

NUTRACEUTICALS AS SUPPLEMENTARY FOOD

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Abstract

About two-thirds of the 6.1 billion people living in the globe rely on the healing power of plant-based materials. 'Nutraceuticals' are apart from herbal items, dietary supplements, certain diets, and processed foods like cereals, soups, and drinks that are used for medical purposes in addition to being a source of nourishment. It plays a vital role in people day to day-to-day life for example green tea. It involves herbal items, probiotics and prebiotics, medicinal foods intended for illness prevention and treatment, and food supplements. It has strong therapeutic effects to pique people's interest. It can be used to boost well-being, slow down ageing, stop chronic diseases from occurring, lengthen life expectancy, or support the body's structure or functions. Currently, the market for Nutraceuticals in India is expanding mostly because of an increase in healthcare spending, but there are still significant problems, including a lack of standardization and awareness, high prices, marketing, and distribution. However, the Nutraceuticals sector is still experiencing tidal expansion, particularly in the USA, India, and European countries.

Keywords: Nutraceuticals, dietary supplement, bovine colostrum, researcher, clinical, functional foods

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1. Introduction

You'll find a variety of foods that have different uses when you walk through the supermarket, such as apples for snacking or pie filling, puffed rice cereal with vitamins and minerals for breakfast, baby formula for early childhood nutrition, gluten-free bread for people with dietary restrictions, and energy drinks for energy. The word "Nutraceuticals" is a combination of the words "nutrient", which refers to a nourishing dietary ingredient, and "Pharmaceutical", which refers to prescription medication (RA Siddiqui, MH Moghadasian, 2020) ^[30]. The Foundation for Innovation in Medicine is an American company with its headquarters in Cranford, New Jersey. Its founder and chairman, Stephen De Felice, came up with the name in 1989 (João Pinto da Costa, 2017) ^[12]. Their significance in human nutrition is one of the most important areas of study, and it has significant implications for consumers, healthcare workers, regulators, and food producers, and Nutraceuticals products can be viewed as non-specific biological medications with the goals of promoting overall

wellness, treating symptoms, and halting the development of cancer. Nutraceutical products can be viewed as non-specific biological medications with the goals of promoting overall wellness, treating symptoms, and halting the development of cancer. The goods of Nutraceuticals are categorized in accordance with their natural origins, pharmacological conditions, and chemical makeup. Pharmaceuticals, functional foods, dietary supplements, and therapeutic foods make up the four main categories of Nutraceuticals (H. Nasir, 2014) ^[25]. Eating patterns and changes in food production and consumption have an impact on people's health, the environment, and society. Diet has an effect on gut health. Food companies have started working on "functional foods", which are described as food items that provide an additional advantage to health (Sascha Sauer, 2014) ^[33].

Nutraceuticals and dietary supplements are collectively referred to as "dietary supplements", which are intended to be taken orally. Dietary supplements are frequently used to enhance health in general and illness prevention, performance (in sports, sex, and other activities), and attractiveness (Sex appeal, weight loss). They are typically regarded as "safe" and less likely to have negative effects. A concentration, metabolite, constituent, extract, or a mixture of any one or more of the following: A mineral, a vitamin, an amino acid, a medicinal plant or other botanical, a nutritional supplement for use by man to augment the diet by increasing.

The total daily intake. Nutraceuticals are among these dietary supplements used for health-related goals other than nourishment. Because of the high level of consumer demand, the scientific research on Nutraceuticals and nutritional supplements are frequently distorted or exaggerated for commercial purposes (Eric Banan-Mwine Daliri, 2015) ^[13].



Fig 1: Nutraceuticals Products

The construction of new blood vessels that supply tumours). They also have anti-inflammatory and antioxidant properties (BN Singh *et al.* 2010) ^[39] and natural polyphenol resveratrol can be found in foods including grapes, berries, and peanuts, its potential anticancer properties have been researched (L.G Carter, *et al.* 2014) ^[10].

2.4 Anti-microbial Activity

Some Nutraceuticals have the potential to compromise the integrity of microbial cell membranes, causing cellular components to seep out and ultimately causing cell death (KA Hammer, *et al.* 1999) ^[16] and some have the potential to compromise the integrity of microbial cell membranes, causing cellular components to seep out and ultimately causing cell death (S Ankhri, *et al.* 1999) ^[34]. It also may prevent the growth and maintenance of microbial biofilms, which are intricate colonies of microbes. Disrupting biofilms can make microorganisms more vulnerable to antimicrobial treatments. A Nutraceuticals that can prevent the growth of biofilms are cranberry (KL LaPlante, *et al.* 2013) ^[18].

2. Mechanism

2.5 Modulation of gut microbiota

The makeup and activity of the gut microbiota, which is essential to sustaining gut health and general well-being, can be modulated by Nutraceuticals products (i.e., dietary food, functional food and medicinal food etc.) in Nutraceuticals, it has a broad application area with every aspect. The usage of Nutraceuticals as traditional foods or as the only components of a meal or diet is common. Over time, Nutraceuticals have demonstrated a number of positive impacts on human health, including the treatment of inflammation, arthritis, cholesterol, diabetes, and a number of other illnesses (Mannucci, Carmen, *et al.* 2021) ^[19]. Natural honey is used in newborn feeding since it has a reputation for being a food with good nutritional value and health benefits like it has antioxidant properties that help with digestion. It also indicates that it has anti-inflammatory, anti-cancer, and antioxidant effects (S Benazir Begum, *et al.* 2015) ^[6].

Anti-Oxidant Activity

Numerous Nutraceuticals contain antioxidants, which work to combat dangerous free radicals in the body and reduce oxidative stress while defending against cell deterioration. Vitamins C and E, beta-carotene, and resveratrol are some examples of popular antioxidant Nutraceuticals (R Guo, S Nair, *et al.* 2017) ^[15].

Anti-inflammatory Activity

Certain dietary supplements have anti-inflammatory qualities that can help the body heal from inflammation. Numerous medical disorders, including heart disease, arthritis, and several forms of cancer, are linked to chronic inflammation. Nutraceuticals having anti-inflammatory properties include, for instance, curcumin, green tea extract, and omega-3 fatty acids (Calder PC, 2017) ^[9].

Anti-cancer Activity

The most prevalent and biologically active catechin is epigallocatechin gallate (EGCG), which is found in green tea in small amounts. Green tea catechins have been found to have anticancer effects by preventing the growth of tumours, triggering apoptosis, and reducing angiogenesis be influenced by Nutraceuticals. To sustain a healthy gut flora, some probiotics and prebiotics are frequently utilised as Nutraceuticals (M Aguirre, *et al.* 2018) ^[1].

2.6 Hormone Regulation

Some dietary supplements may affect how the body regulates hormones. Soy isoflavones, for instance, have been investigated for their estrogen-like properties, which may be advantageous to menopausal women. Other instances are Tribulus terrestris and maca root, which have been employed for their conceivable impacts on testosterone levels (P Tanmahsamut, JH Luie, *et al.* 2017) ^[32].

3. Methodology

A prospective study was conducted to demonstrate and assess Nutraceuticals as supplementary food. Bovine Clustrum, coenzyme Q10, Omega-3 fatty acid, and Curcumin are great sources of vital nutrients for newborns, and in recent years, their use in functional foods has significantly increased and shown different properties. This activity was conducted with bovine claustrum by 3 different methods with its physical and chemical analysis.

Clinical Studies

Clinical studies that examine how nutrition affects human health present special problems in the planning, analysis, and reporting of the study outcomes. The possibility of a result that delivers trustworthy clinical data rises when solid pre-clinical data can be built upon. In order to determine whether there is sufficient preclinical evidence to proceed with clinical research when evaluating a dietary supplement clinical trial, the first step is to review the preclinical studies (Z Elizabeth Floyd, David M Ribnicky, *et al.* 2022) ^[14].

Here are a few instances of clinical research using Nutraceuticals as a meal supplement such as the Coenzyme Q10 clinical trial examined the impact of supplements on heart failure patients. The study looked at how heart failure patients' quality of life, ability to exercise, and cardiovascular outcomes were affected by coenzyme Q10 as a supplement food (Mortensen Sen, *et al.*, 2014) ^[23]. Another medical research has looked into the advantages of consuming additional foods containing curcumin. In this research, the effects of curcumin on oxidative stress, inflammation, and numerous

chronic illnesses, such as cancer, arthritis, and cardiovascular problems, have been examined (Panahi Y, *et al.*, 2017) ^[26]. Numerous clinical investigations have concentrated on probiotics as an additional meal for gut health and immune function. In these investigations, various probiotic strains were investigated along with their benefits on illnesses such as immunological modulation, antibiotic-associated diarrhoea, and irritable bowel syndrome (MC Farland LV, 2015) ^[20].

The advantages of omega-3 fatty acid intake as a supplemental food have been studied in clinical studies and researchers have looked at the effects of antioxidant supplements. They looked at how omega-3 fatty acids affected inflammation, mood problems, cognitive performance, and cardiovascular health with antioxidants including vitamins C and E have been analyzed in relation to oxidative stress, inflammation, and chronic illnesses like cancer and cardiovascular disease (Mozaffarian D, Wu JH, 2011; Bjelakovic G, *et al.* 2012) ^[32, 8].

BC supplements are marketed for the prevention and management of type 2 diabetes, cardiovascular disease, immunity-related and allergy issues, skin disorders, inflammatory bowel disease, gut microbial symbiosis, Parkinson's disease, Alzheimer's disease, and athletic performance. The growing evidence from preclinical and clinical investigations that BC components have significant promise in Nutraceuticals and non-pharmacological treatments is briefly discussed in this review. The general composition, factors influencing conventional and synthetic goods, health benefits of cow colostrum in particular, B- type vitamins, oligosaccharides, immune globins, growth factors, and the function of lactoferrin and lactalbumin in the treatment of cancer (Rahul Mehra, Rajat Singh, Varij Nayan, Harpal S. Buttar *et al.* 2021) ^[22]. Clinical studies reveal that BC products are safe, non-toxic, and well-tolerated when used by people. Innovative products are being developed using bovine colostrum-based functional meals, feed, and medicinal formulations.

Materials and Methods

Our research aimed to manufacture a yoghurt fortified with bovine colostrum using yoghurt from the Oke (Romanian Company) and bovine colostrum for lactic ferments, as well as to perform some physical-chemical analyses. The 4 samples were constituted from yoghurt Oke and bovine colostrum in equal quantities by providing a different amount of time. We evaluated the Nutraceuticals yoghurt samples that contained bovine colostrum to ascertain their lipid, protein, and salt (as NaCl) contents.

Physical and Chemical Analysis in BC

The physical and chemical parameters listed below were measured in the lab using the Gerber

barometer to measure the concentration of lipids, a Sorensen method was used to measure the concentration of protein, and a Mohr method was used to measure the salt content. We only utilised reagents of the highest calibre, and the created solutions adhered to the reagents' directions in accordance with the technique while being new and of the highest grade. Each resultant piece of data is the average of three analyses.

3.2.3 Property in BC

BC has potent antibacterial, antiviral, and antifungal activity. In a small number of *in vitro* and in animal experiments, BC has also shown anticancer effects (Siddhi Bagwe-Parab, Pratik Yadav *et al.* 2021) ^[35].

Especially during the first few weeks of an infant's life, the antibacterial qualities and improving passive immunity against illness are essential. Colostrum's antibacterial properties can affect pathogens directly or indirectly by promoting the growth of a *bifidobacteria* and lactobacillus- rich gut microbiota. Foods containing colostrum send signals to the immune system, and the non-invasive nature of these food antigens is linked to the communicated information. This supports the immune response against infections while preventing aberrant immunological responses.

By preventing the development of disease-causing protozoa, yeasts, bacteria, and viruses, lactoferrin, which is generated from bovine colostrum, has antimicrobial properties (Arslan A, Kaplan M, Duman H, Bayraktar A, Ertürk M, Henrick BM, *et al.* 2021) ^[4].

Results and Discussion

After analysing the result, we observed that the content of lipids was unchanged in all the samples. However, the samples' salt content and protein titre are affected by the colostrum from cows. So, after 40 hours of curing, the samples' best protein content is at 16 hours. As the time following calving increases, the samples' protein content falls. The yoghurt containing clusters that were collected 16 hours after calving has a higher salt concentration. The low- sodium products have fewer than 140 mg of sodium, or 5% of the Daily Value, in accordance with USDA standards for salt intake. Therefore, our nutritional yoghurt has a mild salt concentration. These Nutraceuticals products are very important in people's diets because of their composition of very good nutrients. Because of their protein and immunoglobulins content, supplementary food can help different patients to get a rapid recovery, with a better health status and with lower costs for the hospitals. Also, these products are very useful in athletic diets before, during and after competitions.

4. Uses

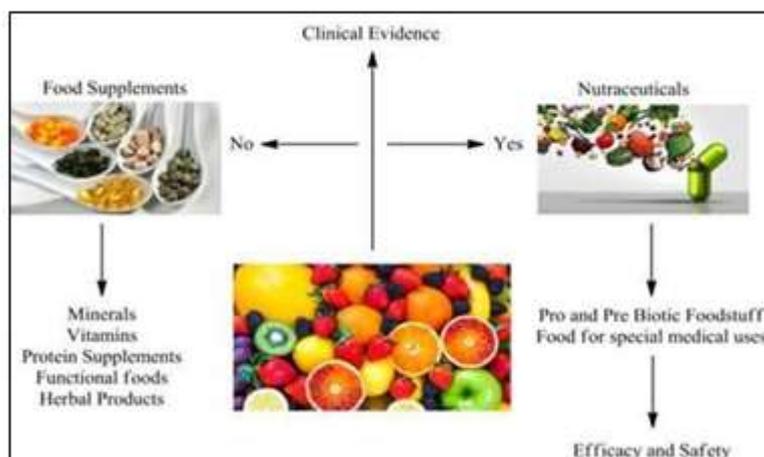


Fig 2: Potential Role of Nutraceuticals

Nutraceuticals are goods with therapeutic uses. Physiological needs or the treatment of a chronic condition may both be met by a Nutraceuticals product. Nutraceuticals are substances that are derived from plants, animals, or microorganisms. They include whole foods, food additives, herbs, phytonutrients, probiotics, vitamins, minerals, and herbal products. Nutraceuticals have countless advantages, and new applications are being found for them every day. Nutraceuticals that are frequently used include (Jenelle Kim, 2022) ^[36].

- **Vitamin B12:** A water-soluble vitamin, vitamin B12 is found in foods including beef, tuna, and dairy products. Many people use vitamin B12 as a dietary supplement to boost energy, maintain strong neurons, and help make DNA and red blood cells.
- **Green Tea:** One of the strongest and most well-known herbal extracts in the world is green tea extract. Green tea functions as an antioxidant that distributes vitamins and nutrients that delay ageing and shield the skin from oxidative stress and environmental deterioration. It has also been used to boost thermogenesis, fat oxidation, and the body's capacity to burn fat.
- **Ginseng:** Historically, ginseng has been used to balance the gastrointestinal tract, control hunger, improve circulation, lessen stress, cleanse and nourish the skin, balance the central and peripheral nerve systems, and stabilize blood sugar. It serves as a natural energizer as well.
- **Glucosamine:** Glucosamine is an amino sugar that is essential for the body's production of cartilage. Many people take glucosamine supplements to relieve arthritis and joint discomfort, even though this compound naturally occurs in the area around the joints and in the bone marrow.
- **Fennel:** These aromatic culinary herbs' anti-inflammatory and antioxidant characteristics make them a tremendous health asset. When consumed as a dietary supplement, fennel's high vitamin and mineral content works as a natural hunger suppressor (Jenelle Kim, 2022) ^[36].

- **Yakult:** From Food to Health claims that are beneficial but do not promise to be a cure, scientific, research- based, and medically-made brands create a probiotics research Centre for microbiology (N Bharti, *et al.* 2020)

Due to its many benefits, encapsulation technology is a particularly promising approach for the delivery of Nutraceuticals. A controlled release of the encapsulated compound is possible thanks to the Nanoencapsulation technique, which also increases bioavailability, enables targeted delivery to target sites, and protects the chemical structure of Nutraceuticals from environmental agents like pH, light, temperature, radicals, or oxygen. Since features of Nutraceuticals depend on its physio-chemical properties after it is placed into the carrier, encapsulation of Nutraceuticals components increases their solubility (Donatella Paolina *et al.* 2021) ^[37].

5. Conclusion

Nutraceuticals are a cutting-edge and exciting research area for the development of novel health products with enormous potential for positive health effects, including safety, efficacy, and affordability. Researchers have come to the conclusion that dietary supplements and good nutrition can both prevent and treat chronic diseases on a global scale (Hamid Nasri, *et al.* 2014) ^[38]. The Nutraceuticals-rich diet, frequent exercise, stress management, and upkeep of good health. Through investigation of the ethno-pharmacological claims made by many traditional practices, a variety of nutraceutical combinations have made their way onto the global market (V Puri, M Nagpal, 2022) ^[28]. The daily diet should consist of 90% of nutrient-rich plant foods, including vegetables, fresh fruits, beans and legumes, raw nuts, seeds, avocados, starchy vegetables, and whole grains. These foods also provide calories that are health-promoting phytochemicals. These foods or Nutraceuticals combine protective elements to create a diet that promotes health and prevents disease. The general objective is to provide readers with high-quality scientific data supporting the use of functional foods, Nutraceuticals, and dietary supplements to enhance health metrics at different phases of life (A Cencic, & W Chingwaru, 2010) ^[11].

6. References

1. Aguirre M, Venema K. Does the gut microbiota contribute to obesity? Going beyond the gut feeling. *Microorganisms*. 2018;6(2):65.
DOI: 10.3390/microorganisms6020065.
2. Ahmadi M, Velcirov AB, Scurtu M, Ahmadi T, Olariu L. Benefits of bovine colostrum in nutraceutical products. *Journal of Agroalimentary Processes and Technologies*. 2011;17(1):42-45.

3. Ankri S, Mirelman D. Antimicrobial properties of allicin from garlic. *Microbes and Infection*. 1999;2(2):125-129
DOI: 10.1016/S1286-4579(99)80003-3.
4. Arslan A, Kaplan M, Duman H, Bayraktar A, Ertürk M, Henrick BM, *et al.* Bovine colostrum and its potential for human health and nutrition. *Front Nutr*. 2021;8:651721. DOI: 10.3389/fnut.2021.651721.
5. Bagwe-Parab S, Yadav P, Kaur G, Tuli HS, Buttar HS. Therapeutic applications of human and bovine colostrum in the treatment of gastrointestinal diseases and distinctive cancer types: The current evidence. *Frontiers in Pharmacology*. 2020;11:01100.
6. Begum SB, Roobia RR, Karthikeyan M, Murugappan RM. Validation of Nutraceuticals properties of honey and probiotic potential of its innate microflora. *LWT- Food Science and Technology*. 2015;60(2):743-775.
7. Bharti N, Kaur R, Kaur S. Health benefits of probiotic bacteria as nutraceuticals. *European Journal of Molecular & Clinical Medicine*. 2020;7(07):4797-807.
8. BJankovic G. Antioxidant supplements for prevention of mortality in healthy participants and patients with various diseases. *Cochrane Database of Systematic Reviews*. 2012;3:CD007176.
9. Calder PC. Omega-3 fatty acids and inflammatory processes: From molecules to man. *Biochemical Society Transactions*. 2017;45(5):1105-1115.
DOI: 10.1042/BST20160474.
10. Carter LG, D'Orazio JA, Pearson KJ. Resveratrol and cancer: Focus on *in vivo* evidence. *Endocrine-Related Cancer*. 2014;21(3):R209-R225.
11. Cencic A, Chingwaru W. The role of functional foods, Nutraceuticals, and food supplements in intestinal health. *Nutrients*. 2010;2(6):611-625.
12. Da Costa JP. A current look at Nutraceuticals—Key concepts and future prospects. *Trends in Food Science & Technology*. 2017;62:68-78.
13. Daliri EBM, Lee BH. Current trends and future perspectives on functional foods and Nutraceuticals. In: Liong, MT. (Ed.) *Beneficial Microorganisms in Food and Nutraceuticals*. Microbiology Monographs. Springer, Cham; c2015. p. 27. https://doi.org/10.1007/978-3-319-23177-8_10
14. Nandigama, N. C. (2019). Hybrid Facial Recognition System Using Histogram of Oriented Gradients and Deep Learning with Dimensionality Reduction. *Research Journal of Nanoscience and Engineering*, 3(4), 30–35. <https://doi.org/10.22259/2637-5591.0304005>.
15. Guo R, Nair S, Zhang Y, Ren J. Adverse cardiac effects of exogenous genotoxicants: Deadly kiss of the 'heart breaker. *Oxidative medicine and cellular longevity*; c2017. p. 2528185. DOI:

- 10.1155/2017/2528185.
16. Hammer KA, Carson CF, Riley TV. Antimicrobial activity of essential oils and other plant extracts. *Journal of Applied Microbiology*. 1999;86(6):985-990. DOI: 10.1046/j.1365-2672.1999.00780.x.
 17. LaPlante KL, Sarkisian SA. Wood-dwelling bacterium selectively destroys pathogens and saves plants. *Journal of Applied Microbiology*. 2013;114(3):713-721. DOI: 10.1111/jam.12080.
 18. Mannucci C, Casciaro M, Sorbara EE, Calapai F, Di Salvo E, Pioggia G, *et al.* Nutraceuticals against oxidative stress in autoimmune disorders. *Antioxidants*. 2021;10(2):261.
 19. Nandigama, N. C. (2023). Enhanced Fingerprint Recognition system using hybrid Feature Fusion with Deep learning and Machine learning Optimization. *Research Journal of Nanoscience and Engineering*, 6(1), 9–15. <https://doi.org/10.22259/2637-5591.0601003>.
 20. Mehra R, Garhwal R, Sangwan K, Guiné RP, Lemos ET, Buttar HS, *et al.* Insights into the research trends on bovine colostrum: Beneficial health perspectives with special reference to manufacturing of functional foods and feed supplements. *Nutrients*. 2015;14(3):659.
 21. Mehra R, Singh R, Nayan V, Buttar HS, Kumar N, Kumar S. Nutritional attributes of bovine colostrum components in human health and disease: A comprehensive review. *Food Bioscience*. 2021;40:100907.
 22. Mortensen SA. The effect of coenzyme Q10 on morbidity and mortality in chronic heart failure: Results from Q-SYMBIO: A randomized double-blind trial. *JACC Heart Failure*. 2014;2(6):641-649.
 23. Mozaffarian D, Wu JH. Omega-3 fatty acids and cardiovascular disease: Effects on risk factors, molecular pathways, and clinical events. *Journal of the American College of Cardiology*. 2011;58(20):2047-206
 24. Nasir H, Baradaran A, Shirzad H, Rafieian-Kopaei M. New Concepts in Nutraceuticals as Alternative for Pharmaceuticals. *International Journal of Preventive Medicine*. 2014;5(12):1487-1499.
 25. Panahi Y. Curcuminoid treatment for knee osteoarthritis: A randomized double-blind placebo-controlled trial. *Phytotherapy Research*. 2017;31(11):1686-1691.
 26. Paolino D, Mancuso A, Cristiano MC, Froiio F, Lammari N, Celia C, *et al.* Nano Nutraceuticals: The new frontier of supplementary food. *Nanomaterials*. 2021;11(3):792.
 27. Puri V, Nagpal M, Singh I, Singh M, Dhingra GA, Huanbutta K, *et al.* A Comprehensive Review on Nutraceuticals: Therapy Support and Formulation Challenges. *Nutrients*. 2022;14(21):4637.