health	[86]
	Multivitamin Tablets	Amway Nutrilite	Comprehensive blend of vitamins and minerals	[87]
Omega-3 Supplements	Fish Oil Capsules	HealthKart	Rich in Omega-3 fatty acids for heart health	[88]
	Flaxseed Oil Supplements	Wow Life Science	Source of Omega-3 and Omega-6 fatty acids	[89]
Probiotics	Probiotic Capsules	Yakult	Contains live probiotic bacteria for gut health	[90]
	Probiotic Drinks	NutriSynapzz	Provides live cultures for digestive balance	[91]
Protein Supplements	Whey Protein Powder	Optimum Nutrition	High-quality protein source for muscle building	[92]
	Plant-Based Protein Powder	Myprotein	Vegan-friendly protein alternative	[93]
Herbal Supplements	Ashwagandha Capsules	Baidyanath	Ayurvedic herb for stress relief and vitality	[94]
	Turmeric Curcumin Supplements	Gaia Herbs	Natural anti-inflammatory and antioxidant	[95]
Meal Replacements	Protein Bars	MuscleBlaze	Convenient snack option with added protein	[96]
	Meal Replacement Shakes	Herbalife	Balanced nutrition in a convenient drink form	[97]

7. FUTURE PERSPECTIVES

Personalization is expected to be a key focus, as consumers increasingly seek tailored solutions to meet their individual health needs and preferences. This may lead to advancements in personalized nutrition plans, genetic

testing, and customized supplement regimens, driven by advancements in technology and data analytics. Additionally, there is growing interest in plant-based and sustainable nutraceuticals, reflecting broader consumer trends towards ethical and environmentally friendly products. As awareness of the importance of preventive healthcare continues to rise, there will be increasing demand for nutraceuticals that offer holistic health benefits and support overall well-being. The integration of digital health platforms and wearable devices is expected to revolutionize how consumers access and interact with nutraceutical products, enabling personalized health monitoring and feedback.

8. CONCLUSION

Defined as products derived from food sources with purported health benefits, nutraceuticals have garnered increasing importance and popularity in recent years. They play a vital role in Indian healthcare, drawing from the rich tradition of Ayurveda and traditional Indian medicine, while also incorporating modern scientific advancements. The historical background of nutraceuticals in India reflects a heritage of successful products rooted in natural ingredients and holistic health practices. Presently, nutraceuticals offer a wide array of health benefits, ranging from nutritional support to disease prevention and treatment, contributing to the overall well-being of individuals. The market overview highlights a robust growth trajectory, with key segments such as dietary supplements, functional foods, and functional beverages driving expansion. However, this growth is underpinned by a stringent regulatory framework established by government policies and FSSAI guidelines to ensure safety, efficacy, and quality. Consumer behaviour and trends indicate a shift towards personalized, sustainable, and digitally integrated solutions, shaping the future trajectory of the industry.

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