



Indian probiotic market growth analysis: An update

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Abstract

In India, probiotic consumer products are primarily available as dairy-based items like yogurt (dahi), fermented milk, and buttermilk, but also include non-dairy options like certain fermented drinks and supplements. The market is seeing growth, especially in the dairy sector, with companies like Amul, Nestle, Mother Dairy, and Yakult-Danone actively marketing probiotic products. While no specific regulatory guidelines exist for probiotic foods in India, the Food Safety and Standards Authority of India (FSSAI) provides certification for products, including those with probiotics. An initiative was, therefore, taken by the Indian Council of Medical Research (ICMR) along with the Department of Biotechnology (DBT), Government of India, New Delhi to formulate guidelines for regulation of probiotic products in the country. These guidelines define a set of parameters required for a product/ strain to be termed as 'probiotic'. Probiotic drugs are used for the prevention, treatment, and mitigation of human diseases and are subjected to the stringent regulations applied to other drugs, thus requiring approval before marketing and continuous pre- and post-marketing safety and quality controls. These include traveler, antibiotic-associated, and acute-infectious diarrhea, ulcerative colitis, necrotizing enterocolitis, inflammatory bowel diseases, irritable bowel syndrome, and *Clostridium difficile* and *Helicobacter pylori* infections. Indian consumers are becoming more aware of functional foods and nutritional supplements and the potential role of these products in balanced diet and in ensuring good health. Probiotics are becoming increasingly popular as functional foods because of their health benefits. However, specific probiotic supplement regulation and comprehensive market analysis are absent, hampering the understanding of consumer preferences, market trends, and potential economic impacts of this industry.

Keywords: Fermented food; Food Safety and Standards Authority of India (FSSAI); Health; India; Indian Council of Medical Research (ICMR); Microbiome; Microbiota; Probiotics

1. Introduction

Probiotics are live microorganisms that have a beneficial effect on human health. The concept of probiotics was introduced in early 20th century by Elie Metschnikof, it however, gained momentum in recent past with considerable growth in functional food market. India is fast emerging as a potential market for probiotics in food with the major players/suppliers being Nestle, Mother Dairy, Danisco, Chr Hansen, Yakult and Danone. Probiotics can be bacteria, moulds or yeast [1-35-70-84]. Probiotic drugs are used for the prevention, treatment, and mitigation of human diseases and are subjected to the stringent regulations applied to other drugs, thus requiring approval before marketing and continuous pre- and post-marketing safety and quality controls [1-35-70-84]. In the last decades, the use of probiotics has been extended to a variety of other disorders, including lactose intolerance, respiratory and urinary infections, asthma, atopic dermatitis, osteoporosis, allergy, metabolic syndromes, as well as liver, neurological, cardiovascular, and autoimmune diseases. The utilization of cheap agro-waste like whey, corn steep liquor, date powder, etc. can reduce the cost of biomass production for probiotics. But most probiotics are bacteria. Among bacteria, lactic acid bacteria are more popular. *Lactobacillus acidophilus*, *Lactobacillus casei*, *Lactobacillus lactis*, *Lactobacillus helveticus*, *Lactobacillus*

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salivarius, *Lactobacillus plantrum*, *Lactobacillus bulgaricus*, *Lactobacillus rhamnosus*, *Lactobacillus johnsonii*, *Lactobacillus reuteri*, *Lactobacillus fermentum*, *Lactobacillus del-brueckii*, *Streptococcus thermophilus*, *Enterococcus faecium*, *Enterococcus faecalis*, *Bifidobacterium bifidum*, *Bifidobacterium breve*, *B. longum* and *Saccharomyces boulardii* are commonly used bacterial probiotics. A probiotic may be made out of a single bacterial strain or it may be a consortium as well. Probiotics can be in powder form, liquid form, gel, paste, granules or available in the form of capsules, sachets, etc [1-35-84].

Probiotics support physiological bodily functions and may reduce risk or shorten the duration or severity of many diseases. In particular, probiotic drugs are frequently used to prevent or help in the treatment of many gastrointestinal diseases due to infections, microbiome dysbiosis, and gut barrier perturbation [1-35-70-84]. These include traveler, antibiotic-associated, and acute-infectious diarrhea, ulcerative colitis, necrotizing enterocolitis, inflammatory bowel diseases, irritable bowel syndrome, *Clostridium difficile* and *Helicobacter pylori* infections [1-35-70-84]. Application of statistical tools to optimize medium composition, pH temperature, agitation, etc. also helps in improving the yield of probiotic biomass [1-35-70-84]. The health benefits associated with probiotics have increased their application in pharmaceutical formulations and functional food development [1-35-70-84]. High production of probiotic biomass requires a cost-effective production method and nutrient media optimization [1-35-70-84]. The biomass production of probiotics can be enhanced by optimizing growth parameters such as substrate, pH, incubation time, etc [1-35-70-84]. For economical industrial production of probiotic biomass, it is required to design a new medium with low cost [1-35-70-84]. Wastes from the food industries are promising components for the development of the low-cost medium [1-35-70-84]. Industrial wastes such as cheese whey and corn steep liquor are excellent examples of reliable sources of nitrogen for the biomass production of probiotic bacteria. The increased yield of biomass reduced the cost of production [1-35-70-84].

2. Indian Probiotic Market Growth Analysis

Global increasing awareness about the health benefits of probiotics resulted to exploration growth in probiotic food supplement market. In coherence with the global scenario, the demand and supply for probiotics in India too is at a steep rise. In India, probiotic consumer products are primarily available as dairy-based items like yogurt (dahi), fermented milk, and buttermilk, but also include non-dairy options like certain fermented drinks and supplements [1-35-70-81]. The market is seeing growth, especially in the dairy sector, with companies like Amul, Nestle, Mother Dairy, and Yakult-Danone actively marketing probiotic products. While no specific regulatory guidelines exist for probiotic foods in India, the Food Safety and Standards Authority of India (FSSAI) provides certification for products, including those with probiotics [1-35-70]. A great number of studies highlight the ability of orally administered probiotics to improve the gut-barrier function, modulate the gut microbiota, enhance host immune response, and exert antimicrobial activities [1-35-70-81]. In addition, probiotics can be able to synthesize vitamins, food degrading enzymes, and molecules contributing to cellular metabolism, thus ameliorating host health. In 2023, the India probiotics market is segmented by product type into probiotic drink, probiotic supplement and probiotic food. Probiotic drinks dominate due to their convenience and immediate health benefits. These drinks are easy to consume, making them a popular choice among urban consumers with busy lifestyles [1-35-70-81].

The Indian probiotics market is projected to surge with a 10.31% CAGR during the forecast years, 2022-2028, generating a total revenue of **\$4796.13 million by 2028** [1-71-84]. Probiotics combine live beneficial yeasts and bacteria that naturally live in the body. Good bacteria or probiotics help to maintain a healthy balance in your body. Further, Probiotics benefit in various ways, like restoring microbiome balance after treatment or illness, boosting gut microbiome health, and supporting the immune system. Probiotic food sources include fermented foods, like kimchi, yogurts, etc., and probiotic supplements [1-71-80]. Indian consumers are becoming more aware of functional foods and nutritional supplements and the potential role of these products in balanced diet and in ensuring good health [1-35-70-84]. Probiotics are becoming increasingly popular as functional foods because of their health benefits. However, specific probiotic supplement regulation and comprehensive market analysis are absent, hampering the understanding of consumer preferences, market trends, and potential economic impacts of this industry [1-35-70-84]. The market analysis highlighted the importance of setting national probiotic supplement regulations to enhance Indian consumer understanding and trust, ensuring product efficacy and safety. Additionally, developed machine learning model provides the industry with valuable predictive tool, enabling companies to optimize their supply chains, effectively meet demand, and make data-driven decisions that could support sustainable market growth [1-35-70]. In India, the younger population has become highly inclined towards wellness and nutrition. Hectic work life and fast-paced lifestyle have led to growth in the prebiotics market [1-71-84]. Also, the Indian diet is rich in oils, spices, refined sugar, and consumption of tea and coffee on a daily basis [1-71-82]. As a result, over 80% of the Indian population suffers from digestive issues such as indigestion and acid reflux. Therefore, functional foods and beverages in the form of probiotic yogurt and cereals are most preferred in the country [1-71-82-84].

Therefore, the consumer awareness and perception about probiotics plays an important role in marketing [1-71-82]. In one of the study conducted by Sehgal (2016) [9], the research design also evaluated the type of probiotic products being sold in the Delhi market, their current labelling and storage practices [9]. The storage temperature is critical to the functionality of the probiotic products as inappropriate storage temperature at any step post manufacture may result in decline of the probiotic microorganisms [9]. A study conducted by Sehgal (2016) [9] also indicated that a cross sectional random population survey using questionnaire across NCR about the knowledge and perception of the Indian consumer (n=735) about probiotics was conducted. Majority of the consumers were not aware about the concept of probiotics and were not able to differentiate probiotics and fermented foods [9]. The perceived barriers to purchase of probiotics included cost and availability [9]. On site analysis of the probiotic products at the retail outlets (n=132 outlets) showed a storage temperature deviation as high as 22 °C which is detrimental to the viability of probiotic microorganisms and thereby the functionality of probiotics [9]. The viable counts were found in range for majority of probiotic foods [9]. The labeling practices of probiotic products (n=213) revealed that there is no mention of the species name and health claims by majority of the Indian brands although it is a must as per the guidelines down by ICMR-DBT, India [9]. There is an urgent need of a regulatory regime governing the sale of probiotic products in India [9].

The Indian probiotics market analysis is segmented by distribution channel, source, strain, and application [1-71]. Market by application includes probiotic foods, cosmetics, veterinary health, probiotic drinks, and dietary supplements [1-71]. Probiotics are used as functional ingredients in conventional foods and drinks. Among these functional teas, foods, non-carbonated & non-alcoholic, and bottled beverages are especially popular [1-71]. Adding probiotics to the juices is more complex than formulating in dairy products because the bacteria need protection from the acidic conditions in the fruit juice. However, with microencapsulation technologies, probiotics can become an important ingredient in functional foods, expanding the probiotic application outside the pharmaceutical and supplement industries [1-71-80].

Besides, the surging geriatric population (1.5 billion) in India is prone to chronic gastrointestinal disorders [1-71-81]. Hence, it acts as a significant growth factor for the market nationally. Additionally, the shifting consumer preferences toward functional beverages and food from a high-calorie diet further augment the demand for probiotics. Moreover, the expanding nutraceutical sector, including several sugar-free, allergen, and dairy formulations, is positively influencing the India probiotics market [1-71-81]. Besides, post the COVID-19 pandemic outbreak, there has been an increase in consumer inclination toward dietary supplements, immunity-boosters, and fortified food products [1-71-82].

There is increasing interest in the development of fruit-juice-based probiotic products. Fruit juices can be an ideal probiotic medium and contain beneficial nutrients [1-81]. Fruit juices have pleasing taste profiles for all age groups and are perceived as refreshing and healthy [1-71-81]. Pomegranate juice was a suitable probiotic drink as results have shown desirable microbial growth and viability for *L. plantarum* and *L. delbrueckii* [1-71]. Thus, manufacturers are investing in the innovation of packaging and flavors of fruit-based probiotic drinks and appealing to the health-conscious community [1-71]. Some of the key companies operating in the India probiotics market include Yakult Honsha Co Ltd, Nestle Inc, KeVita Inc, Amul, Mother Dairy, etc [1-71-82]. Nestle Inc is a multinational food and beverage company with over 2000 brands [1-71-82]. The company offers products in categories such as water, cereals, ice cream, dairy, drinks, chocolate & confectionery, baby foods, chilled and frozen food, coffee, food service, healthcare nutrition, pet care, and culinary [1-71]. The company operates globally and has a presence in America, Europe, Asia-Pacific, the Middle East and Africa [1-71-81].

There has been an increased influx of probiotic products in the Indian market during the last decade [1]. However, there has been no systematic approach for evaluation of probiotics in food to ensure their safety and efficacy [1-35-71-81]. An initiative was, therefore, taken by the Indian Council of Medical Research (ICMR) along with the Department of Biotechnology (DBT) to formulate guidelines for regulation of probiotic products in the country [1]. These guidelines define a set of parameters required for a product/ strain to be termed as 'probiotic' [1]. These include identification of the strain, in vitro screening for probiotic characteristics, animal studies to establish safety and in vivo animal and human studies to establish efficacy [1-81]. The guidelines also include requirements for labelling of the probiotic products with strain specification, viable numbers at the end of shelf life, storage conditions, etc., which would be helpful to the consumers to safeguard their own interest [1-25-81].

On the worldwide market, a great number of probiotic formulations are available to consumers as drugs, dietary supplements, and functional foods. For exerting their beneficial effects on host health, these preparations should contain a sufficient amount of the indicated living microbes and be pathogen-free to be safe [1-35-80]. Therefore, the contained microbial species and their amount until product expiry are required to be accurately reported on the labels [1-35-80]. While commercial formulations licensed as drugs are subjected to rigorous quality controls, less stringent regulations

are generally applied to preparations categorized as dietary supplements and functional foods [1-35]. Many reports indicated that the content of several probiotic formulations does not always correspond to the label claims in terms of microbial identification, number of living organisms, and purity, highlighting the requirement for more stringent quality controls by manufacturers [1-35-80]. Even if manufacturers carry at least some of the responsibility for these inconsistencies, studies that analyze probiotic products should be conducted following recommended and up-to-date methodologies [1-35-70].

Dietary supplements can be administered as tablets, capsules, liquid suspensions, or powders and are intended to complement diet by ensuring the intake of specific dietary components [1-35-80]. In Europe, probiotic food supplements fall under the Food Products Directive and Regulation and each health claim need to be accurately scrutinized by the EFSA before being authorized [1-35-80]. Good Manufacturing Practice that manufacturers of dietary supplements should follow have been developed [1-35-70]. In the US, dietary supplements are regulated by the FDA under the Dietary Supplement Health and Education Act (DSHEA) and the Federal Trade Commission (FTC) and need to comply the Good Manufacturing Practice guideline [1-35-80]. The evidence for the role of the microbiome/microbiota in human health (acute and chronic) is now relevant, with the specification that the influence of our microorganisms goes beyond the gut to incorporate the brain, metabolism, and immune system [1-35-80].

The Indian probiotics market is witnessing rapid expansion, driven by growing consumer awareness of digestive health, rising incidences of gastrointestinal and lifestyle-related disorders, and increased demand for functional foods and beverages. Indian consumers are increasingly incorporating probiotics into daily diets in the form of functional foods and drink [1-35-80]. The Indian probiotics market is experiencing substantial growth, with estimates suggesting it doubled in size over five years, reaching ₹2,070 crore (approximately US\$242 million) in 2025 [1-35-80]. With a growing consumer focus on gut health, immunity, and digestion, probiotics are becoming a key part of Indian diets. Pharmaceutical companies such as Sun Pharmaceutical Industries, USV, Zydus Lifesciences, Torrent Pharmaceuticals, Mankind Pharma, and Dr. Reddy's Laboratories continue to dominate the market, with older brands leading growth. Most common brands involve in Indian probiotic industry are Amul, Mother Dairy, Yakult Danone and Nestle along with other minor brands operating in different areas in their own capacities. Digital marketing, influencer marketing, and e-commerce marketing are commonly practiced to foster brand loyalty [1-35-70-81]. With the influence of media, healthcare professionals, and lifestyle coaches, more individuals are turning to functional foods like probiotics as part of their balanced diets [1-35-70-81]. With a large percentage of the Indian population lactose intolerant or vegetarian and vegan in their dietary habits, there's increased demand for plant-based and dairy-free probiotics [1-35-70]. Producers are taking notice, creating probiotics from sources such as soy, coconut, and fermented vegetables. The increase in plant-based probiotics is a sign of a larger trend towards inclusive and ethical consumption patterns [1-35-70]. Consumers are increasingly looking for products that address their individual health concerns, leading to a shift from generic probiotic offerings to more personalized solutions [1-35-70-81].

3. Probiotics: Applications

Probiotics, known to be live microorganisms, have been shown to improve or restore the gut microbiota, which in turn has been linked to improved health [1-35-70-83]. It is believed that probiotics are the modern equivalent of a panacea, with claims that they may treat or prevent different diseases both in children and adults (e.g., from colic in babies to cardiovascular disease, respiratory infection, and cancer in adults) [1-35-84]. Ever since the early 2000s, probiotic-based fermented foods have had a resurgence in popularity, mostly due to claims made regarding their health benefits [1-35-70]. Fermented foods have been associated with the prevention of irritable bowel syndrome, lactose intolerance, gastroenteritis, and obesity, but also other conditions such as chronic diarrhea, allergies, dermatitis, and bacterial and viral infections, all of which are closely related to an unhealthy lifestyle [1-35-70-81]. Recent and ongoing developments in microbiome/microbiota science have given us new research directions for probiotics. The new types, mechanisms, and applications studied so far, and those currently under study, have a great potential to change scientific understanding of probiotics' nutritional applications and human health care [1-35-80]. In the probiotic field, new variants of microbiome-modulating interventions are being developed, including prebiotics, symbiotics, postbiotics, microbial consortia, live biotherapeutic products, and genetically modified organisms, with renewed interest in polyphenols, fibers, and fermented foods to ensure human health [1-35-84].

While aging and genetics influence the composition and diversity of the microbiome, other modifiable factors, such as diet, exercise, exposure to exogenous microbes, and antibiotic use, may be more important for achieving microbiota eubiosis [1-35-80]. While this offers people the chance to adopt personalized lifestyles, there are also several challenges, including gathering adequate evidence to establish which microbiota interventions are appropriate for which population groups, understanding the mechanisms involved in these processes, and developing new effective probiotic products [1-35-70]. Probiotics are the elements that provide an effective strategy to prevent or ameliorate many

diseases [1-35-70]. However, future research should obtain evidence regarding the optimal dose for each individual strain and the most effective matrix. Future studies should also determine whether probiotic strains, be them ancient or of the new generation, colonize our intestines, or they are simply transitory microorganisms with beneficial effects [1-35-84].

4. The Side Effects and Risks of Probiotics

Live microorganisms in fermented foods have been used for centuries without causing human disease. Probiotic products administered as dietary supplements are regulated as foods, not as drugs [1-35-70-80]. Probiotic supplements (containing a variety of microorganisms in powder, pill, or liquid form) are safe for most people to take daily [6]. According to the study conducted by Maftai et al., (2024) [6], probiotics have a multitude of benefits, some people have experienced mild side effects, many of which will resolve as the body's microbiome readjusts [1-35-80]. Common probiotic side effects are bloating, gas, diarrhea, constipation, nausea, thirst, headaches and migraines, and skin reactions [1-35-70]. Mild gastrointestinal symptoms (gas and bloating), usually improve within a few weeks [1-35-70]. Some people experience increased thirst when they start taking yeast probiotics, especially in the first week as their bodies adjust to the new balance of gut bacteria. Symptoms go away on their own for most people [1-35-80]. Some probiotic foods, especially fermented foods (e.g., sauerkraut and kimchi), contain high levels of biogenic amines, including histamine, tyramine, tryptamine, and phenylethylamine, which are compounds that can trigger headaches and migraines in some people [1-35-70]. Also, biogenic amines were found in some yogurts, but to a much lower degree [1-35-70]. Very rarely, probiotics can cause rashes or itchy skin. This may be due to an allergic reaction to an ingredient in the supplement. It will usually disappear shortly after the person stops taking the supplement [1-35-80]. In addition to side effects, there is also the risk that probiotics (being living organisms) may cause infections that must be treated with antibiotics, especially in people with underlying conditions [1-35-70-81]. To obtain their health benefits, many of the probiotic strains are genetically modified in the laboratory [1-35-70]. For this reason, the safety of each strain must be guaranteed and strictly monitored so that they cannot accumulate in the environment, possess selection markers for antibiotics, or transfer any harmful genetic information to other bacteria [1-35-80]. Therefore, probiotic supplementation should be used with caution in persons at risk. These include: People on anti-rejection medication after a stem cell or solid organ transplant [1-35-80]. People on immunosuppressive medication or corticosteroids and chemotherapy for cancer, and people with autoimmune diseases [1-35-70]. People with structural heart disease with valvular abnormality or valve replacement or a history of infective endocarditis [1-35-70]. People with acute abdomen, active intestinal disease including colitis and the presence of neutropenia or the anticipation of neutropenia after chemotherapy and radiotherapy or the presence of active intestinal perforation and leakage [1-35-80].

5. Conclusion

Probiotics, known to be live microorganisms, have been shown to improve or restore the gut microbiota, which in turn has been linked to improved health. It is believed that probiotics are the modern equivalent of a panacea, with claims that they may treat or prevent different diseases both in children and adults (e.g., from colic in babies to cardiovascular disease, respiratory infection, and cancer in adults). There has been an increased influx of probiotic products in the Indian market during the last decade. However, there has been no systematic approach for evaluation of probiotics in food to ensure their safety and efficacy. An initiative was, therefore, taken by the Indian Council of Medical Research (ICMR) along with the Department of Biotechnology (DBT) to formulate guidelines for regulation of probiotic products in the country. These guidelines define a set of parameters required for a product/ strain to be termed as 'probiotic'. These include identification of the strain, in vitro screening for probiotic characteristics, animal studies to establish safety and in vivo animal and human studies to establish efficacy. The guidelines also include requirements for labeling of the probiotic products with strain specification, viable numbers at the end of shelf life, storage conditions, etc., which would be helpful to the consumers to safeguard their own interest. Indian consumers are becoming more aware of functional foods and nutritional supplements and the potential role of these products in balanced diet and in ensuring good health. Probiotics are becoming increasingly popular as functional foods because of their health benefits. However, specific probiotic supplement regulation and comprehensive market analysis are absent, hampering the understanding of consumer preferences, market trends, and potential economic impacts of this industry. However, probiotics have a multitude of benefits, some people have experienced mild side effects, many of which will resolve as the body's microbiome readjusts. Common probiotic side effects are bloating, gas, diarrhea, constipation, nausea, thirst, headaches and migraines, and skin reactions. Mild gastrointestinal symptoms (gas and bloating), usually improve within a few weeks.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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