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7th National Conference on "Probiotics: Bridging Health, Medicine, and Food Sciences" (NCP-BHMFS 2026)"

Editors

Prof. Dr. R.Ragunathan
Dr. Jesteena Johney
Ms. Nihala K
Ms. V. Abirami

July 2026

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वैज्ञानिक और औद्योगिक अनुसंधान विभाग
Department of Scientific and Industrial Research

7th National Conference on "Probiotics: Bridging Health, Medicine, and Food Sciences" (NCP-BHMFS 2026)"

Editors

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Vision and Mission Statement

Our motto is "Towards Excellence"

CBNR is a Centre for higher learning in the life sciences, provides all areas of academic and industrial need through research and development at affordable cost to the students. We aimed to develop the skills that are necessary to the students and research scholars in the field of life sciences, enable them for the placements and affinity towards the subject.

About CBNR (Centre for Bioscience and Nanoscience Research)

The Centre for Bioscience and Nanoscience Research (CBNR) was established in 2010 with a vision to promote high-quality research, innovation, and scientific skill development in Life Sciences. The institution is affiliated with Bharathiar University and is recognized by DSIR-SIRO under the Ministry of Science and Technology, Government of India.

CBNR is registered with NGO Darpan, I-STEM, and certified under ISO 9001:2015 standards. The institution is also registered under the Ministry of Higher Education and actively participates in the Institution's Innovation Council (IIC) initiatives.

Research Programs

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- Ph.D. in Food and Nutrition (Applied for Approval)

Academic and Training Activities / CBNR regularly organizes:

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- Main Project Guidance
- Research Methodology Programs
- Skill Development Activities for Life Science /Pharma/Food science Students

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- Microbiology
- Biotechnology
- Molecular Biology
- Food Science
- Animal Cell Culture
- Advanced Instrumentation

Additional facilities include:

- Seminar Hall
- Conference Room
- Library
- Research Scholars' Room
- Staff Room
- Herbal Garden
- Wi-Fi Enabled Campus

Research Achievements / Publications and Citations

- Research Papers Published: 150+
- Citation Index: 2,000+
- H-Index: 22
- i10 index : 37

Research Guidance

- Ph.D. Scholars Awarded: 12
- External Ph.D. Scholars Guided: 76
- Current Ph.D. Scholars: 8
- UG and PG Students Trained: 10,000+

Innovation and Entrepreneurship

- Products Developed: 2
- Bio-Startup Launch Planned: 2026
- Academic & Industrial MoUs Signed: 28
- Patent awarded 3, one in pipeline

Key Strengths

✓ 16 Years of Research Excellence

✓ Strong Academic and Industrial Collaborations

✓ State-of-the-Art Research Laboratories

✓ Experienced Research Mentors

✓ Industry-Oriented Training Programs

✓ Focus on Innovation, Entrepreneurship and Skill Development

Benefit to the Society

Now a days there is a decline in number of students opting the bioscience courses due to lack of awareness and available of minimal number of technically skilled persons in the field. So we aimed to create awareness among undergraduate and post-graduate students in universities, colleges etc. on issues related to importance of Microbial biotechnology & its potential applications. The recent and continuing advances in life sciences clearly unfold a scenario energized and driven by the new tools of Microbial biotechnology. Microbial Biotechnology is a

knowledge-driven technology, which needs to be driven by allow of new ideas and concepts in the development of new tools for research to generate green environment.

Area of Research work carried out in CBNR

- **rDNA technology / Medical Molecular Microbiology / Molecular Biology**
- **Bio nanotechnology – Synthesis of Silver / Gold / CNTs nanoparticles and its Textile / medical applications**
- **Ethanobotany / Plant Biotechnology**
- **Microbial enzyme technology / Bioremediation / Food Science**
- **Agricultural / Food Microbiology / Biotechnology / Bio preservative**
- **Aquatic stress management / Environmental Biotechnology**
- **Microbial diagnosis using rDNA technology / Plasmid mediated**
- **All types of Bioinformatics work / Protein Engineering**
- **Bioactive compounds / antioxidant / characterization from Herbal plants / Microbes / Phytochemistry / Herbal drug formulation**
- **Animal cell culture / cancer biology**
- **Nanoparticle synthesis using biopolymer, biomolecules etc.**

About DSIR

The Department of Scientific and Industrial Research (DSIR), under the aegis of the Ministry of Science and Technology, GoI was set up through a Presidential Notification, dated 4th January, 1985 (74/2/1/8 Cab). The mandate of DSIR is to promote industrial research for indigenous technology development, promotion, utilization and transfer. The Department of Scientific & Industrial Research (DSIR) operates the Umbrella Scheme on "Industrial Research & Development (IRD)" consisting following four sub-schemes : (i) Common Research and Technology Development Hubs (CRTDHs); (ii) Patent Acquisition and Collaborative Research & Technology Development (PACE); (iii) Access to Knowledge for Technology Development and Dissemination (A2K+) and (iv) Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM).

The aims of the four sub-schemes of the Umbrella Scheme – "Industrial Research & Development" are given below: i) Common Research and Technology Development Hubs (CRTDHs) – This is a scheme which focuses on creation of Common Research facilities for micro and small enterprises and components of scheme, viz Industrial R&D Promotion Programme; ii) Patent Acquisition and Collaborative Research & Technology Development (PACE) – This scheme focuses on development and demonstration of innovative technologies by industries and institutions, either stand alone or in collaboration; iii) Access to Knowledge for Technology Development and Dissemination (A2K+) – This sub-scheme has three components viz: 'Technology Development and Utilization Programme for Women' (TDUPW) - promotes adoption of new technologies by women for greater operational efficiency and reduction of drudgery; 'Support to Studies' – undertakes study and analysis of developments in the emerging technology areas and documents the findings, leanings and outcomes for wider dissemination including preparation of status reports on technologies from public funded institutions ready for commercialization and 'Support to Events' (seminars, workshops, conferences, exhibitions etc.) - provides a platform for exchange of views leading to useful insights on issues relating to industrial research and iv) Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM)– This

scheme primarily focuses on supporting individual innovators, start-up companies, incubatee companies in public funded technology business incubators and MSMEs.

DSIR has partially supported the conference under Event Program of Access to Knowledge for Technology Development and Dissemination (A2K+) Scheme of DSIR.

Director Message

It gives me immense pleasure to present this program centered on the inspiring theme, "Probiotics: Bridging Health, Medicine, and Food Science." This topic reflects the growing importance of probiotics in promoting human health through an interdisciplinary approach that integrates medical science, nutrition, microbiology, and food technology.

Today, probiotics are recognized not only for their role in maintaining gut health but also for their potential to enhance immunity, improve metabolic health, support mental well-being, and contribute to the prevention and management of various diseases. At the same time, advances in food science have enabled the development of innovative functional foods that make these health benefits more accessible to people worldwide.

This theme highlights the need for collaboration among healthcare professionals, researchers, academicians, food scientists, and industry partners to translate scientific discoveries into safe, effective, and sustainable solutions for public health. By fostering dialogue across disciplines, we can accelerate innovation and address emerging health challenges through evidence-based probiotic applications.

I am confident that this program will serve as a valuable platform for sharing cutting-edge research, exchanging ideas, and building meaningful collaborations. I extend my sincere appreciation to the organizing committee, distinguished speakers, researchers, and participants for their dedication and contributions. May this gathering inspire new perspectives and pave the way for future advancements at the intersection of health, medicine, and food science.

I wish the event every success and hope that the discussions and outcomes will contribute significantly to scientific knowledge and the well-being of society.

With best wishes,

Dr. R. Ragunathan, Ph.D., FSAB

Director and Research Supervisor

Convener Message

It is a privilege to extend my warm greetings on the occasion of this academic program dedicated to the theme "Probiotics: Bridging Health, Medicine, and Food Science." This timely and relevant topic underscores the vital role of probiotics in advancing human health through the integration of medicine, nutrition, microbiology, and food science.

Their applications extend far beyond gut health, encompassing immune modulation, metabolic wellness, mental health, and the development of functional foods that support healthier lifestyles. As research continues to evolve, it is essential to foster interdisciplinary collaboration to translate scientific discoveries into practical solutions that benefit society.

As a department committed to academic excellence and research innovation, we believe that this program will provide an excellent platform for researchers, clinicians, academicians, students, and industry professionals to exchange knowledge, discuss emerging trends, and explore future directions in probiotic science. Such interactions are invaluable in strengthening research collaborations and promoting evidence-based practices in both healthcare and food systems.

I congratulate the organizing committee for their dedication in bringing together experts from diverse disciplines to deliberate on this important theme. I also extend my best wishes to all the speakers, delegates, and participants. I am confident that the discussions and insights shared during this program will inspire new ideas, encourage collaborative research, and contribute meaningfully to scientific progress and public health.

I wish the event every success and hope it serves as a catalyst for innovation and excellence in the field of probiotics.

With best wishes,

Dr. Jesteena Johney., Ph.D

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Precision Nutrition for Military Readiness: Advancing Soldier Health through Personalized Metabolic Interventions

Dr. K. Kadirvelu

Scientist 'G' & Associate Director

DRDO- DEBEL, Ministry of Defence, Govt. of India

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Abstract

Military personnel operate in demanding environments that place significant physical and mental stress on the body. Extreme climates, irregular work schedules, sleep disruption, and prolonged deployments can affect metabolism, immunity, gut health, and cognitive performance. Conventional dietary recommendations provide general guidance but do not consider individual differences in genetics, metabolism, gut microbiota, or lifestyle. Recent advances in precision nutrition have created new opportunities to improve soldier health and operational readiness. Individual variations in metabolic responses, genetic background, gut microbiome composition, circadian rhythm, and environmental exposure influence how nutrients are absorbed and utilized. Among these factors, the gut microbiome plays a central role in maintaining gut health, regulating immune function, supporting nutrient metabolism, and influencing the gut - brain axis. A balanced gut microbiota contributes to better stress resilience, improved cognitive function, and reduced risk of gastrointestinal disorders, which are common during military deployments. Microbiome profiling and targeted probiotic interventions, therefore, offer promising strategies for maintaining the health and performance of defence personnel under challenging operational conditions.

Personalized dietary interventions, microbiome-based supplementation, AI-assisted nutritional prediction, and continuous metabolic monitoring can improve endurance, immune competence, gastrointestinal health, and recovery while supporting mission-specific nutritional planning. These approaches also enable the development of customized combat rations, genotype-guided dietary recommendations, and real-time nutritional support using wearable technologies. Such strategies are particularly valuable during high-altitude deployment, prolonged field operations,

disrupted sleep cycles, and other demanding operational environments where nutritional requirements vary considerably among individuals. The integration of omics technologies, gut microbiome science, digital health tools, and personalized nutrition has the potential to strengthen metabolic health, improve operational performance, enhance resilience, and support the long-term health and readiness of defence personnel.

***Keywords**: Precision Nutrition, Military Readiness, Gut Microbiome, Gut Health, Metabolic Health, Nutrigenomics, Artificial Intelligence, Personalized Nutrition, Operational Performance, Defence Health*

Probiotics from Traditional and tribal foods of South India – A valuable source for therapeutic potential

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Abstract

This research explored the therapeutic potential of fermented food-associated coagulase-negative staphylococci (CNS), particularly *Staphylococcus hominis* strain MANF2, isolated from Koozh. Initial screening showed that all six CNS strains possessed strong anti-tubercular activity against *Mycobacterium tuberculosis* H37Rv, with more than 90% relative light unit (RLU) reduction, while also exhibiting broad-spectrum antimicrobial activity against several non-mycobacterial pathogens. Among them, strain MANF2 demonstrated superior antagonistic activity, desirable technological traits, and a favourable safety profile, supporting its suitability as a starter culture for fermented foods. Further investigation led to the purification and characterization of a bioactive glyceraldehyde-3-phosphate dehydrogenase-like protein from MANF2, which displayed enhanced anti-tubercular efficacy and significant anticancer activity against A549 lung and HT-29 colon cancer cell lines. The protein was identified by MALDI-TOF MS/MS, and its major peptide, NMANF2, exhibited promising structural and functional characteristics. In addition, MANF2 was employed as a biological reducing agent for the green synthesis of anisotropic gold nanoplates through microwave-assisted methods. Statistically optimized nanoparticles exhibited pentagonal and square morphologies with potent anti-tubercular activity (up to 92.6% RLU reduction) and strong anticancer effects against HT-29 cells (IC50: 41.3 µg/mL). Collectively, these findings highlight the remarkable biomedical and biotechnological potential of *S. hominis* MANF2 as a source of novel therapeutic proteins and functional gold nanomaterials.

Role of probiotics in functional foods: a health perspective

Dr. Rama Bhat P

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Abstract

Functional foods are consumable products providing health benefits beyond basic nutrition, They have transitioned from a market niche to a cornerstone of modern preventive healthcare. Central to this paradigm shift is the incorporation of probiotics: live microorganisms that, when administered in adequate amounts, confer a health benefit on the host. Through the modulation of gut microbiota composition, probiotics strengthen the intestinal epithelial barrier, inhibit pathogen colonization, and produce key bio-active metabolites such as short-chain fatty acids (SCFAs). Clinically, regular consumption of probiotic functional foods-ranging from traditional fermented dairy (yogurt, kefir) to novel matrix delivery systems like plant-based beverages and matrix-encapsulated snacks—is strongly associated with improved gastrointestinal health, enhanced immune system regulation, and reduced systemic inflammation. Furthermore, emerging research highlights the gut-brain axis, demonstrating that gut-microbiota modulation via functional foods can positively influence metabolic health, lipid profiles, and neurobehavioral parameters. Various daily functional foods used daily enhances health through nutritious as they have no toxic effects. By taking balanced food, honey, fresh fruit juices, dry seeds, fresh vegetables, raw vegetables boosting the immunity and adds probiotics minerals and vitamins. Despite these clear health benefits, challenges remain regarding strain-specific efficacy, viability during processing and shelf storage, and targeted delivery within the gastrointestinal tract. Addressing these technical and clinical hurdles through advanced microencapsulation and targeted strain selection is vital. Ultimately, integrating probiotics into daily functional foods offers a non-invasive, cost-effective strategy for disease prevention, personalizing nutrition, and optimizing long-term human health.

Bio-Entrepreneurship in the Probiotic Industry: Innovation to Impact

Dr. Megha P M

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Dhoni P.O, Palakkad, Kerala, India

Abstract

The probiotic industry is rapidly emerging as a promising sector at the intersection of biotechnology, functional foods, preventive healthcare, and innovation-led enterprise. With growing consumer awareness of gut health, immunity, and evidence-based nutrition, probiotics are no longer limited to traditional fermented products but are expanding into nutraceuticals, pharmaceuticals, animal health, and precision nutrition. This transformation has created significant opportunities for science-driven entrepreneurship that can convert microbiological research into market-ready solutions with meaningful public health impact. The growth of this sector depends on several critical elements, including the identification of viable probiotic strains, product formulation, intellectual property protection, regulatory adherence, market validation, funding, and scalable business models. Emerging technologies such as microbiome engineering, synthetic biology, artificial intelligence, and precision nutrition are further accelerating the development of next-generation probiotic innovations. In India, the combination of a strong fermented food heritage, expanding biotechnology capabilities, increasing health consciousness, and a supportive startup environment creates immense potential for probiotic-led enterprise. To fully realize this potential, stronger collaboration is needed among academia, industry, incubators, investors, and policymakers. Such integration can help bridge the gap between research and commercialization, enabling the creation of sustainable ventures that generate economic value while improving health outcomes. Probiotic bio-entrepreneurship thus represents a strategic pathway for advancing innovation, public wellbeing, and the broader bioeconomy.

Keywords: *Probiotics, Bio-entrepreneurship, Microbiome, Bioeconomy*

The Probiotic Odyssey: From History to Milestones and Emerging Horizons

Dr. Keerthi TR

Professor

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Abstract

The utilization of live microorganisms for health benefits dates back to early human civilization through the consumption of fermented foods. The scientific study of probiotics began in 1905 when Bulgarian physician Stamen Grigorov isolated the rod-shaped lactic acid bacterium *Lactobacillus delbrueckii subsp.bulgaricus* and the spherical *Streptococcus thermophilus* from yoghurt. Subsequently, Élie Metchnikoff proposed that the consumption of these fermented dairy products prolonged lifespan. By 1935, Minoru Shirota developed the first commercial probiotic drink, Yakult. The internationally accepted definition of "probiotic"—live microorganisms that confer a health benefit when administered in adequate amounts—was established by the Food and Agriculture Organization and World Health Organization. Late 20th and early 21st-century research expanded the clinical application of probiotics to include gastrointestinal disorders, immune function, and vaginal health. Emerging fields like bacteriotherapy—utilizing healthy, probiotic-enriched fecal samples now represent a promising approach for managing gastrointestinal pathologies. Furthermore, cellulose hydrogel bioreactors are being developed to simulate the human gut environment, enabling advanced production of microbial metabolites and targeted therapeutic research. Advancements in molecular biology have driven the concept of strain-specificity in probiotic characterization. Contemporary research integrates genetic engineering, next-generation sequencing, CRISPR-Cas9, bioinformatics, and artificial intelligence to map microbiomes and develop personalized probiotics and psychobiotics. Furthermore, multi-omics metadata and artificial intelligence prediction algorithms now enable highly tailored, precision therapeutic interventions.

From Plant to Product: Scientific Development of Evidence-Based Nutraceuticals for Preventive Healthcare

Dr. Reshma V.R. Nair

Chief Scientist

Centre of Excellence in Nutraceuticals (CoEN)

Bio 360 Life Sciences Park, Thiruvananthapuram, Kerala

Abstract

The global rise in chronic non-communicable diseases and the growing emphasis on preventive healthcare have positioned nutraceuticals as an important component of evidence-based health management. Modern nutraceutical development has evolved far beyond the traditional use of medicinal plants by integrating ethnopharmacology, phytochemistry, advanced analytical sciences, formulation engineering, and translational research into a multidisciplinary approach for developing safe, effective, and scientifically validated products. The journey from **plant to product** encompasses the systematic selection of botanical resources, optimized extraction and purification, comprehensive phytochemical characterization using advanced chromatographic and spectroscopic techniques, marker-based standardization, biological evaluation, safety assessment, stability studies, and regulatory compliance to ensure product quality, efficacy, and reproducibility. Recent advances in **microbiome science** have further transformed nutraceutical research by demonstrating the crucial role of gut microorganisms in mediating the health benefits of dietary phytochemicals. Plant polyphenols, dietary fibres, probiotics, and prebiotics interact synergistically with the gut microbiota to generate bioactive metabolites that influence immune regulation, intestinal barrier integrity, metabolic homeostasis, inflammation, and the gut–brain axis. These discoveries have driven the development of next-generation microbiome-targeted nutraceuticals, including synbiotics, postbiotics, and microbiome-supportive functional foods. Simultaneously, innovative delivery platforms such as nanoencapsulation, liposomes, phytosomes, nanoemulsions, oral thin films, and other targeted delivery systems are overcoming the limitations of conventional formulations by enhancing the stability, bioavailability, and controlled release of plant-derived bioactive compounds.

The convergence of phytochemistry, microbiome science, advanced formulation technologies, and precision nutrition is redefining the future of nutraceutical innovation. Emerging strategies, including artificial intelligence-assisted formulation, personalized nutrition, designer synbiotics, and live biotherapeutic products, are paving the way for evidence-based precision health interventions. **These scientific advancements are exemplified by the multidisciplinary research efforts at the Centre of Excellence in Nutraceuticals (CoEN), Kerala, where medicinal plant research is translated into standardized, innovative, and evidence-based nutraceutical products through advanced analytical and formulation technologies.** Together, these multidisciplinary approaches bridge **health, medicine, and food sciences**, reinforcing the pivotal role of probiotics in shaping the future of preventive healthcare.

The Role of Probiotic Bacteria in Promoting Human Health, Nutrition, and Social Well-Being: Focus on *Bacillus, Lactobacillus,* and *Bifidobacterium*

Dr.R.Ragunathan

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Abstract

"The human body harbors different types of microbial communities, collectively referred to as the microbiota. These microorganisms colonize epithelial surfaces, including the skin, urogenital tract, and gastrointestinal tract (GIT), where they contribute to host health by aiding digestion, modulating the immune system, and preventing the colonization of pathogenic microorganisms. Probiotics are live microorganisms that help maintain good health. When ingested in adequate amounts, they provide beneficial effects by supporting the balance and physiological functions of the human intestinal microflora through various mechanisms. More recently, probiotics have been defined as "live microbes that transit the gastrointestinal tract and, in doing so, confer health benefits to the consumer." This definition differs from earlier ones, which primarily emphasized the interactions between probiotics and the native intestinal microflora. Among the probiotics Genus of *Bacillus, Lactobacillus, Bifidobacterium,* are most important in their diverse production of compounds and potential applications.

Importance of Probiotics in diet

Dr. Jesteena Johney

Department of Food and Nutrition, Centre for Bioscience and Nanoscience Research, Coimbatore-21, Tamil Nadu, India

Abstract

Probiotics are live microorganisms that provide health benefits to the host when consumed in adequate amounts. They play a significant role in maintaining the balance of the intestinal microbiota, enhancing digestive health, and improving nutrient absorption. Regular consumption of probiotic-rich foods such as yogurt, fermented milk, kefir, kimchi, and other fermented products has been associated with reduced gastrointestinal infections, prevention of antibiotic-associated diarrhea, and improved immune function. Probiotics also contribute to the synthesis of vitamins, regulation of inflammatory responses, and inhibition of pathogenic microorganisms. Recent studies suggest that probiotics may have beneficial effects beyond gut health, including support for metabolic, cardiovascular, and mental health through the gut–brain axis. Incorporating probiotics into the daily diet is considered a safe and effective nutritional strategy for promoting overall health and reducing the risk of various chronic diseases. Continued research is expected to further clarify the mechanisms and therapeutic applications of probiotics in human nutrition. Probiotic bacteria (*Lactobacillus* sp.) was isolated from a natural source using selective culture techniques. The isolates were identified based on the morphological, biochemical, and molecular characteristics- DNA,PCR,16sRNA study. Confirmation of probiotic potential was carried out through standard probiotic screening assays, including acid and bile tolerance. The confirmed probiotic isolates exhibited characteristics suitable for further evaluation in food and health-related applications such as, antibacterial , antifungal, anticancer study, followed by the bacteria was used to prepare jelly. Shelf life analysis of the sample was carried out with time interval and confirmed by determine its pH, stability, microbial load and nutrient content.

***Keywords**: DNA, PCR, 16sRNA study, Jelly, shelf life*

Phenotypic and Molecular Characterization of Carbapenem-Resistant Enterobacteriaceae Isolated from Various Clinical Specimens

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Abstract

Background: Carbapenem-resistant Enterobacteriaceae (CRE) has emerged as a major global public health concern due to their increasing multidrug resistance and limited therapeutic options. The rapid dissemination of carbapenemase-producing strains, particularly those harboring the *blaNDM* gene, has significantly complicated the management of healthcare-associated infections. This study aimed to evaluate the phenotypic antimicrobial susceptibility pattern and molecular characteristics of CRE isolated from various clinical specimens.

Methods: A prospective study was conducted on 561 clinical specimens, including urine, pus, blood, sputum, swab, stool (motion), and catheter tip samples. Enterobacteriaceae isolates were identified using standard microbiological methods. Antimicrobial susceptibility testing was performed by the Kirby–Bauer disc diffusion method according to CLSI guidelines. Carbapenem-resistant isolates were further analyzed phenotypically and subjected to polymerase chain reaction (PCR) for the detection of the *blaNDM* gene. Statistical analysis was performed using appropriate descriptive methods.

Results: A total of 271 Enterobacteriaceae isolates were recovered, of which urine specimens accounted for the highest number of isolates (71.9%), followed by pus (18.4%) and blood (2.9%). *Escherichia coli* (186 isolates) was the predominant organism, followed by *Klebsiella* spp. (68 isolates) and *Proteus* spp. (17 isolates). Carbapenem antibiotics, particularly imipenem and meropenem, demonstrated the highest antimicrobial activity, whereas high resistance was observed against ampicillin, cephalosporins, and fluoroquinolones. Among 12 phenotypically confirmed CRE isolates, five (41.7%) were positive for the *blaNDM* gene by PCR.

Conclusion: The study demonstrates a significant prevalence of multidrug-resistant *Enterobacteriaceae* and confirms the presence of *blaNDM*-mediated carbapenem resistance among clinical isolates. Combined phenotypic and molecular detection methods are essential for the early identification of CRE, appropriate antimicrobial therapy, continuous surveillance, and effective infection control practices.

Gut Derived Pediocin as a Natural Preservative against Food-Borne Pathogen

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Abstract

Pediococcus pentosaceus is a lactic acid bacterium its ability to produce pediocin, bacteriocin that shows impressive activity against food-borne pathogens. This study set out to extract and partially purify pediocin from a specific *P. pentosaceus* isolate, characterize its antimicrobial properties, and assess its potential as a natural food preservative, both on its own and in conjunction with traditional preservation methods. We obtained cell-free supernatant from stationary-phase cultures and then concentrated and partially purified pediocin through ammonium sulfate precipitation (70% saturation). To test its antimicrobial activity, we used agar well diffusion and minimum inhibitory concentration (MIC) tests against bacterial strains. Their ability to survive gastrointestinal transit, adhere to the intestinal epithelium, and modulate the host immune response positions them as promising candidates for functional food applications. Application trials were conducted using model food systems, specifically minimally processed ready-to-eat sweet, where we applied pediocin preparations both alone and in combination with lower concentrations of common chemical preservatives. The results indicated that the extracted pediocin effectively inhibited *S.aureus* in a strong, dose-dependent manner, showed limited activity, and maintained its effectiveness across pH levels 3–8 and moderate heat, and was inactivated by proteolytic enzymes, confirming its protein nature. In food trials, pediocin significantly lowered pathogen levels during storage, and when used alongside reduced amounts of chemical preservatives and refrigeration, it successfully extended shelf life.

***Keywords**: Bacteriocin, MIC, Antimicrobial activity*

Evaluation of Plant Metabolites, Biological Activities and GC-MS Analysis of Methanolic Leaf Extract of *Simarouba glauca*

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Abstract

Simarouba glauca (Lakshmi Taru), a medicinal plant belonging to the family Simaroubaceae, is known for its diverse therapeutic properties. The present study aimed to evaluate the phytochemical constituents, antioxidant activity, biological activities, toxicity, and chemical composition of the methanolic leaf extract of *Simarouba glauca*. Fresh leaves were collected, shade-dried, powdered, and extracted using methanol. Preliminary phytochemical screening was carried out to identify the presence of bioactive compounds. The antioxidant potential was assessed using the DPPH free radical scavenging assay, while biological activities, including antibacterial effects, were evaluated using standard laboratory methods. Toxicity studies were also performed to determine the safety profile of the extract. Furthermore, Gas Chromatography–Mass Spectrometry (GC-MS) analysis was conducted to identify the major phytochemical constituents responsible for the observed biological activities. The findings indicate that the methanolic leaf extract contains several bioactive metabolites with promising antioxidant and antimicrobial properties, supporting the traditional medicinal use of *Simarouba glauca* and highlighting its potential as a source of natural therapeutic agents.

***Keywords**: Phytochemical analysis, antioxidant, GCMS*

Development of Novel Nano-Biotechnology-Based Drug Delivery Systems for Targeted Therapeutic Applications

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Abstract

The convergence of nanotechnology and biotechnology has transformed modern drug delivery by enabling precise, controlled, and site-specific delivery of therapeutic agents while minimizing systemic toxicity. Conventional drug delivery systems often suffer from poor bioavailability, rapid degradation, non-specific distribution, and limited therapeutic efficacy, highlighting the need for advanced delivery platforms. This study aims to develop and evaluate innovative nano-biotechnology-based drug delivery systems using biodegradable biopolymers and recombinant protein-based nanocarriers for targeted therapeutic applications. The research involves the synthesis of drug-loaded nanoparticles through biocompatible fabrication techniques, followed by comprehensive physicochemical characterization, including particle size, morphology, surface charge, encapsulation efficiency, and controlled drug release behavior. Surface functionalization with ligands or antibodies will be employed to enhance target specificity and cellular uptake. The therapeutic performance of the developed nanocarriers will be assessed through in vitro cytotoxicity, cellular internalization, and stability studies, while in vivo investigations will evaluate pharmacokinetics, biodistribution, therapeutic efficacy, and safety. Mathematical modeling and statistical analyses will further optimize drug release kinetics and validate experimental outcomes. The expected outcome is the development of a safe, biodegradable, and efficient targeted drug delivery platform with enhanced therapeutic efficacy, improved controlled release, reduced adverse effects, and broad applicability in anticancer and antimicrobial therapy. This work is anticipated to contribute significantly to the advancement of nanomedicine by providing sustainable, scalable, and clinically translatable drug delivery systems with strong potential for scientific publications, intellectual property generation, and future biomedical applications.

Keywords: *Nanobiotechnology, Drug Delivery System, Nanoparticles, Targeted Therapy, Biopolymers, Controlled Drug Release, Nanomedicine, Biocompatibility, Drug Targeting, Therapeutic Applications*

Bioactive Compounds from *Phellinus badius*: Exploring Its Potential for Functional Foods and Human Health

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Abstract

The increasing demand for natural health-promoting products has accelerated research on medicinal mushrooms as valuable sources of bioactive compounds for functional foods and nutraceutical applications. *Phellinus badius*, a wild medicinal polypore mushroom, has attracted attention due to its rich phytochemical composition and diverse pharmacological properties. The present study aimed to evaluate the bioactive potential of *P. badius* through phytochemical profiling, Fourier Transform Infrared (FTIR) spectroscopy, Gas Chromatography–Mass Spectrometry (GC–MS), and antimicrobial activity against selected human pathogenic microorganisms. Preliminary phytochemical screening confirmed the presence of alkaloids, flavonoids, phenolics, tannins, terpenoids, saponins, and carbohydrates, indicating the mushroom's therapeutic significance. FTIR analysis revealed the presence of major functional groups associated with alcohols, phenols, carboxylic acids, amines, and aromatic compounds, while GC–MS analysis identified several biologically active metabolites possessing antioxidant, antimicrobial, anti-inflammatory, and health-promoting properties. The mushroom extract exhibited appreciable antimicrobial activity against selected bacterial and fungal pathogens, demonstrating its potential as a natural antimicrobial agent. The combined findings suggest that *P. badius* is a promising source of bioactive compounds that can be utilized in the development of functional foods, nutraceuticals, and natural therapeutic products. Furthermore, the incorporation of mushroom-derived bioactive metabolites into functional food formulations may

complement gut health, enhance immune function, and contribute to disease prevention. This study highlights the significance of *P. badius* as an underexplored medicinal mushroom with considerable potential for applications in food, pharmaceutical, and healthcare industries. Further studies involving toxicity assessment, bioavailability, and clinical validation are recommended to support its commercialization as a functional food ingredient.

Keywords: *Phellinus badius, Medicinal mushroom, Functional foods, Bioactive compounds, GC–MS, FTIR, Antimicrobial activity, Nutraceuticals, Human health*

Development and Characterization of Probiotic-Loaded Carrageenan Bioplastic Film from *Kappaphycus alvarezii* for Sustainable Food Packaging

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Abstract

The increasing demand for environmentally sustainable food packaging has encouraged the development of biodegradable materials with functional health benefits. This study focuses on the preparation of a carrageenan-based bioplastic film derived from the marine red seaweed *Kappaphycus alvarezii* and its potential application as a probiotic carrier for active food packaging. Carrageenan was extracted and used to prepare biodegradable films by the solution-casting method with glycerol as a plasticizer. The prepared films were characterized using FTIR analysis to confirm the functional groups responsible for film formation. Water absorption studies demonstrated moderate moisture uptake, while soil burial tests revealed complete biodegradation within 14 days, confirming the eco-friendly nature of the developed material. The incorporation of probiotic microorganisms into the carrageenan matrix is expected to enhance food safety by inhibiting spoilage microorganisms while maintaining probiotic viability during storage. The biodegradable film exhibited desirable transparency, flexibility, and film-forming properties, indicating its suitability for sustainable food-packaging applications. The study highlights the potential of seaweed-derived carrageenan as a renewable biomaterial for developing biodegradable probiotic packaging systems that combine environmental sustainability with functional food preservation.

Keywords: Kappaphycus alvarezii, *Carrageenan, Probiotics, Biodegradable Film, Active Food Packaging, FTIR, Sustainable Packaging*

Microbiome-Based Drugs: Revolutionizing Modern Therapeutics

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Abstract

The human microbiome, and in particular the microbiome of the gastrointestinal tract, is becoming an increasingly attractive area for scientific research. This is due to the fact that it plays a major role in the physiology of the human body. Experts are trying to create microbiome therapeutics, the main directions of which are based on engineered microbiota, its metabolic products, and methods to regulate their activity. It is noteworthy that drugs that regulate microbiome functions may allow for more targeted and less damaging treatment of the body.

This article discusses microbiome drugs and therapeutics and their role in modern medicine.The article covers in detail the role of LBPs in disease prevention and treatment. Scientists believe that microbiome therapeutics can offer exciting new ways of treating various diseases, from gastrointestinal tract and obesity to diabetes, immunity, and cancer. These therapeutics can be conventionally divided into two categories: consisting of live bacteria such as LBPs and probiotics, and consisting of metabolites, for example, postbiotics and metabolites derived from microbiota. The latest breakthroughs in microbiome research have opened up many promising therapeutic approaches. Moreover, scientists highlight promising areas of research that target microbiome cells, for example, gene regulation techniques. At the same time, the authors discuss the many challenges that such therapeutics face in bringing to market. The article shows that further research will make microbiome drugs an integral part of the pharmaceutical industry. Such therapeutics will fundamentally redefine the principles of disease prevention and treatment while minimizing the deleterious effects on the physiology of the human body.

This review highlights the vast potential of microbiome therapeutics, as well as some of the challenges that the pharmaceutical industry is currently facing.

Keywords: *Microbiome-based drugs, Probiotics, Postbiotics, Precision medicine, Personalized therapeutics, Drug discovery, Pharmaceutical biotechnology, Modern therapeutics*

Bioprospecting of Fish Gut Associated *Pseudomonas Stutzeri* (Gm 30) For Its Aquaculture Probiotic Property

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Abstract

Bioprospecting of fish gut-associated bacteria for aquaculture probiotic properties is a promising approach to enhancing the sustainability and health of aquaculture systems. Gut microbes play a critical role in nutrition, development, immunity, and resistance against invasive pathogens. Further, recent studies revealed that fish gut-associated microbes are a promising source for secondary metabolites, enzymes, and aquaculture probiotics. A group of Gram-positive bacteria that contain high guanine plus cytosine (G+C) in their DNA and are well recognized. This project focuses on isolating and characterizing bacteria from the digestive tract of fish *Mugil cephalus* (Grey Mullet), collected from the coastal regions of Chennai. A total of thirty two fish gut-associated bacteria were isolated from the marine fish. From which only two isolates (GM1, GM30) demonstrated overall probiotic potential, exhibiting antagonistic activity against fish pathogens showed maximum 20mm and 17mm respectively (*A.salmonicida*, *V.harveyii).* The isolates produced extracellular digestive enzymes (Protease, Amylase, Lipase, cellulose, pectinase), indicating their ability to enchance nutritional digestion and absorption in fish. High siderophore synthesis was observed. Good cell surface hydrophobicity was seen, suggesting moderate to high intestinal attachment by the potential strains. The isolates exhibited considerate pH and bile tolerance with auto-aggregation against the potential strains. These findings suggest that the fish associated bacteria is a promising source for probiotic.

***Keywords**: Bacteria, Fish gut, Fish pathogen, Probiotic, Antimicrobial activity, Enzyme production*

Isolation and molecular confirmation of biosurfactant producing bacteria and its applications

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Abstract

The rapid pace of global industrialisation has intensified the search for natural resources, driving scientific innovation toward sustainable alternatives such as biosurfactants. These amphiphilic microbial products, composed of hydrophobic and hydrophilic moieties, reduce surface and interfacial tension by accumulating at fluid interfaces. Their eco-friendly nature, coupled with the ability to be synthesised from inexpensive waste substrates, has fuelled extensive research in recent years. Environmental and nutritional factors including carbon and nitrogen sources, pH, temperature, and salinity critically influence biosurfactant yield. Owing to their versatile physicochemical properties, biosurfactants find applications in hydrocarbon and heavy metal bioremediation, agriculture, cosmetics, and microbial-enhanced oil recovery (MEOR). Glycolipids and lipopeptides, in particular, serve as detergents, emulsifiers, foaming agents, moisturisers, and potential antimicrobial agents.

This study focused on isolating and characterising indigenous biosurfactant-producing bacteria from oil-contaminated soils across Kerala and Tamil Nadu, India. Soil samples collected from petrol outlets and workshops yielded *Bacillus* species, confirmed through selective media and molecular identification. Promising isolates were deposited in NCBI GenBank under accession numbers MN243658 (*Bacillusamylo liquefaciens*), MN243657 (*Bacillus* sp.), and MN243656 (*Bacillus thuringiensis*). Biosurfactant production was validated using assays such as oil dispersion, emulsification, drop collapse, BATH assay and hemolysis. Analytical

characterisation (UV, FTIR, TLC, GC-MS, HPTLC) identified the product as surfactin, a lipopeptide with strong biodegradation potential. Surfactin demonstrated antibacterial activity against *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumoniae*, and *Staphylococcus aureus*, as well as antifungal activity against *Aspergillus* species. Additionally, surfactin enhanced plant growth and chlorophyll content, showed biocompatibility in MTT assays (70% cell survival), and accelerated wound healing with 91.55% cellular migration after 48 hours. These findings highlight surfactin's multifunctional potential in environmental, biomedical, and agricultural applications.

Extraction of Secondary Metabolites from Probiotic Bacteria Isolated From Cowmilk

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Abstract

In the present study low molecular weight compound was produced by lactobacillus plantarum isolated from cow milk. The bacteria was isolated using MRS agar (De Man, Rogosa and Sharp agar) medium. The biochemical tests were performed for the confirmation. Further 16sRNA studies was performed for molecular identification. The low molecular weight compound was produced and optimum day was found to be 24 hours. The compound was extracted using ethyl acetate. The extracted compound was further analysed using UV-Vis and plasma peak was observed at 280nm confirmed the low molecular peptide. The active functional group were further characterized using FTIR. TLC study also carried out and Rf value was found to be 0.4545 confirmed the low molecular peptide. The antibacterial activity was studied against pathogen and *Salmonella typhi* (19mm) save better results using purified product. The anti-inflammatory study was conducted and confirmed. The activity for crude and purified compounds. Further the anticancer activity was performed against MCF-7 alpha cell lines and the % of cell death was calculated.

***Keywords**: UV-Visible, FTIR, TLC, antibacterial study*

A Review of "Application of Probiotics in Food: A Comprehensive Review of Benefits, Challenges, and Future Perspectives"

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Abstract

Probiotics have become an important component of functional foods due to their ability to improve human health through natural and sustainable approaches. The incorporation of probiotics into food products has gained substantial attention, primarily due to their well-documented health benefits such as modulating gut microbiota, enhancing immune responses, and providing potential therapeutic effects. Recent advances in food science have enabled the incorporation of probiotics into a wide range of functional food products while improving their stability and viability. Furthermore, probiotics contribute to sustainable health by reducing dependence on synthetic therapeutics and promoting preventive healthcare. The application of probiotics beyond conventional dairy products into plant-based foods, fermented beverages, cereals, and novel symbiotic formulations, thereby increasing consumer accessibility and promoting environmental sustainability. Emerging research also highlights their potential in personalized nutrition and precision health. This review focuses on the latest developments in probiotic-based functional foods, their health-promoting mechanisms, current challenges, and future prospects in achieving sustainable nutrition and overall well-being. The emerging technologies such as microencapsulation, precision fermentation, and microbiome-based personalized nutrition have significantly improved probiotic stability, targeted delivery, and therapeutic efficacy.

***Keywords**: Human health, modulation of gut microbiota, sustainable health, microencapsulation*

Molecular Characterization and Evaluation of Salt and Temperature Stress Responses in a Rhizospheric Fungal Isolate

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Abstract

Fungi inhabiting the rhizosphere play essential roles in maintaining soil health, nutrient cycling, and plant growth, while some species exhibit remarkable tolerance to environmental stresses. The present study aimed to isolate and characterize a culturable fungal isolate from rhizospheric soil using molecular approaches, and to evaluate its growth response under different salt concentrations and temperature conditions. The fungal isolate was cultured on Malt Extract Agar (MEA) and subsequently propagated in MGYP broth to obtain sufficient mycelial biomass. Genomic DNA was extracted from the fungal mycelium, followed by PCR amplification of the fungal ribosomal DNA marker for molecular identification. The amplified PCR product was subjected to sequencing, and the obtained sequence will be analyzed using BLAST and phylogenetic analysis to determine its taxonomic identity and evolutionary relationship with related fungal species. In addition, the isolate was exposed to varying sodium chloride concentrations and temperature conditions to assess its tolerance to environmental stress by monitoring fungal growth. The integration of morphological observations, molecular identification, phylogenetic analysis, and stress tolerance assessment provides a comprehensive characterization of the fungal isolate. The findings of this study are expected to contribute to the understanding of environmentally adapted rhizospheric fungi and their potential ecological significance, providing a foundation for future studies on their applications in agriculture and environmental biotechnology.

Exopolysaccharide Extraction from *Chlorella Ellipsoidea* MZ621181 Using RSM and Its Role in Gaba Production

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Abstract

Exopolysaccharide the most abundant polysaccharide in algae. Many factors influence the EPS production, limiting the nitrogen and phosphorus concentration in the medium. On depletion, these elements in the medium reduce algal growth and enhance EPS production by protecting the cells from starvation. This study conceptualizes the isolation and extraction of EPS from *Chlorella ellipsoidea* MZ621181, its prebiotic properties, and GABA production using soybean milk medium. *Chlorella* was isolated from the pond water, identified microscopically and they were analysed for optimal EPS yield using various methods, their composition, water holding index, solubility test, and they were characterized using UV spectrometer, FTIR, XRD, LC MS. GABA production was evaluated in soybean milk supplemented with EPS using *Lactobacillus fermentum*. Fourier Transform Infrared (FTIR) and X-ray diffraction (XRD) analyses characterized the functional groups and crystalline nature of EPS. Thermal degradation studies indicated EPS stability up to 100°C. Liquid Chromatography-Mass Spectrometry (LC-MS) further elucidated the carbohydrate composition of EPS, highlighting glucose, ribose, glucuronic acid, and xylose presence.This research underscores the potential of *Chlorella ellipsoidea* MZ621181 as a valuable source of bioactive compounds

Keywords: *Exopolysaccharide, Chlorella sp., GABA, Nutraceuticals, characterization*

A Comparative Study of Azo Dye Degradation by Plant Aqueous Extract

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Abstract

Azo dyes are extensively used in textile and related industries, and their persistent release into aquatic environments poses serious ecological and human health risks due to their toxic and recalcitrant nature. The development of sustainable and environmentally benign alternatives to conventional dye treatment methods has therefore become imperative. In the present study, a comparative investigation was conducted on the degradation of an azo dye using aqueous extracts of Aloe vera leaves and Sabja (*Ocimum basilicum*) seeds as green, plant-based degradation agents. Dye degradation was evaluated under controlled laboratory conditions by monitoring the decrease in absorbance at the dye's characteristic maximum wavelength (λmax) using UV–Visible spectrophotometry. The influence of key operational parameters, including extract concentration, dye concentration, pH and temperature, was systematically examined, and degradation kinetics were analysed. Fourier Transform Infrared (FTIR) spectroscopy was employed to elucidate the structural changes associated with the degradation process. FTIR spectra of the treated dye samples revealed a marked reduction or disappearance of characteristic azo (–N=N–) stretching bands, along with significant shifts in peaks corresponding to aromatic, sulfonate, hydroxyl, and amine functional groups, confirming effective azo bond cleavage and transformation of the dye structure. Comparative analysis demonstrated that *Aloe vera* aqueous extract exhibited higher degradation efficiency and faster reaction kinetics than Sabja seed extract, attributed to differences in phytochemical composition, particularly the presence of polysaccharides and redox-active phenolic compounds. The findings highlight the potential of *Aloe vera* and Sabja seed aqueous extracts as cost-effective, non-toxic, and sustainable alternatives for azo dye remediation and provide a scientific basis for their application in green wastewater treatment technologies.

Keywords: *Azo dye degradation, Aloe vera aqueous extract, Sabja (Ocimum basilicum) seed extract, FTIR analysis, green remediation*

Ecological Persistence of Enterococcus faecium in Circular Waste Streams: Implications for Probiotic Safety, Gut Microbiota, and One's health

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Abstract

Enterococcus faecium occupies a unique dual niche in microbiology: it is widely utilized as a probiotic for gut health and disease prevention, yet specific environmental strains have emerged as multidrug-resistant opportunistic pathogens. As the paradigm of sustainable waste management promotes the circular reuse of treated biosolids in agriculture, the environmental fate of such microbes becomes a critical concern for food safety and public health. This study investigates the ecological dynamics and persistence of E. faecium (strain PG) isolated from post-treatment biosolids, bridging the gap between environmental microbiology and probiotic science. Through molecular characterization and ecological profiling, we demonstrate that *E. faecium* exhibits remarkable resilience against desiccation, pH fluctuations, and antimicrobial stressors, primarily mediated by robust biofilm formation and mobile genetic elements. While these survival traits are advantageous for probiotic viability in the gastrointestinal tract, they also facilitate the persistence and horizontal gene transfer of antimicrobial resistance (AMR) in environmental reservoirs. Understanding these ecological mechanisms is crucial for "Bridging Health, Medicine, and Food Sciences," as it informs the rigorous screening of safe probiotic strains, mitigates the risk of AMR dissemination through the food and water chain, and protects human gut microbiota. This research underscores the necessity of integrating ecological risk assessment into probiotic development and biosolid management, ensuring that the therapeutic benefits of probiotics are harnessed without compromising environmental and public health safety.

Keywords: *Enterococcus faecium, Probiotic Safety, Gut Microbiota, Environmental Persistence, Antimicrobial Resistance, One Health, Food Safety*

Anti cancer activity of GABA from *Lactiplantibacillus planatarum* and *Lactiplantibacillus pentosus*

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Abstract

GABA, an amino acid with four carbons, which is non protein produced by decarboxylation of L-Glutamate, by the enzyme Glutamate Decarboxylase (GAD), with Pyridoxal-5-Phosphate as co factor. Among various types of probiotics, genus of Lactobacillus, have occurred as budding agents with various health benefits, including anticancer properties , modification of colon physicochemical conditions, metabolic activities in the intestinal microflora, production of anti-mutagenic or anti-tumorigenic compounds, and stimulation of the immune system.

Colorectal cancer is increasing in various developed and under developed countries due to fermentation of undigested food, improvement of the host's immune response, and inhibition of tyrosine kinase signaling pathways .In the present study The HCT-116 (Human Colorectal adenocarcinoma cell line) was used to study the anticancer activity using MTT assay. Ic50 values were studied and the results of cytotoxicity study performed by MTT assay suggest that the GABA from ,*Lactiplantibacillus planatarum* and *Lactiplantibacillus pentosus* cytotoxic in nature on Human colorectal cancer cells with the IC 50values of 76ug/ml and 123ug/ml respectively.

Anti-Cadidiasis Activities of Novel Probiotics

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Abstract

Candida is an opportunistic pathogen that causes mucosal and deep systemic candidiasis. The emergence of drug resistance and the side effects of currently available antifungal have restricted their use as long-term prophylactic agents for candidal infections. Given this scenario, probiotics have been suggested as a useful alternative for the management of candidiasis. Probiotics are collection of live microorganisms that have health benefits, most common probiotics are *Lactobacillus* that suppress C*andida* growth and biofilm development in vitro. Probiotics may serve in the future as a worthy ally in the battle against chronic mucosal candidal infections. The probiotics can physically block *Candida* from attaching to epithelial cells by adhering to the same sites, preventing colonization. Probiotics help to prevent candidiasis by promoting a health balance of gut bacteria. In the presence of study, seven *Lactobacillus* strain were isolated and identified from fermented dairy products. Potential isolates of *Lactobacillus* ABSK04 was shown a good result. Anticandidal activity, potential strain ABSK04 centrifuged and supernatant was identified using the agar well diffusion method and anti-biofilm activity was performed by tube method. Result showed inhibitory activity against *Candida albicans*. This study revealed maximum inhibition of biofilm formation. The novel probiotics *Lactobacillus* have ability to Anti-biofilm and Anti-microbial properties. Our findings conclude that lactobacillus represent a promising candidate to be used in the treatment of candidiasis caused by *C. albicans* strains.

"Let your food be your medicine and your medicine be your food".

***Keywords**: Probiotics, Candida, Candidiasis, opportunistic, Lactobacillus, Improve gut health*

A Prospective Analysis of the mecA Gene among MRSA and MSSA Isolated from Clinical Wound Samples

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Abstract

Methicillin-resistant Staphylococcus aureus (MRSA), which is resistant to many antibiotics, is a major worldwide health concern that is associated with high rates of morbidity and mortality. Even though MRSA is regarded as a serious nosocomial disease, it has become more common outside of healthcare settings in recent years, spreading across the community. S. aureus isolates, 3 to 5% is Methicillin-resistant Staphylococcus aureus (MRSA) strains (Chibuikeibe Ibe et al.). Apart from frequently causing skin diseases including abscesses and respiratory infections, Staphylococcus aureus has the ability to transform into an opportunistic pathogen. The rapid increase of MRSA and MDR-MRSA strain frequencies may be due to overuse or misuse of antibiotics. Several studies have shown that the genetic exchange of plasmids encoding antibiotic-resistant genes between bacteria is the primary factor influencing approximately 90% of MRSA strains. According to Cirz et al. (2005) and Harbottle et al. (2006), this resistance in S.aureus may be partially caused. Based on mortality rates Methicillin Resistant S.aureus (MRSA) strains are more virulent than Methicillin Susceptible S.aureus (MSSA) strain.

***Keywords**: Molecular Detection, of Methicillin Resistant Staphylococcus aureus, mecA gene*

Evaluation of the prebiotic potential of mango seed kernel and barnyard millet using *Lactobacillus plantarum* through biochemical characterization, *in-vitro* gastrointestinal tolerance and *ftsZ* gene expression analysis

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Abstract

Increased awareness and demand for sustainable functional foods have necessitated the search for less-exploited plant sources for prebiotic application. Thus, the current study aimed to examine the prebiotic efficacy of processed mango kernel (*Mangifera indica* L.) and barnyard millet (*Echinochloa frumentacea*) using *Lactobacillus plantarum* by various biochemical, microbiological, and molecular methods. Biochemical profiling revealed that processed mango kernel and barnyard millet are rich in nutrients and bioactive compounds. Processed mango kernel exhibited higher reducing sugar, phenolic content, carbohydrates and protein whereas barnyard millet showed higher flavonoid content. Both substrates proved as promising candidates for the selection as readily fermentable substrates for probiotic organisms.

Evaluation of prebiotic potential of substrates by using the concentration-dependent growth and viability of *Lactobacillus plantarum* in MRS broth resulted in growth significantly increased with increasing concentrations up to 60 mg/mL for both substrates. Survival of *Lactobacillus plantarum* under conditions similar to stomach environments was assessed by viable cell counting. The surviving count of viable colony-forming units was promising in presence of experimental substrates which showed their role in enhancing survival capacity of probiotics in gastro-intestinal tract. Molecular analysis of the bacterial cultures was performed by quantifying the expression of the bacterial cell division gene *ftsZ* using quantitative real time PCR (qRT-PCR). The *ftsZ* gene expression analysis revealed a significant upregulation in the treated cultures compared to the control, indicating enhanced bacterial proliferation. These findings confirm the prebiotic potential of the tested samples by demonstrating their ability to stimulate the growth and metabolic activity of *Lactobacillus plantarum*.

Based on the study it can be concluded that both processed mango kernel and barnyard millet have excellent physicochemical characteristics and significantly enhance the growth and survival of probiotic *Lactobacillus plantarum* under *in vitro* conditions. Considering their nutritional profile and probiotics supporting behavior in the gastro-intestinal environment, these substrates can be explored for formulation of new-age sustainable functional foods having prebiotic functionality. Advanced and long term research and clinical trials using the products are required to confirm the in vivo prebiotic functionalities.

Keywords: *Processed mango kernel, barnyard millet, Lactobacillus plantarum, prebiotics, functional foods, biochemical characterization, gastrointestinal tolerance, ftsZ gene*

Development and Characterization of Nanocomposite Cellulose-Based Active Packaging Incorporated with Probiotics for Sustainable Food Preservation

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Abstract

The rising demand for sustainable food packaging has really sped up the shift away from typical petroleum-based plastics toward biodegradable and bioactive packaging materials that can help food quality and safety at the same time, while also lowering environmental impact. Cellulose-based biopolymers are now seen as pretty promising packaging matrices because they are biodegradable, renewable, they make films well, and they are biocompatible. But in practice, their broader use is still kinda held back by a few issues like limited mechanical strength, high sensitivity to water, and barrier properties that are not quite enough. Nanocomposite technology, especially when it is paired with probiotic incorporation, looks like a fresh way to tackle those problems and end up with multifunctional active packaging systems. In this work, the goal is to develop and characterize a nanocomposite cellulose-based active packaging film, this film includes probiotic microorganisms, and it is intended for sustainable food preservation. The films will be prepared using a solvent casting approach, where a cellulose-based polymer matrix, nanofillers, plasticizers, and selected probiotic strains will be mixed together. After fabrication, the resulting films will be analyzed in a broad, detailed way for their physicochemical, mechanical, thermal, structural, and barrier-related properties. This will be done using Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM) plus X-ray Diffraction (XRD), Differential Scanning Calorimetry (DSC), and Thermogravimetric Analysis (TGA). Mechanical testing will include tensile strength and elongation at break, and barrier performance will be checked via water vapor permeability and moisture-related measurements. In addition, probiotic viability, the antimicrobial effect against selected foodborne pathogens, biodegradability, and storage stability will be evaluated, so we can better understand how well the films perform over time. food stuff will be packaged and then we will keep an eye on several

quality factors, like microbial count, weight loss, color, texture, and how much longer the product stays acceptable, especially when it is kept under refrigeration. In other words nanotechnology plus probiotic, cellulose based packaging is expected to give us a biodegradable active packaging setup with better functional outcomes, stronger food safety performance, longer shelf life and less reliance on conventional plastic materials. This should support sustainable food preservation, and also align with circular bioeconomy ideas in a more realistic way.

Keywords: *Nanocomposite, Active packaging*

Types of Probiotics and Their Role in Gut Microbiota and Human Health

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Abstract

The human gastrointestinal (GI) tract harbours a **complex and dynamic community of microorganisms**, collectively known as the **gut microbiota**, which plays a vital role in digestion, nutrient absorption, immune regulation, metabolic homeostasis, and protection against pathogens. Disruption of this microbial balance (**dysbiosis**) has been associated with various gastrointestinal, metabolic, inflammatory, and infectious diseases. **Probiotics** are **live, non-pathogenic microorganisms that confer health benefits when administered in adequate amounts** by restoring gut microbial balance and improving host health. This review summarizes the **types of probiotics,** their **mechanisms of action, interactions with the gut microbiota,** and their role in promoting human health. The most extensively studied probiotic genera include **Lacto*bacillus, Bifidobacterium, Streptococcus, Bacillus, Enterococcus, Propionibacterium***, and the probiotic yeast ***Saccharomyces boulardii***, commonly found in fermented foods and dietary supplements. These microorganisms strengthen the intestinal barrier, produce **short-chain fatty acids (SCFAs)**, regulate immune responses, and maintain gastrointestinal homeostasis. Evidence suggests that probiotics help prevent and manage gastrointestinal, metabolic, immune-related, urogenital, and oral disorders. Recent advances in microbiome research and gene-sequencing technologies have improved the understanding of strain-specific mechanisms and personalized nutrition. Although probiotics are safe, and their efficacy depends on the specific strain, dosage, and host health. Overall, probiotics represent a promising strategy for maintaining gut microbiota and improving human health. Further clinical studies are needed to confirm their efficacy and therapeutic applications.

Keywords: *Probiotics; Gut microbiota;* ***Lactobacillus****;* ***Bifidobacterium****; Dysbiosis; Short-chain fatty acids (SCFAs)*

Development of a Probiotic and Prebiotic-Enriched Guava Jelly as a Functional Food for Gut Health and Digestive Wellness

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Abstract

Increasing awareness of the importance of gut health and the growing demand for functional foods have created interest in convenient, non-dairy products enriched with probiotics and prebiotics. A fruit-based guava jelly offers a promising approach to developing a nutritious and consumer-friendly functional food with potential digestive health benefits. This study proposes the development of a guava-based functional jelly enriched with the probiotic *Lactiplantibacillus plantarum* and the prebiotic inulin. The formulation will include guava pulp, pectin, sugar, and citric acid, with the probiotic culture incorporated after cooling to preserve its viability. The developed product will be evaluated for physicochemical properties, probiotic viability during refrigerated storage, and sensory acceptability. The developed jelly is expected to demonstrate acceptable sensory characteristics, retain probiotic viability during refrigerated storage, and serve as a convenient functional food with the potential to support gut health and digestive wellness. The proposed probiotic and prebiotic-enriched guava jelly represents a promising functional food designed to combine nutritional value with digestive wellness benefits. If successfully developed, the product may contribute to the growing demand for innovative, consumer-friendly functional foods and encourage healthier dietary choices.

Keywords: *Functional food, Guava jelly, Probiotics, Prebiotics, Inulin, Gut health, Lactiplantibacillus plantarum*

Bacteriocin Producing *Pediococcus Sp* Derived From Fermented Cucumber

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Abstract

Bacteriocins are naturally occurring antimicrobial peptides produced by several lactic acid bacteria, including *Pediococcus* sp. These compounds have attracted significant attention because they can inhibit the growth of foodborne pathogens. In addition, many studies reported that *Pediococcus* species had probiotic functions including anti-inflammation, anti-cancer, antioxidant, detoxification, and cholesterol-lowering in the food industry. The use of bacteriocins in humans is considered safe because they are degraded by proteolytic enzymes in the stomach. Consequently, the colonization of bacteriocin producing probiotics in the gastro intestinal tract could prevent pathogenic bacterial invasion through bacteriocin production and alter the host's immune response. this study aimed to isolate and characterize a bacteriocin producing *Pediococcus* from fermented cucumber, for potential applications in food safety and health. It highlights the isolation and identification of these bacteria, the characteristic of their bacteriocins, and antimicrobial activity against foodborne pathogenic microorganisms. The antimicrobial activity of bacteriocin producing *Pediococcus sp* isolated from fermented cucumber was evaluated against *Staphylococcus aureus*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* using the agar well diffusion method. The *Pediococcuss* culture was grown in the MRS broth and cell free supernatant containing bacteriocin was collected by centrifugation. *Staphylococcus aureus*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* was inoculated onto muller-hinton agar plates, and wells were filled with bacteriocin containing supernatant. The plates are incubated at 37^{o}c for 24 hrs. after incubation plates are observed. The zone of inhibition was noted in plates. The isolate PK-2 and PK-3 was showed a strong anti-microbial activity against these foodborne pathogens. it can be considered as a promising biotherapeutic organisms.

Keywords: *Bacteriocin, Pediococcusssp, Foodborne pathogens, fermented cucumber, biotherapeutic organisms*

Biotherapeutic Potential of Probiotic *Bifidobacterium Sp* Against Enteric Bacterial Pathogens

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Abstract

Probiotics are live microorganisms which when administrated in adequate amounts confer a health benefit on the host (FAO/WHO, 2002). *Bifidobacterium sp* are one of the major genera of bacteria that make up on the colon flora in mammals and have great beneficial impact on health. In the present study, a total of five Lactic acid Bacterial strains were isolated from fermented food Yogurt, Cheese and Butter milk. Probiotic potential of the isolates were investigated through probiotic potentiality test, pH tolerance test, NaCl tolerance test, bile salt tolerance test, growth rate in artificial gastric juice and antibacterial activity. One of the isolate ALP-4 was observed as potential probiotic based on their probiotic properties and antibacterial activities. The isolate ALP-4 showed resistance to stomach pH (pH 3.0), tolerance against 0.3% bile concentration, gastric juice tolerance and high anti-pathogenic bacterial activities. The isolate *Bifidobacterium sp*AlP-4 showed as potent inhibitor against pathogens with inhibition zone diameter of 13 mm (*Pseudomonas aeruginosa*), 14 mm (*Escherichia coli*), 16 mm (Staphylococcus aureus), and 18 mm (*Staphylococcus epidermidis*). The potential isolate ALP-4 was characterized and identified as *Bifidobacterium sp* by cultural, staining, morphology, standard biochemical method and carbohydrate fermentation patterns. As *Bifidobacterium sp* ALP-4 showed strong ability to with stand to stomach pH, tolerance against 0.3% bile concentration, gastric juice conditions and have significant activity against pathogenic bacteria, it can be considered as a promising biotherapeutic organisms.

***Keywords**: Bifidobacterium sp, WHO Guidelines, fermented dairy products, Gastric juice tolerance, inhibit foodborne pathogens, Biotherapeutic*

Evaluation of Probiotics Potential and Antimicrobial Activities of *Streptococcus Lactis* from Fermented Dairy Products

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Abstract

Fermented dairy products are an important source of probiotic lactic acid bacteria with potential application in food preservation and human health. The present study focused on the evaluation of the probiotic potential and antimicrobial activity of *Streptococcus lactis* isolated from fermented dairy products. Samples were serially diluted and cultured on de Man, Rogosa and Sharpe (MRS) agar medium, followed by incubation under37^{o}c at 24 hrs. Presumptive *Streptococcus lactis* isolates were identified using colony morphology, Gram staining, catalase test, and standard biochemical characterization. The probiotic potential of the isolate was evaluated based on its ability to tolerate acidic pH and 0.3% bile salts. Antimicrobial activity was determined against the foodborne pathogens *Staphylococcus aureus* and *Bacillus cereus* using the agar well diffusion method. *Streptococcus lactis* culture was grown in the MRS broth and cell free supernatant was collected by centrifugation. The isolate LA-1 and LA-4 showed good survival under acidic conditions and 0.3% bile salt concentration compared to isolates LA-2,LA-3 and produced distinct zones of inhibition against both test organisms, indicating the production of bacteriocin-like antimicrobial compounds. These findings suggest that *Streptococcus lactis* possesses promising probiotic properties and effective antibacterial activity against important foodborne pathogens. Therefore, it has potential for use as a natural biopreservative and functional starter culture in fermented dairy products.

Keywords: *Evaluation of probiotics, Streptococcus lactis, MRS agar, antimicrobial compounds, bilesalt tolerance, biopreservative*

Development and Functional Evaluation of Probiotic Beverages from Underutilized Fruits: A Comparative Study of *Ziziphus mauritiana*, *Citrus maxima*, and *Syzygium samarangense*

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Abstract

The increasing demand for plant-based functional foods has accelerated the exploration of underutilized fruits as sustainable substrates for probiotic beverage development. The present study investigated the potential of *Ziziphus mauritiana* (Indian jujube), *Citrus maxima* (pomelo), and *Syzygium samarangense* (wax apple) for the formulation of non-dairy probiotic beverages using *Lactobacillus rhamnosus*. The probiotic strain, isolated from the fruit surface and molecularly confirmed through 16S rRNA sequencing and NCBI BLAST analysis, was incorporated into the respective fruit matrices using a fruit-surface inoculation approach to enhance microbial adaptability, compatibility, and functional stability.

Phytochemical screening of the developed beverages confirmed the presence of several bioactive constituents, including carbohydrates, proteins, flavonoids, alkaloids, steroids, saponins, terpenoids, and other phytochemicals, indicating their rich functional composition. Nutritional evaluation performed using AOAC standard methods demonstrated appreciable levels of vitamin C, dietary fiber, potassium, calcium, and phosphorus across all three fruit beverages. Total phenolic content ranged from 25.6 to 44.2 GAE/100 mL, while antioxidant potential assessed by DPPH and FRAP assays revealed significant free radical scavenging activity, with DPPH values ranging from 10.99–16.40 µg/g and FRAP values from 24.40–40.82 µg/g.

The incorporation of *Lactobacillus rhamnosus* not only maintained probiotic viability but also enhanced the nutritional and functional quality of the beverages. Among the three fruits, *Ziziphus mauritiana* and *Syzygium samarangense* exhibited comparatively higher phenolic content, whereas *Citrus maxima* demonstrated superior antioxidant activity and mineral richness. Overall, the findings establish these underutilized fruits as promising non-dairy probiotic carriers with considerable potential for developing sustainable, nutrient-rich functional beverages that support health promotion while adding value to neglected fruit resources.

Keywords: *Lactobacillus rhamnosus, probiotic beverage, Ziziphus mauritiana, Citrus maxima, Syzygium samarangense, underutilized fruits, phytochemical analysis, antioxidant activity, functional foods*.

A study on the cytotoxic effect of trihydroxyflavanone hesperetin in U87 human glioblastoma cells

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Abstract

Background: Glioblastoma is the most aggressive malignant brain tumor in adults, exhibiting rapid growth, extensive invasiveness, and poor clinical outcomes. Oxidative stress plays a pivotal role in glioblastoma progression and therapeutic response. The antioxidant capacity of flavonoids can modulate the level of oxidative stress, which can reduce the onset of cancers. Hesperetin (HST) is a bioflavonoid known for its significant cytotoxic effect and therapeutic applicability.

Objectives: To evaluate the cytotoxic effect of HST in the U87 human glioblastoma cell line through the visualization of cytotoxicity-associated morphological alterations using AO/EB dual staining.

Methodology: The cytotoxic effect of HST was determined at different concentrations (20 µM and 40 µM) in U87 human glioblastoma cells using Acridine Orange/Ethidium Bromide (AO/EB) dual fluorescent staining.

Results: The *in vitro* analysis revealed that cells exposed to different concentrations of HST displayed pronounced apoptotic morphology, characterized by nuclear condensation, fragmentation, and a shift from green to yellow and orange/red fluorescence. Meanwhile, the control cells preserved their viability and appeared mainly green under fluorescence microscopy.

Conclusion: The results indicate that HST exerts anticancer activity against U87 human glioblastoma cells, which ultimately promotes apoptosis, highlighting the potential of HST as a promising therapeutic strategy for glioblastoma management.

Keywords: *Hesperetin, Oxidative stress, AO/EB, Cytotoxicity, U87 Human Glioblastoma cells*

Isolation, Characterization and Application of Lactobacillus-Derived Low Molecular Weight Peptides for Food Safety

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Abstract

Background: Lactic acid bacteria, particularly *Lactobacillus* spp., are renowned for their probiotic potential and ability to produce bioactive peptides with antimicrobial properties. This study outlines a comprehensive three-phase strategy to isolate, characterize, and utilize *Lactobacillus*-derived low molecular weight peptides for enhancing food safety and quality.

Methods: *Lactobacillus* spp. will be isolated from raw milk samples, identified via biochemical assays, and molecularly confirmed using 16S rRNA gene sequencing, with resultant sequences submitted to the NCBI database. Focuses on the production of low molecular weight peptides using an optimized natural medium. The peptides will be extracted and partially purified through solvent and salt precipitation methods, followed by characterization using UV-Vis spectroscopy, FTIR, and HPLC. The antimicrobial efficacy of the free and microencapsulated peptides (or cells) against common foodborne pathogens will be evaluated, including determination of the Minimum Inhibitory Concentration (MIC).The most promising isolate will be incorporated into a prototype food product. The product will undergo physicochemical analysis before and after the addition of the bioactive component, along with a 20–40day shelf-life study assessing total microbial load. Finally, the biocompatibility of the active compound will be evaluated using a cell line-based assay.

Expected Outcomes: This integrated approach aims to deliver a characterized, antimicrobial *Lactobacillus*-derived,peptide, successfully microencapsulated and incorporated into a stable food product with extended shelf life. Successful biocompatibility will further

support its safety for potential functional food applications, offering a natural alternative for controlling foodborne pathogens.

***Keywords**: Lactobacillus spp., Probiotics, Low Molecular Weight Peptides, Antimicrobial Activity, Microencapsulation, Food Safety, Functional Foods*

Production of Volatile Compounds from Probiotic Bacteria and Its Food Applications

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Abstract

The present study aimed to evaluate the production of volatile compounds by probiotic bacteria and their potential applications in food products. Probiotic bacteria were isolated from fermented dairy products by serial dilution and cultured on de Man, Rogosa and Sharpe (MRS) agar medium. The isolates were identified using colony morphology, Gram staining, catalase test, and standard biochemical characterization. Selected probiotic isolates were cultivated in MRS broth under optimized incubation conditions (37^{o}c for 24 hrs) to promote the production of volatile compounds. The metabolites produced by the probiotic isolate were extracted from the culture supernatant and analyzed by Thin Layer Chromatography (TLC) for preliminary characterization. The antimicrobial activity of the extracted compounds was evaluated against *Staphylococcus aureus* and *Bacillus cereus* using the agar well diffusion method. In addition, the food application of the probiotic culture was assessed by incorporating it into a fermented dairy product, followed by sensory evaluation, pH determination, titratable acidity, and microbiological quality assessment during storage. The results demonstrated that the probiotic isolate produced volatile bioactive compounds with antimicrobial activity and improved the sensory quality of the food product. These findings indicate that probiotic bacteria can serve as a natural source of flavor-producing and antimicrobial metabolites, offering promising applications in the development of functional foods and natural food preservation systems.

***Keywords**: Probiotics, Fermented dairy products, Volatile compound, Thin layer chromatography, antimicrobial activity, food preservative*

Probiotics in Functional Foods: Enhancing Sustainable Health through Fermented Foods and Medicine–Food Homology

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Abstract

Functional foods are foods that provide health benefits beyond basic nutrition. They not only supply essential nutrients but also help improve body functions, strengthen immunity, and reduce the risk of chronic diseases such as diabetes, obesity, cardiovascular disease, and gastrointestinal disorders. Among the various functional food ingredients, probiotics have gained significant attention because of their ability to promote human health naturally. Probiotics are live microorganisms that provide health benefits when consumed in adequate amounts. Common probiotic microorganisms include *Lactobacillus acidophilus, Lactobacillus rhamnosus, Lactobacillus plantarum, Lacticaseibacillus casei* (formerly *Lactobacillus casei), Bifidobacterium bifidum, Bifidobacterium longum, Streptococcus thermophilus*, and the probiotic yeast *Saccharomyces boulardii*. These beneficial microbes help maintain a healthy gut microbiome, improve digestion, enhance nutrient absorption, strengthen the immune system, and inhibit the growth of harmful microorganisms. An emerging area of research is the fermentation of Medicine–Food Homology (MFH) materials with probiotics. MFH refers to natural foods and medicinal plants that can serve both as nutritious foods and traditional medicines. During fermentation, probiotics convert complex plant compounds into simpler, more bioavailable substances through a process called biotransformation. This process reduces toxins and anti-nutritional factors, improves flavor, increases beneficial compounds such as polyphenols, flavonoids, peptides, vitamins, and organic acids, and enhances the overall nutritional value of the food. At the same time, MFH ingredients provide nutrients that support probiotic growth and the production of health-promoting metabolites.

Keywords*: Probiotics; Functional Foods; Medicine–Food Homology (MFH); Fermentation; Biotransformation*

Probiotics in Gut Health: Mechanisms, Clinical Evidence, and Future Direction

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Abstract

The growing evidence in the role of gut microbiota in determining human health has led to probiotics as a practical approach to supporting gastrointestinal function. Probiotics are live microorganisms that confer a health benefit when consumed in adequate amounts, and they have been widely investigated for their potential to restore microbial composition and improve intestinal health. This review summarizes the current evidence on the biological mechanisms through which probiotics exert their effects. Evidence from systematic reviews, meta-analyses, randomized controlled trials, and other peer-reviewed studies indicates that selected probiotic strains can enhance intestinal barrier integrity, influence the composition of the gut microbiota, inhibit the growth of pathogenic microorganisms, produce beneficial metabolites, and regulate immune and inflammatory responses. Clinical findings suggest beneficial effects in reducing antibiotic-associated diarrhea, improving symptoms of irritable bowel syndrome, supporting remission in ulcerative colitis, and promoting overall digestive health. The analyses indicate that probiotics are a fundamental component of gut microbiota modulation, contributing to the maintenance of gut homeostasis and gastrointestinal health while supporting their application in evidence-based clinical practice The further advancement in microbiome research and personalized nutrition is expected to enhance the clinical application of probiotics.

Keywords: *Probiotics; Gut microbiota; Gut health; Gastrointestinal disorder; Microbiome; Personalized nutrition*.

Recent Therapeutic Potential of Bioactive Metabolites Produced by Selected Probiotic Bacteria: A Review

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Abstract

Probiotic bacteria have gained considerable attention because of their ability to produce bioactive metabolites that contribute to human health beyond their conventional probiotic functions. These metabolites, including bacteriocins, exopolysaccharides, short-chain fatty acids, vitamins, enzymes and immunomodulatory compounds, play an important role in maintaining gut homeostasis and protecting the host against various diseases. The present review highlights the recent therapeutic potential of bioactive metabolites produced by selected probiotic bacteria, particularly *Lacticaseibacillus rhamnosus* and *Bifidobacterium longum***.** Recent studies have reported that these metabolites exhibit antimicrobial, antioxidant, anti-inflammatory and immunomodulatory properties and have promising applications in cancer prevention, diabetes management, gut microbiota modulation and the development of functional foods and nutraceuticals. These findings highlight the growing importance of probiotic-derived bioactive metabolites as promising natural compounds for therapeutic applications and the development of functional foods, offering new opportunities for future healthcare innovations.

Keywords: *Probiotic bacteria, bioactive metabolites, Lacticaseibacillus rhamnosus, Bifidobacterium longum, therapeutic applications, functional foods*.

Virulence Factors and Minimum Inhibitory Concentrations of Selective Over-The-Counter-Purchased Antibiotics against Regional *Klebsiella Pneumoniae*

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Abstract

Klebsiella pneumoniae is a clinically significant opportunistic Gram-negative pathogen responsible for a wide range of hospital- and community-acquired infections, including pneumonia, urinary tract infections, septicemia, and wound infections. The increasing prevalence of multidrug-resistant (MDR) strains, coupled with the indiscriminate use of over-the-counter antibiotics, has become a major public health concern, limiting treatment options and contributing to therapeutic failure. The present study, entitled "Virulence Factors and Minimum Inhibitory Concentrations of Selective Over-the-Counter-Purchased Antibiotics Against Regional *Klebsiella pneumoniae*," was conducted at the PG and Research Department of Microbiology, M.R. Government Arts College, Mannargudi, to evaluate the antimicrobial susceptibility, minimum inhibitory concentrations (MICs), and virulence characteristics of regional K. pneumoniae isolates obtained from sputum specimens. The isolates were confirmed using conventional microbiological techniques, including Gram staining, colony morphology on selective media, and standard biochemical characterization such as IMViC, urease, oxidase, catalase, citrate utilization, and carbohydrate fermentation tests. Antibiotic susceptibility testing was performed using the Kirby–Bauer disc diffusion method according to CLSI guidelines against a panel of commonly prescribed antibiotics, while MICs of selected fluoroquinolone antibiotics, including ciprofloxacin, ofloxacin, and norfloxacin, were determined using the agar dilution method to assess their inhibitory effectiveness. In addition, important phenotypic virulence factors, namely biofilm formation and haemolysin production, were evaluated using qualitative tube methods, Congo red agar assay, and blood agar haemolysis tests. The study confirmed the characteristic microbiological and biochemical features of *K. pneumoniae* and demonstrated variability in antimicrobial susceptibility among the clinical isolates, indicating

differences in resistance profiles against the tested antibiotics. The MIC analysis revealed varying inhibitory concentrations required to suppress bacterial growth, reflecting differences in antibiotic effectiveness among the isolates. Furthermore, the detection of biofilm-forming ability and haemolysin activity highlighted the pathogenic potential of the isolates and their possible contribution to persistent infections and increased antimicrobial resistance. The findings emphasize that the coexistence of antibiotic resistance and virulence factors in *K. pneumoniae* represents a significant challenge for effective clinical management. Continuous surveillance of antimicrobial susceptibility patterns, routine MIC determination, and assessment of virulence traits are essential for guiding appropriate antibiotic therapy and preventing the spread of resistant strains. These findings provide valuable baseline information for clinicians, microbiologists, and public health professionals involved in the control and management of antimicrobial-resistant bacterial infections.

Gut–Brain Axis Modulation by Probiotics: Recent Advances and Therapeutic Potential

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Abstract

The gut–brain axis is a bidirectional communication network that connects the gastrointestinal tract and the central nervous system through neural, endocrine, immune, and metabolic pathways. In recent years, probiotics have gained considerable attention for their ability to modulate this axis, giving rise to the concept of **psychobiotics**—probiotic microorganisms that positively influence mental health. This review summarizes recent advances in understanding the role of probiotics in regulating gut microbiota composition, reducing intestinal inflammation, enhancing epithelial barrier integrity, and producing neuroactive compounds such as gamma-aminobutyric acid (GABA), serotonin precursors, and short-chain fatty acids (SCFAs). These mechanisms contribute to improved stress resilience, mood regulation, and cognitive function and may alleviate symptoms associated with anxiety, depression, and other neuropsychiatric disorders. Clinical and preclinical studies have demonstrated promising outcomes with probiotic strains belonging to the genera ***Lactobacillus*** and ***Bifidobacterium***; however, their efficacy depends on strain specificity, dosage, and host characteristics. Despite these encouraging findings, further large-scale clinical trials are required to establish standardized therapeutic protocols. Overall, probiotics represent a promising non-pharmacological strategy for promoting mental well-being through modulation of the gut–brain axis, offering new opportunities for integrative healthcare and personalized nutrition.

Keywords: *Probiotics, Gut–brain axis, Psychobiotics, Mental health, Gut microbiota, Lactobacillus, Bifidobacterium, Neuroactive metabolites*.

HR-TEM Observation of 5 BZD-Treated *Staphylococcus aureus*

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Abstract

The increasing prevalence of antibiotic-resistant bacterial pathogens has created an urgent need for the development of novel antibacterial agents with unique mechanisms of action. In the present study, the antibacterial effect of the newly synthesized compound 5 BZD against *Staphylococcus aureus* was investigated using High-Resolution Transmission Electron Microscopy (HR-TEM) to examine its impact on bacterial cell ultrastructure. *Staphylococcus aureus* cultures were grown in Mueller–Hinton Broth and treated with 5 BZD at its minimum inhibitory concentration (MIC) for 6 hours at 37 °C, while untreated bacterial cells served as the control. Following incubation, the cells were harvested, fixed with glutaraldehyde and osmium tetroxide, dehydrated through graded ethanol solutions, embedded in epoxy resin, sectioned into ultrathin slices, and stained with uranyl acetate and lead citrate before examination under HR-TEM. The untreated control cells exhibited a characteristic spherical morphology with intact cell walls, well-defined plasma membranes, and uniformly distributed cytoplasmic contents. In contrast, 5 BZD-treated cells exhibited marked ultrastructural alterations, including disruption of the cell membrane, irregular cell morphology, cytoplasmic shrinkage, and leakage of intracellular components. Several bacterial cells displayed collapsed cell envelopes and severe structural disintegration, indicating extensive damage to membrane integrity. These findings demonstrate that 5 BZD exerts a pronounced antibacterial effect by targeting and disrupting the bacterial cell envelope, leading to irreversible cellular damage and bacterial death.

Phytochemical Profiling and *In Vitro* Anticancer Activity in Ethanolic Extract of *Annona muricata* L. Flower against MCF-7 Cells

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Abstract

Annona muricata L. is a medicinal plant rich in many bioactive phytochemicals having known antioxidants and anticancer agents. However, there is a lack of information about the composition of its flower extract and its anticancer potential against human breast cancer cells.This study characterized the phytochemical composition of ethanolic extract of *A. muricata* flowers using the LC-MS technique and evaluation on MCF-7 human breast cancer cells. The MTT assay determined cell viability, while apoptosis was assessed by acridine orange/ethidium bromide (AO/EB) staining. Intracellular reactive oxygen species (ROS) generation was evaluated using carboxy-H2DCFDA staining. LC–MS analysis revealed three major chromatographic peaks at retention times of 3.65, 4.14, and 4.64 min with peak areas of 11.85%, 85.30%, and 2.85%, respectively, corresponding to tentative acetogenins, alkaloids, and phenolic constituents. The extract significantly reduced MCF-7 cell viability in a concentration-dependent manner, accompanied by apoptotic morphological alterations and increased intracellular ROS production.The ethanolic flower extract of *A. muricata* possesses significant antiproliferative activity against MCF-7 cells by inducing oxidative stress-mediated mitochondrial apoptosis. The identified phytochemicals, particularly acetogenin-rich constituents, may contribute to the observed anticancer activity and warrant further mechanistic investigations.

Keywords: *Acetogenins, Annona muricata L., apoptosis, breast cancer, LC–MS, MCF-7 cells, reactive oxygen species (ROS).*

Mycorrhizal fungal diversity in certain regions of Western Ghats

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Abstract

The Western Ghats, also known as the Sahyadri, is a mountain range that stretches 1,600 km along the western coast of the Indian peninsula. Covering an area of 160,000 km^2 (62,000 mi^2) and it consists of nearly 30% of all the species of flora and fauna found in India, most of which are endemic to this region. At least 325 globally threatened species occur in the Western Ghats.Sadhuragiri Hills and Valparai Hills are prominent sites in Tamil Nadu's southern Western Ghats, blending rich biodiversity with cultural significance, ideal for studies on tropical flora.AMF belong to the *Glomeromycota* phylum and are obligate biotrophs that colonize roots intracellularly, forming branched arbuscules (the hallmark structure) for phosphorus and carbon trading with hosts.AMF increase root biomass, photosynthesis rates, and overall yield, particularly in nutrient-poor soils. Soil sample collected were in Valparai,June 2025, September 2025,December 2025and in Sadhuragiri August 2025, November 2025exhibited the significance difference in spore diversity. Trap culture is done for all the collected samples and labelled; further spore diversity was done by using wet sieving/decanting methods. Seasonal fluctuation effects resulted the difference in spore diversity in the selected sites of western ghats. Research gaps in strain specificity, climate impacts, and field efficacy drive innovations like molecular signaling and global diversity mapping.The objective of the study is: Environmental factors influencing AMF diversity across the study sites will be identified and evaluated, effective AMF isolates with potential applications in forest conservation and ecological restoration programmes will be identified, the study provides opportunities to discover and report novel AMF isolates associated with the selected species and study sites, Potential AMF isolates capable of enhancing seed germination and promoting early seedling development will be identified for future conservation and propagation efforts.

***Keywords**: AMF, Mycorrhizal colonization, Ecological adaptation, Spore diversity*.

Development and Functional Characterization of a Peanut-Based Probiotic Yogurt Fermented with *Lactobacillus plantarum*

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Abstract

The increasing demand for sustainable and health-promoting foods has accelerated the development of innovative dairy alternatives that provide both nutritional and functional benefits. However, many commercially available plant-based yogurts are limited by low protein content, poor texture, and inadequate probiotic functionality. To address these challenges, the present study explores peanuts (Arachis hypogaea) as a nutrient-rich substrate for the development of a probiotic yogurt fermented with *Lactobacillus plantarum*. Peanut milk was prepared through standardized soaking, wet grinding, filtration, and pasteurization, followed by controlled fermentation to enhance probiotic growth and improve product quality. The developed yogurt was evaluated for its physicochemical characteristics, sensory acceptability, probiotic viability, and functional properties. In vitro studies were further conducted to assess its antimicrobial, antidiabetic, and anti-inflammatory activities, providing insight into its potential health-promoting effects beyond basic nutrition. The findings demonstrate that probiotic fermentation enhances the nutritional and functional value of peanut-based yogurt, producing a sustainable, protein-rich, dairy-free alternative. This study highlights the potential of integrating plant proteins with probiotic fermentation to develop next-generation functional foods that can benefit individuals with lactose intolerance, milk protein allergies, and those following vegan or flexitarian diets while supporting sustainable food systems.

***Keywords**: Peanut yogurt (Arachis hypogaea), Lactobacillus plantarum, Functional foods, Probiotic fermentation, Plant-based dairy alternative, Sustainable nutrition, Antimicrobial activity, Antidiabetic activity, Anti-inflammatory activity*.

Types of Probiotics, Gut Microbiota and Human Health

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Abstract

The human gut microbiota plays a pivotal role in maintaining health by regulating metabolic, immunological, and protective functions. Recent studies emphasize the importance of probiotic species, particularly genera such as Lactobacillus and *Bifidobacterium*, in modulating gut microbial composition and enhancing host resilience. Probiotics exert beneficial effects through mechanisms including competitive exclusion of pathogens, production of antimicrobial compounds, and modulation of host immune responses. Evidence demonstrates that specific strains of Lactobacillus can stimulate anti-inflammatory pathways and improve mucosal immunity, thereby reducing the risk of gastrointestinal and systemic disorders. Furthermore, the synergistic use of prebiotics and synbiotics enhances probiotic efficacy by promoting colonization and metabolic activity, leading to improved gut barrier function and nutrient absorption. Clinical and experimental findings suggest that probiotics contribute to the prevention and management of conditions such as irritable bowel syndrome, inflammatory bowel disease, metabolic syndrome, and even neurobehavioral disorders via the gut–brain axis. Despite promising outcomes, variability in strain-specific effects, dosage, and host factors underscores the need for personalized approaches and rigorous clinical validation. Collectively, these insights highlight probiotics as a cornerstone in strategies aimed at restoring gut homeostasis and advancing human health. Key Themes from the Articles Types of probiotics: Mainly *Lactobacillus, Bifidobacterium, Saccharomyces boulardii*, each with distinct mechanisms of action. Gut microbiota and health: Central to digestion, immunity, and metabolic regulation. Immune modulation by *Lactobacillus*: Enhances anti-inflammatory cytokines and strengthens mucosal defenses.

Keywords-*Probiotics, Gut microbiota, Lactobacillus, Bifidobacterium, Immune modulation, prebiotics, Synbiotics, Gut brain axis*.

Isolation and characterisation of indigenous probiotic microorganisms from finger millet to develop autochthonous synbiotic functional food gummies

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Abstract

Millets are an ancient staple food commonly known as nutri-cereals. Their rich nutritional profile and therapeutic properties make them an excellent addition to a balanced diet. Low glycemic index and gluten-free status are two advantages of millets that make them an attractive food for individuals with diabetes and celiac disease. Millets can be considered as 'biotic vehicle' as they possess prebiotic, probiotic, synbiotic and postbiotic properties. The present study explores the biotic potentials of millet. The study aims to isolate and characterise indigenous probiotic microorganisms from finger millet and to develop autochthonous synbiotic functional food gummies by combining finger millet-derived probiotics and prebiotic finger millet milk. Lactic acid bacteria were isolated from fermented finger millet flour by culturing on de Man-Rogosa-Sharpe (MRS) agar. Preliminary characterisation of isolates was carried out using Gram staining, motility, catalase and oxidase tests. Probiotic potential of isolates was further analysed based on their acid tolerance, bile salt tolerance, resistance to phenol and autoaggregation assay. Safety assessments were performed by antibiotic susceptibility assay, antagonistic activity and hemolytic assay. The selected isolate was identified using Matrix-assisted laser desorption ionization time-of-flight mass spectrometry (MALDI-TOF MS) analysis as *Lactobacillus plantarum.* Finger millet milk was incorporated with *Lactobacillus plantarum* to prepare synbiotic gummies. The viable probiotic count was estimated before and after synbiotic gummy preparation. Synbiotic functional food gummies will be an ideal choice for children as they provide the benefits of both nutrient-rich millet and probiotic *Lactobacillus plantarum*.

***Keywords**: Millet, Probiotics, Prebiotics, Symbiotic, Functional food, Gummies*

Formulation, Evaluation and Antioxidants Activity of Herbel Cream Containing *Mallotus Peltatus*

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Abstract

Background: Herbal creams containing plant-derived antioxidants have gained considerable attention due to their potential to protect the skin against oxidative stress and premature aging. *Mallotus peltatus* is a medicinal plant rich in bioactive phytochemicals with significant antioxidant properties.

Objective: The present study aimed to formulate and evaluate a herbal cream containing Mallotus peltatus extract and to assess its antioxidant activity for potential topical skin care applications.

Methods: The extract of *Mallotus peltatus* was prepared using a suitable extraction method and incorporated into an oil-in-water cream base. The formulated cream was evaluated for its physicochemical properties, including appearance, pH, spreadability, viscosity, homogeneity, was hability, and stability. Skin irritation studies were performed to determineits safety. The antioxidant activity of the formulation was assessed using standard in vitro free radical scavenging assays.

Results: The prepared herbal cream showed good physical characteristics, satisfactory stability, acceptable pH, and excellent spreadability. Skin irritation studies indicated that the formulation was safe for topical application. The antioxidant assay demonstrated significant free radical scavenging activity, suggesting the presence of potent antioxidant constituents in *Mallotus peltatus* extract.

Conclusion: The formulated herbal cream containing *Mallotus peltatus* exhibited desirable physicochemical characteristics and promising antioxidant activity. The findings suggest that the formulation may serve as a natural and effective skincare product for protecting the skin against oxidative damage. Further clinical studies are recommended to confirm its therapeutic efficacy.

Keywords: *Mallotus peltatus, Herbal cream, Antioxidant activity, Formulation, Evaluation, Skin protection, Phytochemicals*.

Nature's Healing Touch: Development of A Polyherbal Topical Cream for Athlete's Foot and Cracked Heels Using Five Indian Medicinal Plants

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Abstract

Athlete's foot affects approximately 15–20% of the population and is caused by a fungal infection from dermatophytes. This infection can easily spread through direct contact with infected skin or contaminated surfaces. Cracks in the feet provide entry points for bacteria, resulting in additional complications. This study aimed to evaluate the antifungal and antibacterial properties of a topical cream formulated to treat athlete's foot and foot cracks. The cream was prepared using ethanolic extracts from the whole plant of *Centella asiatica*, the root of *Rubia cordifolia*, and the leaves of *Chromolaena odorata* and *Azadirachta indica*. Phytochemical screening revealed the presence of secondary metabolites, such as alkaloids, flavonoids, tannins, glycosides, carbohydrates, and saponins in these extracts. The antifungal and antibacterial activities of the herbal formulation were assessed using the fungus *Candida albicans* and the bacterium *Staphylococcus aureus*. The results demonstrated that the topical cream exhibited significant antifungal and antimicrobial activities at various concentrations. Additionally, the cream effectively inhibited the fungi responsible for athlete's foot and reduced skin dryness, preventing foot cracks. The findings suggest that this herbal formulation could serve as an effective treatment for athlete's foot and related foot complications, providing a natural alternative to conventional treatments. Further research and clinical trials are recommended to optimize the formulation and validate its efficacy and safety in larger populations. This innovative approach has the potential to benefit millions suffering from athlete's foot globally.

Keywords: *Athlete's foot, fungal infection,topical cream,Centella asiatica, Rubia cordifolia, Azadirachta indica, phytochemical screening*.

Formulation and Evaluation of A Citrus Maxima and *Salvia rosmarinus* Herbal Hair Mask for the Management of Hair Fall

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Abstract

Hair loss is a common concern that affects individuals worldwide and can negatively influence self-confidence and overall hair appearance. The present research focuses on the formulation and evaluation of a multifunctional herbal hair mask containing pomelo peel (Citrus maxima) and rosemary leaves (*Salvia rosmarinus*). These plant materials are selected for their potential antioxidant, antimicrobial, and hair-care properties. The primary objective is to develop a natural and effective hair mask that may help reduce hair fall, control dandruff, and support overall scalp health while providing conditioning benefits. The formulation process involves the collection and preparation of pomelo peel and rosemary leaves, followed by their incorporation with selected herbal ingredients such as amla, neem leaves, reetha, bhringraj, tulsi, ginger, hibiscus flower, and shikakai. The ingredients are processed and blended in suitable proportions to obtain a uniform herbal hair mask. Different formulations are prepared and evaluated to optimise the concentration of active ingredients and to assess important parameters such as physical appearance, homogeneity, pH, spreadability, was hability, and stability of the final product. The developed formulation is intended to provide a convenient, economical, and plant- based alternative to synthetic hair-care products. Pomelo and rosemary may contribute beneficial bioactive compounds, while the additional herbal ingredients support cleansing, conditioning, and scalp-care functions. The evaluation results can help identify the most suitable formulation with acceptable quality, stability, and user-friendly characteristics. Overall, the study highlights the potential of combining *Citrus maxima* and *Salvia rosmarinus* with complementary medicinal plants to develop a multifunctional herbal hair mask. Such a formulation may offer a promising natural approach for managing hair fall, reducing dandruff, and improving the general health and appearance of hair and scalp.

Keywords*: Anti-hair fall, Anti-fungal, Anti-dandruff, Citrus maxima, Salvia Rosmarinus, Herbal hair mask, Herbal cosmetics.*

Formulation and Characterization of Polyherbal Phytosomal Gel for Dermocosmetic Applications

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Abstract

Phytosomes represent a novel lipid-based drug delivery system designed to enhance the absorption, bioavailability, skin permeation, and pharmacokinetic profiles of conventional herbal extracts. This study aimed to develop and characterize a polyherbal phytosomal gel incorporating extracts from Cassia fistula flowers and *Couroupita guianensis* leaves for dermocosmetic applications. The preliminary phase involved evaluating the physical parameters and conducting phytochemical screening of the herbal extracts. Phytosomes containing C. fistula and C. guianensis were synthesized using the reflux method. The prepared phytosomes were evaluated for percentage practical yield, microscopic structure, Scanning Electron Microscopy (SEM), and in-vitro drug diffusion. Results confirmed that the phytosome complex demonstrated superior diffusion kinetics compared to raw extracts. Subsequently, phytosomal gels were formulated to serve as efficient carriers for topical delivery. The formulations underwent comprehensive evaluation, including assessments of physical appearance, pH, viscosity, homogeneity, spreadability, transparency, and Fourier- Transform Infrared Spectroscopy (FTIR). Among the formulations, the batch designated as "PG5" exhibited optimal physicochemical characteristics. Additionally, antioxidant activity investigations confirmed that the finalized phytosomal gel retained robust antioxidant capabilities. In conclusion, the newly formulated polyherbal phytosomal gel ("PG5") demonstrates enhanced skin delivery properties, desirable physical characteristics, and effective antioxidant activity, highlighting its strong potential as an advanced dermocosmetic formulation.

Keywords: *Polyherbal phytosomal gel, Cassia fistula, Couroupita guianensis, Phytosomes, Reflux method, In-vitro drug diffusion, Antioxidant activity, Topical drug delivery*

Secondary Metabolites from Probiotics Microorganisms: Therapeutic and industrial Applications

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Abstract

Secondary metabolites produced by probiotic microorganisms have gained considerable attention due to their diverse biological activities and applications across health, medicine, and food science. These bioactive compounds, including bacteriocins, exopolysaccharides, organic acids, biosurfactants, and antioxidant metabolites, exhibit antimicrobial, anti-inflammatory, immunomodulatory, and gut-health-promoting properties. Recent advances in metabolomics and microbial biotechnology have enhanced the identification and characterization of these metabolites, revealing their potential in disease prevention, therapeutic interventions, and microbiome modulation. In the food industry, probiotic-derived metabolites contribute to natural preservation, improved food quality, and the development of functional foods and nutraceuticals. Their safety, sustainability, and multifunctionality position them as promising alternatives to synthetic additives and conventional therapeutics. Consequently, secondary metabolites from probiotic microorganisms serve as a vital bridge connecting human health, medical innovation, and industrial food applications.

Keywords: *Probiotics; Secondary Metabolites; Bacteriocins; Exopolysaccharides; Therapeutics; Functional Foods; Nutraceuticals; Biotechnology*.

Secondary Metabolites from Probiotic Microorganisms: Therapeutic and Industrial Application

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Abstract

Probiotic microorganisms, including ***Lactobacillus, Bifidobacterium, Bacillus*** species, and selected yeasts, are widely recognized for their **health-promoting properties.** Beyond improving gut health, they produce bioactive secondary metabolites such as bacteriocins, **exopolysaccharides (EPS), organic acids, bioactive peptides, biosurfactants, and vitamins** with significant **therapeutic and industrial applications.** These metabolites exhibit antimicrobial, antioxidant, anti-inflammatory, immunomodulatory, and anticancer activities. Bacteriocins such as **nisin and pediocin** inhibit **pathogenic microorganisms** and offer potential alternatives to conventional antibiotics. Exopolysaccharides enhance **gut health**, support immune function, and **improve food texture**, while organic acids and hydrogen peroxide suppress pathogen growth and extend food shelf life. Probiotic-derived metabolites are increasingly used in **functional foods, nutraceuticals, biodegradable packaging, cosmetics, and sustainable agriculture as natural biopesticides and biofertilizers**. This review highlights the **biosynthesis**, b**iological functions,** and applications of probiotic secondary metabolites, while discussing challenges such as **strain variability**, **low metabolite yield**, and **large-scale production**. Advances in metabolic engineering and **omics technologies** are expected to enhance metabolite production and promote the development of sustainable therapeutics and **eco-friendly industrial products.**

Keywords: *Probiotics; Secondary metabolites; Bacteriocins; Exopolysaccharides; Industrial biotechnology*.

Probiotics as Multifunctional Bioagents for Disease Prevention, Food Preservation, and Functional Food Development: Emerging Trends and Future Perspectives

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Abstract

The growing demand for sustainable healthcare and nutritionally enriched foods has accelerated interest in probiotics as multifunctional bioactive microorganisms. Defined as live microorganisms that confer health benefits when administered in adequate amounts, probiotics have emerged as promising agents in disease prevention, natural food preservation, and the development of functional foods. Recent advances in microbiome research have demonstrated that probiotic strains, particularly species of *Lactobacillus*, *Bifidobacterium*, *Lacticaseibacillus*, and *Bacillus*, play a significant role in maintaining gut microbial balance, enhancing immune responses, inhibiting pathogenic microorganisms, and reducing the risk of gastrointestinal, metabolic, inflammatory, and infectious diseases.

In food systems, probiotics contribute to preservation through the production of organic acids, bacteriocins, hydrogen peroxide, and other antimicrobial metabolites that improve food safety and extend shelf life while reducing dependence on synthetic preservatives. Simultaneously, the incorporation of probiotics into dairy products, fermented beverages, cereals, fruits, and plant-based formulations has expanded the scope of functional food development, meeting consumer demand for health-promoting and minimally processed products. Emerging technologies such as microencapsulation, synbiotic formulations, precision fermentation, and artificial intelligence-assisted probiotic screening are improving probiotic stability, viability, and targeted functionality. Despite these advances, challenges including strain-specific efficacy, storage stability, regulatory standardization, and consumer acceptance continue to limit large-scale commercialization. Future research integrating omics technologies, personalized nutrition, and

next-generation probiotics is expected to accelerate innovation and broaden therapeutic and industrial applications. This review highlights recent developments and emphasizes the expanding role of probiotics as sustainable solutions linking human health, food quality, and functional food innovation.

Keywords: *Probiotics; Disease Prevention; Functional Foods; Food Preservation; Gut Microbiota; Lactic Acid Bacteria; Microencapsulation; Synbiotics; Next-Generation Probiotics*.

Curd, Milk and Herbs: Reading the Hidden Probiotic Wisdom in Tribal Medicine of Tamil Nadu

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Abstract

The indigenous tribal communities of Tamil Nadu possess a rich repository of traditional medicinal knowledge, passed down through generations as an integral part of their cultural and ethnobotanical heritage. A distinctive feature of their healing practices is the administration of herbal remedies through fermented and non-fermented dairy carriers such as curd, cow milk, goat milk, buttermilk, butter, and ghee. While these practices were developed empirically, without formal scientific understanding of microbiology, they inherently harness the synergistic potential of probiotics and phytotherapeutics. Curd and buttermilk, rich in beneficial lactic acid bacteria, likely enhance the bioavailability, absorption, and efficacy of herbal actives, while simultaneously modulating gut microbiota and supporting digestive and immune health. This traditional dairy-herbal combination reflects an intuitive, culturally embedded application of probiotic science long before its formal recognition. The present paper explores these indigenous practices through an ethnopharmacological lens, examining how such age-old customs align with contemporary scientific understanding of the gut-microbiome axis, functional foods, and probiotic-mediated health benefits. By documenting and scientifically validating these traditional formulations, this study aims to bridge indigenous knowledge systems with modern probiotic research, highlighting opportunities for sustainable health innovation, community-based nutrition strategies, and the preservation of invaluable tribal medicinal heritage for future generations.

Keywords: *Ethnoprobiotics; Tribal medicine; Gut microbiota; Fermented dairy; Traditional knowledge; Functional foods*

Probiotics and Gut Health: A Functional Food Approach to Sustainable Wellness

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Abstract

Probiotics are live beneficial microorganisms that support gut health and overall well-being. The human gut microbiota plays an important role in digestion, nutrient absorption, immune regulation, and protection against harmful microorganisms. Probiotics can help maintain microbial balance and support a healthy intestinal environment. Probiotic-rich functional foods such as yogurt, kefir, and fermented foods provide a convenient way to incorporate these beneficial microorganisms into the diet. Regular consumption may contribute to improved digestive health and immune function. The benefits of probiotics depend on the specific strain, dosage, and individual health conditions. Therefore, research on probiotic strains and innovative functional food products is essential. Probiotics offer a promising approach to promoting sustainable wellness through nutrition and functional foods.

***Keywords**: Probiotics, Gut health, Functional foods, Gut microbiota, Fermented foods, Sustainable wellness, Nutrition*

Types of Probiotics, Gut Microbiota, and Human Health

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Abstract

Probiotics are live microorganisms that provide health benefits by maintaining the balance of gut microbiota in the human gastrointestinal tract. Common probiotic genera such as *Lactobacillus*, *Bifidobacterium*, and *Saccharomyces* are widely used in fermented foods and supplements. The gut microbiota plays a vital role in digestion, nutrient absorption, immune regulation, and protection against pathogens. Its composition is influenced by diet, lifestyle, and antibiotic use.

A balanced microbiota supports overall health, whereas imbalance (dysbiosis) is linked to various disorders, including gastrointestinal diseases and metabolic conditions. Probiotics help restore this balance through mechanisms such as antimicrobial activity and immune modulation. This study highlights the types of probiotics and their significant role in maintaining gut health and promoting human well-being.

Keywords: *Probiotics; Gut Microbiota; Human Health; Dysbiosis*

Formulation and Evaluation of An Invasome-Loaded Beauty Stick Containing Cashew Apple, Basil Oil , and Pearl Essence From *Nemipterus Randalli* Fish Scales

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Abstract

The present study focuses on the formulation and evaluation of an invasome-loaded beauty stick using natural bioactive ingredients, namely cashew apple (Anacardium occidentale) extract, basil essential oil (Ocimum basilicum), and pearl essence derived from the scales of Nemipterus randalli. Cashew apple extract, a rich source of antioxidants and polyphenols, was prepared by refrigerated centrifugation, while basil essential oil was extracted using a Clevenger apparatus and incorporated into invasomes by the mechanical dispersion method. Pearl essence was isolated from fish scales through a purification process to enhance the cosmetic and skin-beneficial properties of the formulation. Six formulations (BS1–BS6) were prepared by varying the concentrations of cashew apple extract and basil oil. The prepared beauty sticks were evaluated for physicochemical properties, including appearance, pH, hardness, melting point, breaking point, spreadability, antioxidant activity, antimicrobial activity, total phenolic content, and FTIR compatibility. Among the developed formulations, BS5 demonstrated the best overall performance, exhibiting good stability, acceptable pH, optimum hardness, excellent spreadability, and enhanced antioxidant and antimicrobial activities. FTIR analysis confirmed the compatibility of the selected ingredients without significant chemical interactions. The findings suggest that the developed invasome-loaded beauty stick is a stable, effective, and eco-friendly cosmetic formulation with promising applications in skin care by providing antioxidant, antimicrobial, moisturizing, and skin-enhancing benefits.

Keywords: *Invasomes; Beauty Stick; Anacardium occidentale; Ocimum basilicum; Nemipterus randalli; Pearl Essence; Antioxidant Activity; Antimicrobial Activity; Cosmetic Formulation*.

Secondary Metabolites from Probiotic Microorganisms: Therapeutic and Industrial Applications

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Abstract

Probiotic microorganisms are beneficial microbes that confer health benefits to the host when administered in adequate amounts. Beyond their role in maintaining gut health, probiotics produce a wide range of secondary metabolites with significant therapeutic and industrial importance. These bioactive compounds include bacteriocins, organic acids, exopolysaccharides (EPS), biosurfactants, short-chain fatty acids (SCFAs), vitamins, and antioxidant metabolites, which exhibit diverse biological activities. The present review highlights the major secondary metabolites produced by probiotic microorganisms and their applications in healthcare, food, pharmaceutical, and biotechnology industries. Bacteriocins possess potent antimicrobial activity against several pathogenic microorganisms, making them promising natural alternatives to conventional antibiotics and food preservatives. Organic acids and SCFAs contribute to gut health by regulating intestinal pH, enhancing nutrient absorption, and modulating the gut microbiota. Exopolysaccharides demonstrate antioxidant, immunomodulatory, anti-inflammatory, and cholesterol-lowering properties while improving the texture and stability of fermented food products. Biosurfactants produced by probiotic strains exhibit antimicrobial and anti-biofilm activities with potential applications in medical and environmental fields. In industrial sectors, probiotic-derived metabolites are increasingly utilized for the development of functional foods, nutraceuticals, pharmaceuticals, and natural biopreservatives due to their safety, sustainability, and eco-friendly nature. Recent advances in genomics, metabolomics, and microbial biotechnology have further enhanced the discovery and large-scale production of these valuable metabolites. Despite significant progress, challenges related to strain selection,

production optimization, stability, and commercialization remain. Future research focusing on advanced fermentation technologies and metabolic engineering will facilitate the efficient utilization of probiotic secondary metabolites for therapeutic interventions and industrial innovations. Overall, probiotic-derived secondary metabolites represent a promising resource for improving human health and promoting sustainable biotechnological applications.

Keywords: *Probiotics, Secondary Metabolites, Bacteriocins, Exopolysaccharides, Therapeutic Applications, Industrial Biotechnology*.

Design and Evaluation of A Herbal Skin Rejuvenation Faceserum

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Abstract

Herbal cosmetics have gained significant attention due to their safety, effectiveness, and minimal side effects compared to synthetic products. The present study aimed to formulate and evaluate a polyherbal skin rejuvenating cosmetic face serum using extracts of **Moringa oleifera** **Bougainvillea glabra**. These medicinal plants were selected for their antioxidant, antimicrobial, and skin-protective properties. The plant materials were extracted using suitable extraction techniques, and different serum formulations (FS1–FS6) were prepared using glycerin, hyaluronic acid, xanthan gum, rose oil, sodium benzoate, and distilled water. The prepared formulations were evaluated for their physicochemical properties, including appearance, homogeneity, pH, viscosity, spreadability, and redispersion. Preliminary phytochemical screening, antioxidant activity, and FTIR analysis were also performed to confirm the presence of bioactive compounds and compatibility of ingredients. Among all the formulations, FS3 exhibited the most desirable characteristics, showing appropriate pH, good viscosity, excellent spreadability, satisfactory antioxidant activity, and overall stability. Comparative evaluation with a marketed synthetic serum indicated that the formulated herbal serum possessed comparable or superior properties.
The findings suggest that the developed polyherbal face serum is a safe, stable, and effective cosmetic formulation with promising skin rejuvenating potential. It may serve as a natural alternative to synthetic face serums for improving skin health and appearance.

Keywords*; Polyherbal Face Serum, Moringa oleifera, Bougainvillea glabra, Skin Rejuvenation, Herbal Cosmetics, Antioxidant Activity, Phytochemical Screening, Cosmetic Formulation, Natural Skin Care, Serum Evaluation*

Formulation and Characterisation of A Herbal Cream Using *Camellia Sinensis* and *Eclipta Alba* For Acne Treatment

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Abstract

Acne vulgaris is one of the most common chronic inflammatory skin disorders affecting adolescents and adults. It is characterized by the formation of comedones, papules, pustules, nodules, and in severe cases, permanent scarring. Although several synthetic anti-acne medications are available, prolonged use may cause adverse effects such as skin irritation, dryness, erythema, and antibiotic resistance. Therefore, herbal formulations have gained significant attention due to their safety, efficacy, affordability, and minimal side effects.

The present study was undertaken to formulate and evaluate a herbal cream for the treatment of acne using extracts of Green Tea (Camellia sinensis) and Eclipta alba (False Daisy). Green tea is well known for its rich content of catechins, particularly epigallocatechin gallate (EGCG), which possesses potent antioxidant, anti-inflammatory, antimicrobial, and sebum-regulating properties. Eclipta alba contains several bioactive phytochemicals, including flavonoids, coumarins, alkaloids, phenolic compounds, tannins, and glycosides, which contribute to its antimicrobial, wound-healing, anti-inflammatory, and antioxidant activities. The combination of these herbal extracts is expected to provide a synergistic effect in reducing acne lesions and promoting healthy skin.

The herbal cream was prepared by the emulsion method, where the oil phase consisted of almond oil, stearic acid, beeswax, and castor oil, while the aqueous phase contained glycerin, potassium hydroxide, and purified water. The plant extracts were incorporated into the formulation after the preparation of the cream base to ensure uniform distribution and stability of the active constituents.

The prepared formulation was evaluated for various physicochemical and pharmaceutical parameters, including appearance, colour, odour, homogeneity, pH, spreadability, washability, viscosity, smoothness, consistency, and stability. In addition, biological evaluations such as antibacterial activity, anti-inflammatory activity, and antioxidant activity were carried out to assess the therapeutic potential of the formulation. The results indicated that the optimized herbal cream exhibited satisfactory physicochemical characteristics, good spreadability, acceptable skin pH, excellent homogeneity, and desirable stability. Furthermore, the formulation demonstrated promising antibacterial, antioxidant, and anti-inflammatory activities, supporting its effectiveness in acne management.

In conclusion, the formulated herbal cream containing Camellia sinensis and Eclipta alba extracts showed potential as a safe, stable, and effective topical preparation for the management of acne vulgaris. The study suggests that this herbal formulation may serve as a promising alternative to conventional synthetic anti-acne products with fewer adverse effects.

***Keywords**: Acne vulgaris, Herbal cream, Camellia sinensis, Eclipta alba, Green tea, False daisy, Antibacterial activity, Anti-inflammatory activity, Antioxidant activity, Herbal formulation*.

Histochemical and Phytochemical Approaches in the Authentication and Quality Evaluation of Medicinal Plants: A Review

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Abstract

Medicinal plants are an important source of bioactive compounds and continue to play a significant role in traditional and modern healthcare. Accurate identification and quality evaluation of medicinal plant materials are essential for ensuring their safety, efficacy, and therapeutic value. Histochemical and phytochemical analyses have emerged as valuable techniques for detecting and localizing important secondary metabolites such as alkaloids, flavonoids, tannins, lignin, terpenoids, glycosides, starch, and oils within plant tissues. Histochemical methods employ specific staining reagents to reveal the distribution of these compounds, whereas phytochemical screening provides preliminary information regarding their chemical composition and biological potential. Together, these approaches support the authentication of medicinal plants, help detect adulteration, and contribute to pharmacognostic standardization and quality control. Recent advances in microscopy and analytical techniques have further enhanced the reliability of these methods in herbal drug research. This review highlights the principles, applications, and significance of histochemical and phytochemical analyses in medicinal plant evaluation and discusses their role in supporting the development of safe herbal medicines, nutraceuticals, and functional food products. Integrating these techniques with modern pharmacognostic research can strengthen the scientific validation of medicinal plants and promote their wider application in healthcare.

***Keywords**: Medicinal plants, Histochemistry, Pharmacognostic research*

Development and Evaluation of A Herbal Moisturizing Cream Incorporating Virgin Coconut Oil and Pumpkin Seed Extract

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Abstract

Moisturizing creams are semisolid topical formulations designed to maintain skin hydration, restore the skin barrier, and protect against dryness and other dermatological conditions. The present study aimed to formulate and evaluate a herbal moisturizing cream containing pumpkin seed extract based on virgin coconut oil (VCO) as a natural emollient and moisturizer. Pumpkin seed (Cucurbita pepo L., family Cucurbitaceae) is a rich source of bioactive constituents, including tocopherols, phytosterols, carotenoids, vitamins A and C, zinc, magnesium, and essential fatty acids, which contribute to antioxidant, nourishing, and skin-conditioning properties. Pumpkin seed extract was obtained using the Soxhlet extraction method and incorporated into cream formulations prepared by the fusion method. Virgin coconut oil served as the primary moisturizing agent, while beeswax was used as the cream base, cetyl alcohol as a thickening agent, borax as an emulsifying agent, and propyl paraben as a preservative. Four formulations (F1–F4) were developed by varying the concentration of the active ingredient and evaluated for their physicochemical characteristics, including appearance, color, odor, pH, homogeneity, spreadability, viscosity, washability, consistency, and stability. The formulations exhibited satisfactory physical properties and remained stable throughout the evaluation period. Among the prepared formulations, F4 demonstrated superior performance with an optimum pH compatible with the skin, excellent homogeneity, desirable viscosity, enhanced spreadability, and overall stability. The findings indicate that the combination of virgin coconut oil and pumpkin seed extract can be successfully formulated into a stable and effective herbal moisturizing cream with promising skin-conditioning properties. The developed formulation may serve as a safe and natural alternative to conventional moisturizing creams for maintaining healthy and hydrated skin.

Keywords: *Virgin Coconut Oil, Pumpkin Seed Extract, Herbal Moisturizing Cream, Cucurbita pepo, Soxhlet Extraction, Physicochemical Evaluation*.

Transforming Rice Water into a Source of Bioactive Plant-Derived Nano vesicles

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Abstract

Plant-derived exosome-like Nano vesicles (PDNVs) have emerged as promising natural Nano carriers because of their biocompatibility and potential therapeutic applications. Rice water obtained from white rice is generally discarded as household waste, although it contains various bioactive molecules. The present study aims to isolate PDNVs from white rice water using the Polyethylene Glycol (PEG-6000) precipitation method, a simple, cost-effective and environmentally friendly approach. The isolated PDNVs will be characterised using suitable analytical techniques to evaluate their physicochemical properties. In addition, their antioxidant potential will be investigated to assess their possible biomedical applications. This study highlights a sustainable waste-to-wealth strategy by converting discarded white rice water into a valuable source of plant-derived Nano vesicles. The findings may contribute to the development of natural, safe and affordable Nano vesicle-based formulations for future therapeutic and healthcare applications.

Keywords: *Plant-derived exosome-like Nano vesicles, White rice water, PEG-6000, Antioxidant activity, Sustainable nanotechnology*.

A Novel Green Approach to Hair Delivery Systems : Formulation and Comprehensive Evaluation of A Pronisomalhair Replenisherroll_on Incorporating Poultry Feather Keratin and *Sapindusmukorossi*saponins

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Abstract

Hair problems such as dandruff, scalp infections, hair damage, and hair fall have increased due to environmental factors and extensive use of chemical-based products. The present study aimed to develop and evaluate a novel proniosomal hair replenisher roll-on containing natural keratin extracted from poultry chicken feathers and saponin extracted from *Sapindusmukorossi* (Reetha). The formulation was designed to provide a cost-effective, eco-friendly, and convenient approach to hair and scalp care. Keratin was extracted by alkaline hydrolysis, while saponin was obtained using a hydroalcoholic extraction method. The extracted materials were characterized and incorporated into proniosomal formulations, which were further developed into hair replenisher roll-ons.

The prepared formulations were evaluated for physicochemical properties including pH, viscosity, homogeneity, spreadability, stability, antimicrobial activity, and FTIR compatibility. Among the six formulations prepared, HR-4 exhibited the most desirable characteristics, including suitable pH, good viscosity, excellent homogeneity, stability, and spreadability. The formulation also demonstrated significant antibacterial and antifungal activity against *Escherichia coli* and *Candida albicans*, indicating its potential effectiveness in controlling dandruff and scalp infections. FTIR studies confirmed the presence of keratin and saponin in the final formulation without any significant incompatibility.

The study concludes that the developed proniosomal hair replenisher roll-on is a promising herbal formulation with hair-nourishing and antimicrobial properties. The roll-on dosage form

offers ease of application, portability, and improved patient compliance, making it a potential alternative to conventional hair care products.

Keywords: *Proniosomes, Hair Replenisher Roll-On, Keratin, Sapindus mukorossi, Saponin, Trichology, Antimicrobial Activity*

Extraction and Characterization of Chitin-Derived N- Acetylglucosamine from Scylla Serrata Waste for Anti-Inflammatory Skincare Formulations

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Abstract

The growing demand for natural and sustainable ingredients in cosmetic formulations has encouraged the exploration of bioactive compounds with multifunctional properties. N-Acetyl glucosamine (NAG), a derivative of chitin, is recognized for its moisturizing, skin-rejuvenating, and anti-inflammatory effects, making it a valuable ingredient in topical skincare products. _Scylla olivacea_ (orange mud crab) shells serve as an abundant natural source of chitin, which can be converted into N-acetyl glucosamine through suitable extraction methods. The present study was undertaken to formulate and evaluate a topical pheromone cream incorporating N-acetyl glucosamine extracted from _Scylla olivacea_ and pheromones isolated from human urine. The collected samples were authenticated, and chitin was extracted and processed to obtain N-acetyl glucosamine. The extracted compound was characterized using standard identification tests and Fourier Transform Infrared (FTIR) spectroscopy. A topical cream was then prepared and subjected to evaluation for its physical characteristics and antioxidant activity using standard pharmaceutical procedures. The formulated cream exhibited satisfactory physicochemical properties and demonstrated antioxidant potential, indicating its suitability for topical application. The incorporation of N-acetyl glucosamine is expected to improve skin hydration, support skin barrier function, and promote healthy skin appearance, while pheromones may enhance the sensory appeal of the formulation. The study highlights the feasibility of developing a novel cosmetic preparation by combining naturally derived bioactive ingredients with innovative formulation strategies. Further experimental and clinical investigations are recommended to confirm the long-term safety, stability, and effectiveness of the developed formulation before its application in commercial cosmetic products.

Keywords: *N-Acetyl glucosamine, Scylla olivacea, Chitin, Pheromone, Topical cream, FTIR, Antioxidant activity, Cosmetics, Skin care*

Design and Evaluation of A Herbal Hair Oil Blend For Promoting Hair Growth

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Abstract

The present study focuses on the formulation and evaluation of a polyherbal hair oil designed to enhance hair growth and improve scalp health. Herbal hair oil is a blend of natural ingredients including oils, herbs. milk, etc. designed to improve hair health. These oils can offer benefits such as stimulating hair growth, reducing dandruff and improve scalp health. The formulation incorporates extracts from a blend of medicinal herbs known for their beneficial properties, including Amla (*Emblica officinalis*), Bhringraj (*Eclipta prostrata*), Aloevera(*Aloe barbadensis*), Indigo plant(*Indigofera tinctoria*), Liquorice(*Glycynhiza glabra*), Thannika(*Terminalia bellirica*), Kohl stone, Milk, Coconut oil. These herbal ingredients were carefully selected based on their effectiveness in promoting hair growth, preventing dandruff, and nourishing the scalp.

The formulated hair oil was subjected to a series of organoleptic and physicochemical evaluations to determine its quality and stability. The colour, odour, skin irritation and sedimentation are the organoleptic evaluations performed. The acid value, saponification value, pH, viscosity and specific gravity are the physicochemical evaluations performed. These evaluations confirm that the poly herbal hair oil formulation is stable, safe, and potentially effective for improving hair and scalp health.

Keywords*: Poly herbal oil, Herbal formulation , Scalp health, Organoleptic evaluation , Stability assessment, Herbal extracts*

Development of A Microbiome-Supportive Cosmetic Stick Incorporated With *Saccharomyces Boulardii* Isolated From Vitis Vinifera L

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Abstract

The present study was carried out to formulate and evaluate a Saccharomyces boulardii probiotic-loaded cosmetic stick using Vitis vinifera L. (grape) as the source of the probiotic. Saccharomyces boulardii was isolated from grape pulp and identified by morphological, staining, and biochemical tests. The isolated probiotic was then incorporated into a cosmetic stick prepared by the fusion method using suitable ingredients such as beeswax, carnauba wax, lanolin, glycerin, propylene glycol, vitamin E, salicylic acid, and lavender oil. Six different formulations (CS1–CS6) were prepared and evaluated for their physical appearance, pH, hardness, melting point, spreadability, hydration, breaking point, and antioxidant activity. Among all the formulations, CS5 showed the best overall performance with smooth texture, good stability, excellent spreadability, proper pH, good skin hydration, and the highest antioxidant activity. The results suggest that the formulated probiotic cosmetic stick is safe, stable, and suitable for topical application. It may help moisturize the skin, provide antioxidant protection, and support healthy skin. Therefore, this probiotic-loaded cosmetic stick has good potential as a natural and effective skincare product.

Keywords: *Saccharomyces boulardii, Vitis vinifera L., Probiotic, Cosmetic stick, Antioxidant activity, Skin hydration, Topical formulation*

Fermented Foods as Functional Foods: Health Benefits and Future Perspectives

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Abstract

Fermented foods are increasingly being recognized as functional foods that offer an extra health benefit in addition to basic nutrition. There is a vast variety of traditionally produced fermented foods and beverages, resulting from the production of lactic acid bacteria, yeasts, or molds, which are rich in probiotics, bioactive peptides, vitamins, organic acids, and antioxidants. Knowledge of the nutritional and health properties of various fermented foods is of enormous importance, given their potential to improve human health. The intake of different types of fermented foods and beverages promotes the improvement of gut biodiversity and digestion, balances the action of the immune system, and prevents the development of various diseases, for example, diabetes, obesity, cardiovascular diseases, and inflammatory processes. Moreover, fermented foods often contain increased amounts of biologically active substances, which improve the safety and shelf life of food products. Fermented foods are increasingly being recognized as functional foods that offer an extra health benefit in addition to basic nutrition. There is a vast variety of traditionally produced fermented foods and beverages, resulting from the production of lactic acid bacteria, yeasts, or molds, which are rich in probiotics, bioactive peptides, vitamins, organic acids, and antioxidants. Knowledge of the nutritional and health properties of various fermented foods is of enormous importance, given their potential to improve human health. The intake of different types of fermented foods and beverages promotes the improvement of gut biodiversity and digestion, balances the action of the immune system, and prevents the development of various diseases, for example, diabetes, obesity, cardiovascular diseases, and inflammatory processes. Moreover, fermented foods often contain increased

amounts of biologically active substances, which improve the safety and shelf life of food products.

Keywords: *Fermented foods, Functional foods, Probiotics, Gut microbiota, Bioactive compounds, Digestive health*.

Pharmacognostic Investigation of Mimosa Pudica and Piper Betle With Formulation and Evaluation of An Antifungal Herbal Nail Lacquer

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Abstract

Onychomycosis is a common fungal infection of the nails that often requires prolonged treatment and is associated with poor patient compliance and frequent recurrence. The present study aimed to develop and evaluate a herbal nail lacquer containing extracts of Mimosa pudica and Piper betle as a natural alternative for the management of fungal nail infections. Herbal extracts were incorporated into a nail lacquer base using suitable film-forming agents, plasticizers, solvents, and other excipients to obtain a stable and effective topical formulation. The prepared formulations were evaluated for their physicochemical characteristics, including appearance, drying time, gloss, smoothness of application, film formation, non-volatile content, viscosity, water resistance, and stability. The antifungal activity of the formulations was assessed using standard in vitro methods against common fungal pathogens associated with onychomycosis. The developed nail lacquers exhibited satisfactory physicochemical properties with uniform film formation, rapid drying, adequate adhesion, and acceptable stability under storage conditions. The formulations demonstrated significant antifungal activity, indicating the synergistic potential of Mimosa pudica and Piper betle extracts in inhibiting fungal growth. The herbal ingredients also offer additional benefits such as reduced toxicity, improved biocompatibility, and minimal adverse effects compared with conventional synthetic antifungal agents. The findings suggest that the developed herbal nail lacquer is a promising topical drug delivery system for the treatment of onychomycosis. Further pharmacological studies, including in vivo evaluation and clinical trials, are recommended to establish its long-term safety, therapeutic efficacy, and potential for commercial development as a cost-effective herbal antifungal formulation.

Keywords: *Herbal nail lacquer, Mimosa pudica, Piper betle, onychomycosis, antifungal activity, topical drug delivery*

Essence alchemy: Innovative Extraction and Formulation Strategies for Natural Essential Oils

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Abstract

Natural essential oils are concentrated volatile compounds extracted from aromatic plants and have been widely utilized in pharmaceuticals, cosmetics, food preservation, and aromatherapy due to their diverse biological activities. These oils possess antimicrobial, antioxidant, anti-inflammatory, antifungal, and therapeutic properties, making them valuable ingredients in the development of natural health products. However, the quality, yield, and chemical composition of essential oils are greatly influenced by the extraction technique employed. Conventional extraction methods, such as steam distillation, hydrodistillation, cold pressing, and solvent extraction, are still extensively used but often present limitations, including thermal degradation, prolonged extraction time, and solvent residues.

These green extraction techniques offer higher yields, reduced energy consumption, and enhanced environmental sustainability. Furthermore, innovative formulation approaches such as nanoemulsions, liposomes, solid lipid nanoparticles, and microencapsulation have addressed challenges related to the volatility, instability, and poor aqueous solubility of essential oils. These advanced delivery systems improve stability, bioavailability, controlled release, and therapeutic efficacy, thereby expanding the application of essential oils in modern pharmaceutical and cosmetic formulations.

This review highlights recent innovations in extraction and formulation technologies for natural essential oils, emphasizing their advantages, industrial applications, and future prospects. The integration of eco-friendly extraction methods with advanced drug delivery systems offers promising opportunities for developing safe, effective, and sustainable products. Continued research in this field is expected to enhance the commercial value and therapeutic potential of

essential oils while supporting the global shift toward natural and environmentally responsible formulations.

Keywords: *Essential oils, Supercritical fluid extraction, Microwave-assisted extraction, Nanoemulsions, Microencapsulation, Drug delivery systems, Sustainable formulations*.

Harnessing Probiotics for Human Health: Mechanisms, Therapeutic Potential, and Future Perspectives

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Abstract

The human gut microbiome is a complex and dynamic microbial ecosystem that plays a critical role in maintaining intestinal homeostasis, immune regulation, metabolism, epithelial barrier integrity, and protection against pathogens. Disruption of this microbial community, known as gut dysbiosis, has been linked to numerous health conditions, including inflammatory bowel disease, antibiotic-associated diarrhoea, infections, metabolic disorders, and cancer. Antibiotic therapy is one of the primary causes of dysbiosis, as it significantly alters the diversity and composition of the gut microbiota, with some changes persisting long after treatment. Consequently, restoring microbial balance has become an important therapeutic objective. Probiotics, particularly Lactobacillus and Bifidobacterium species, have shown considerable potential in promoting microbiome recovery through competitive exclusion of pathogens, production of antimicrobial compounds, modulation of immune responses, enhancement of intestinal barrier function, and regulation of microbial metabolites. Recent advances have expanded microbiome-based interventions beyond conventional probiotics to include prebiotics, synbiotics, ecobiotics, culturomics, gnotobiotic models, and genetically engineered probiotics, offering new opportunities for precision and personalized therapies. However, challenges related to efficacy, safety, product quality, regulatory standards, and inter-individual variability continue to limit their widespread clinical application. This review provides a comprehensive overview of antibiotic-induced gut dysbiosis and current advances in microbiome-based strategies for restoring gut microbial homeostasis.

***Keywords**: Gut microbiome; Antibiotic-induced dysbiosis; Probiotics; Lactobacillus; Bifidobacterium; Microbiome restoration*.

Development of Non-Dairy Probiotic Beverages as Sustainable Functional Foods

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Abstract

The increasing demand for functional foods has led to the development of non-dairy probiotic beverages as sustainable alternatives to traditional dairy products. These beverages are particularly suitable for individuals with lactose intolerance, milk allergies, and those following vegan lifestyles. Plant-based substrates such as fruit juices, vegetable juices, cereals, legumes, and coconut water provide excellent sources of nutrients for the growth and survival of probiotic microorganisms. The incorporation of beneficial bacteria, such as Lactobacillus and Bifidobacterium species, enhances the nutritional and functional value of these beverages. Regular consumption of non-dairy probiotic beverages may improve gut microbiota balance, support digestion, strengthen the immune system, and contribute to overall health and well-being. In addition, the use of plant-based raw materials promotes environmental sustainability by reducing dependence on dairy production and encouraging the utilization of locally available agricultural resources. Despite challenges related to probiotic stability, sensory quality, and shelf life, recent advances in food processing technologies have improved the commercial potential of these products. Therefore, non-dairy probiotic beverages represent an innovative and sustainable functional food with promising applications in nutrition and public health.

Keywords*: Non-dairy probiotics, Functional foods, Plant-based beverages, Gut microbiota, Sustainable nutrition, Lactobacillus*.

Nanotechnology and Probiotics: Emerging Innovations in Healthcare and Food Systems

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Abstract

Nanotechnology and Probiotics have become promising concepts for a number of years. Nanotechnology allows the creation of materials and structures at a scale of 1–100 nm. It leads to the development of new drug delivery systems, imaging devices, antimicrobials, and food packaging. Nanotechnology improves healthcare and food systems by enabling targeted drug delivery, rapid disease diagnosis, antimicrobial treatments, smart food packaging, and enhanced food preservation. Probiotics promote gut health and immunity, and when combined with nanotechnology, they exhibit improved stability, controlled release, longer shelf life, and greater effectiveness in functional foods and therapeutic applications. Probiotics are bacteria that improve human health, support the immune system, and help treat intestinal infections and metabolic syndrome. Nano encapsulation makes it possible to deliver probiotics to defined locations while maintaining their viability and target cell reception. When used in food, both nanotechnology and probiotics help improve food security, nutritional value, and quality, as well as extend the shelf life of foods. In addition, their combined use allows treating and preventing a wide range of diseases, as well as implementing personalized medicine. However, despite their positive impact, some threats, barriers to implementation, and challenges to development still exist. This article discusses recent advances in the study and application of nanotechnology and probiotics and covers their benefits for the health care and food industries.

***Keywords**: Nanotechnology, Probiotics, Nano encapsulation, Functional Foods, Healthcare, Food Systems*.

Nutritional and Functional Perspectives of Soy Milk and Oat Milk: A Comparative Review

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Abstract

Soy milk and oat milk have emerged as most widely consumed functional foods, plant-based milk alternatives contributing to increasing consumer awareness of health, sustainability, lactose intolerance and ethical dietary choices. They differ considerably in their nutritional composition, bioactive constituents, and physiological effects. Soy milk is recognized for its high-quality protein, balanced amino acid profile and presence of isoflavones, phytosterols, and lecithin which have been associated with cardiovascular protection, improved bone health, glycaemic regulation and reduced risk of hormone-dependent diseases. In contrast, oat milk is distinguished by its high content of β-glucan, dietary fibre, phenolic compounds, and avenanthramides which contribute to cholesterol reduction, improved gut microbiota, enhanced glycaemic control, antioxidant activityand anti-inflammatory effects.

This review provides a comprehensive comparative assessment of soy milk and oat milk by evaluating their nutritional composition, bioactive compounds, functional properties, mechanisms of action, health benefits, processing technologies, bioavailability and sustainability. Recent evidence suggests that while soy milk offers superior protein quality and broader evidence for chronic disease prevention, oat milk demonstrates unique advantages in promoting gastrointestinal health and cardiovascular function through its soluble fibre content. The review further highlights current challenges, including antinutritional factors, allergenicity, nutrient bioavailability and product standardization, while identifying future research opportunities in personalized nutrition, precision functional foods and sustainable food innovation.

Keywords: *Soy milk, Oat milk, Plant-based milk, Functional foods, Isoflavones, β-Glucan, Bioactive compounds, Human health, Sustainable nutrition*.

Probiotics as Multifunctional Bioagents: Bridging Disease Prevention, Food Preservation, and Functional Food Innovation

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Abstract

Probiotics are live microorganisms that are beneficial for the host's health when ingested in adequate amounts. Thus, they represent the link between the concept of preventing diseases and the modern food industry. The most prevalent species of probiotics, including *Lactobacillus* and *Bifidobacterium* are capable of modulating gut microbiota, reinforcing the integrity of the intestinal epithelium, and regulating immune responses. These mechanisms make probiotics useful in the treatment of gastrointestinal tract dysfunction, metabolic disorders, such as obesity or diabetes, and even certain tumors. Furthermore, the application of probiotics and their antimicrobial metabolites, such as bacteriocins or organic acids, contribute to the extension of the shelf life of various food products by inhibiting the growth of spoilage and pathogenic microorganisms. Engineering technologies, such as CRISPR-Cas9, artificial intelligence and microencapsulation enhance the functional versatility of probiotics and ensure their viability through the digestive tract.

The scoping of the existing scientific literature demonstrates that probiotics can be regarded as the key elements for improving human health through the prevention of diet-related diseases and ensuring the safety and sustainability of the food supply. The development of innovative technologies facilitates the growth of the knowledge about these microorganisms and expands their potential applications in the food and pharmaceutical industries. It can be concluded that interdisciplinary research, including microbiology, genetics, food technologies and medicine, is crucial to address the current understanding of probiotics. Future research should focus on large-

scale clinical validation and standardizaed regulatory frameworks to promote their viability, functionality and commercialization.

Keywords: *Probiotics; Functional Foods; Disease Prevention; Bio-preservation; CRISPR; Gut Microbiota*.

Comparative Assessment of Secondary Metabolite Production by Probiotic Microorganisms Isolated from Dairy and Non-Dairy Sources

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Abstract

The growing demand for functional and plant-based foods has accelerated research on probiotic microorganisms from both dairy and non-dairy sources as producers of health-promoting secondary metabolites. This review comparatively evaluates the metabolite profiles of probiotics isolated from fermented dairy products and plant-based substrates, focusing on bacteriocins, organic acids, short-chain fatty acids, exopolysaccharides, bioactive peptides, and vitamins. Dairy-derived probiotics are recognized for their efficient production of antimicrobial compounds and fermentation-associated metabolites, whereas non-dairy probiotics exhibit greater metabolite diversity due to varied substrates rich in dietary fibers and polyphenols. These bioactive metabolites contribute to antimicrobial, antioxidant, anti-inflammatory, and immunomodulatory activities while supporting gut microbiota balance. In addition to their therapeutic benefits, they have promising applications in functional foods, nutraceuticals, pharmaceuticals, and natural food preservation. The comparative assessment highlights the potential of non-dairy probiotic sources as sustainable alternatives to conventional dairy probiotics and provides insights for developing innovative metabolite-based probiotic products.The comparative assessment of probiotic microorganisms from dairy and non-dairy sources indicates that Dairy-derived probiotics are well known for their efficient production of bacteriocins, organic acids, and bioactive peptides, whereas non-dairy probiotics are antioxidant molecules due to the varied composition of plant-based substrates also offer advantages for lactose-intolerant individuals, vegans, and consumers seeking plant-based functional foods.

Keywords: *Probiotic microorganisms, Secondary metabolites, Dairy probiotics, Non-dairy probiotics, Bioactive compounds, Functional foods, Therapeutic applications, Industrial biotechnology*.

Standardisation and Quality Evaluation of Sapota Pulpincorporated Cheese Using Probiotic *Lactobacillus Acidophilus*

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Abstract

The present study was conducted in 2025 at the Department of Community Science, College of Agriculture, Vellanikkara, Kerala Agricultural University, with the objective of developing and evaluating the quality of sapota pulpincorporated synbiotic cheese using *Lactobacillus acidophilus*. The microbial population of the prepared starter culture was determined by serial dilution followed by plating on MRS agar and incubation at 37°C for the enumeration of *L. acidophilus*. Sapota pulp was incorporated into cheese at different concentrations ranging from 10 to 40 per cent, while plain cheese served as the control. Based on sensory evaluation, cheese containing 10 per cent sapota pulp recorded the highest overall acceptability score (8.91) and was selected for further studies involving the incorporation of free and encapsulated *L. acidophilus* under optimized conditions. The results revealed that cheese containing encapsulated *L. acidophilus* exhibited significantly higher viable cell counts than cheese containing free cells throughout the study. The difference was statistically significant, as confirmed by one way ANOVA. Furthermore, encapsulation of *L. acidophilus* significantly improved the sensory acceptability of sapota incorporated probiotic cheese compared with cheese containing free probiotic cells. Synbiotic cheeses were subsequently developed by incorporating inulin at three different concentrations (2, 3, and 4 per cent). The best formulation was selected based on organoleptic evaluation by a panel of twenty semi trained judges. The optimized synbiotic cheese, along with the control, was stored under refrigerated conditions for one month and subjected to physicochemical evaluation. The optimized synbiotic cheese recorded a moisture content of 60.46 per cent, peroxide value of 0.42 meq O_2 kg^{-1} fat, carbohydrate content of 5.34 g 100 g^{-1}, protein content of 14.72 g 100 g^{-1}, fat content of 20.44 g 100 g^{-1}, and pH of 5.46. The *in vitro* availability of calcium and potassium was 72 and 74 per cent, respectively. The present investigation successfully standardized the process for the

development of sapota incorporated synbiotic cheese using encapsulated *Lactobacillus acidophilus*. Encapsulation by the extrusion technique effectively enhanced the viability, stability, and survivability of probiotic cells during refrigerated storage, maintaining the minimum viable count recommended by FSSAI. The incorporation of the prebiotic inulin further improved the nutritional quality and oxidative stability of the cheese while providing desirable sensory and textural characteristics. Overall, the study demonstrated that the integration of encapsulated probiotics and prebiotics into sapota based cheese is a promising approach for developing a functional dairy product with enhanced probiotic viability, improved nutritional and sensory quality, greater storage stability, and potential health benefits.

Keywords: *Probiotics, Encapsulation, Physico-chemical, Sensory evaluation*

Postbiotics: The Next Generation of Functional Ingredients in Nutrition and Food Science

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Abstract

The increasing recognition of the gut microbiota as a key determinant of human health has accelerated interest in novel functional ingredients that extend beyond traditional probiotics and prebiotics. Among these, postbiotics have emerged as a promising class of bioactive compounds derived from foodgrade microorganisms. According to the International Scientific Association for Probiotics and Prebiotics (ISAPP), postbiotics are preparations of inanimate microorganisms and their components that confer health benefits on the host when administered in adequate amounts. They comprise a diverse range of substances, including cell wall components, cellfree supernatants, enzymes, exopoly saccharides, short chain fatty acids, bacteriocins, peptides, vitamins, and other microbial metabolites. Owing to their chemical stability, safety profile, extended shelf life and ease of incorporation into food systems, postbiotics offer several advantages over conventional probiotics, particularly in products where maintaining microbial viability is challenging. This review summarizes the current knowledge on postbiotics, highlighting their classification and biotic family. Particular emphasis is placed on their applications in the food industry, where postbiotics are increasingly utilized as functional food ingredients, natural preservatives, and quality enhancing agents. They contribute to improved product stability, texture, sensory characteristics, and shelf life while exhibiting antimicrobial, antioxidant, anti-inflammatory, immunomodulatory, and antihypertensive activities that promote consumer health. Naturally occurring postbiotics are present in fermented foods such as yogurt, kefir, fermented vegetables, and fermented tea, while their intentional incorporation into functional foods is gaining considerable attention. Furthermore, postbiotics demonstrate potential applications in food packaging, biofilm control, and the development of next generation functional foods. Despite these promising developments, further research is required to standardize production methods, elucidate mechanisms of action, and establish regulatory frameworks to facilitate their wider commercial adoption. Overall, postbiotics

represent an innovative and sustainable approach to enhancing both food quality and human health, positioning them as a key component in the future of functional food development.

Keywords: *Postbiotics, Bioactive component, Biotic family, Functional foods*

Anti-inflammatory Bioactive Compounds from Probiotic Microorganisms Probiotic Microorganisms: A Review

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Abstract

Inflammation is a major factor in the pathogenesis of several chronic diseases, including inflammatory bowel disease, obesity, diabetes, cardiovascular disorders, and autoimmune conditions. Probiotic microorganisms, particularly *Lactobacillus*, *Bifidobacterium*, *Lactococcus*, and selected *Bacillus* species, produce a diverse range of bioactive compounds with potent anti-inflammatory properties. These metabolites include short-chain fatty acids (SCFAs), exopolysaccharides (EPS), bacteriocins, bioactive peptides and other microbial-derived molecules that regulate host immune responses. They suppress the production of pro-inflammatory cytokines such as tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6), and interleukin-1β (IL-1β), while promoting anti-inflammatory cytokines, particularly interleukin-10 (IL-10). Additionally, these compounds strengthen intestinal barrier integrity, modulate gut microbiota composition, and inhibit inflammatory signaling pathways, including nuclear factor-kappa B (NF-κB) and mitogen-activated protein kinase (MAPK). Owing to their natural origin, safety, and multifunctional biological activities, probiotic-derived bioactive compounds have emerged as promising therapeutic agents for the prevention and management of inflammatory diseases. Furthermore, they have significant applications in functional foods, nutraceuticals, pharmaceuticals, and biomedical products. Recent advances in microbial biotechnology and metabolomics are expected to facilitate the discovery of novel anti-inflammatory metabolites and their translation into effective therapeutic interventions.

Keywords: *Probiotics, Bioactive compounds, Anti-inflammatory activity, Short-chain fatty acids (SCFAs), Exo polysaccharides (EPS), Bacteriocins, Cytokines, Gut microbiota, Functional foods, Nutraceuticals*.

Comparative Assessment of Whey Protein from Different Sources for Probiotic Supplement Development

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Abstract

The growing convergence of microbiome science, precision nutrition, and functional food biotechnology has highlighted the urgent need for advanced probiotic delivery systems that ensure microbial stability, targeted intestinal release, and enhanced therapeutic efficacy. Whey protein has emerged as a multifunctional biomaterial owing to its exceptional nutritional profile, unique protein architecture, and reservoir of bioactive peptides capable of supporting probiotic survival and host health. This comparative assessment critically evaluates whey protein concentrate (WPC), whey protein isolate (WPI), hydrolysed whey protein (WPH), and whey proteins from diverse dairy sources with respect to their molecular composition, physicochemical properties, protein–microbe interactions, encapsulation efficiency, gastrointestinal resilience, storage stability, and functional bioactivity. Particular emphasis is placed on the role of β-lactoglobulin, α-lactalbumin, lactoferrin, glycomacropeptides, and hydrolysis-derived peptides in enhancing probiotic viability, intestinal colonisation, immune modulation, antioxidant defence, and maintenance of gut barrier integrity. The assessment further explores the integration of advanced food engineering technologies, including protein self-assembly, microencapsulation, nanoencapsulation, spray drying, freeze drying, and intelligent protein-based delivery systems, for developing next-generation probiotic formulations.

Comparative evaluation identifies hydrolysed whey protein and highly purified whey protein isolate as the most promising delivery matrices due to their superior encapsulation performance, enhanced protection against gastric and bile stress, prolonged probiotic viability, controlled release behaviour, and synergistic biological functionality. Beyond improving

probiotic efficacy, these protein systems represent a sustainable strategy for the valorisation of dairy by-products, supporting circular bioeconomy principles while advancing evidence-based nutraceutical innovation. Collectively, the findings establish whey protein asa dynamic functional biomaterial rather than a conventional nutritional ingredient and provide a scientific foundation for the rational design of precision probiotic supplements. Future research should prioritise multi-omics-guided formulation strategies, artificial intelligence-assisted optimisation, personalised microbiome-targeted nutrition, and clinical validation to accelerate the translation of whey protein-based probiotic systems into next-generation healthcare, thereby strengthening the interface between health, medicine, and food sciences.

Keywords: *Whey protein; Whey protein isolate (WPI); Whey protein hydrolysate (WPH); Probiotics; Functional foods; Precision nutrition; Microbiome therapeutics; Bioactive peptides; Probiotic encapsulation; Nutraceuticals; Intelligent delivery systems; Circular bioeconomy*.

Adults' Knowledge and Practices on Probiotic Foods and Popularization of Probiotic Recipe in Alanallur Panchayat, Kerala

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Abstract

In the present era, rapid lifestyle changes, unhealthy dietary patterns, and increased dependence on processed foods have significantly affected the nutritional status and overall health of adults. These changes have contributed to the rising prevalence of lifestyle-related disorders such as obesity, diabetes, and cardiovascular diseases. In this context, probiotics have gained importance as functional foods due to their beneficial effects on gut health, immunity, and overall wellbeing. However, despite their health benefits, awareness and proper utilization of probiotic foods among adults remain inadequate, particularly in rural and semi-urban areas. Given the growing burden of lifestyle diseases, integrating probiotic foods into daily diets offers a sustainable public health strategy. The primary aim of the study is to assess the knowledge and practices of adults regarding probiotic foods in Alanallur Panchayat, Palakkad, Kerala, and to develop, standardize, and popularize a probiotic recipe among the sample to improve dietary habits and overall health outcomes. The study was conducted among 100 randomly selected adults from Alanallur Panchayat, Palakkad, and data were collected using a pre-structured questionnaire. The questionnaire covered socio-demographic profile, lifestyle patterns, and knowledge and practices regarding probiotic foods. In addition, a probiotic energy bar was developed and standardized through the trial-and-error method. Organoleptic evaluation was carried out, and microbial analysis was conducted to assess safety and probiotic content. Finally, the product was popularized among the participants.

The results revealed that the majority of participants were educated females who had basic knowledge and a positive perception toward probiotics but demonstrated poor in-depth

understanding and limited probiotic consumption practices. The developed probiotic energy bar showed high sensory acceptability and contained viable probiotic organisms, making it a suitable option for improving dietary intake among adults. The popularization of the probiotic bar using an educational brochure was effective not only in enhancing awareness but also in promoting the adoption of probiotic foods. Community education programmes help to bridge the gap.

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