

2024 FOOD SCIENCE INSIGHTS: 20 TRENDING RESEARCH STREAMS IN MODERN FOOD SCIENCE

The report highlights **20 critical trends in food science for 2024**, derived from global research indexed in the Food Science and Technology Abstracts (FSTA) database. These themes address key challenges in **food production, nutrition, sustainability, and health**.

1. **Transformative Food Tech:** Advanced machinery, nanotechnology, and smart packaging to optimise production and preservation.
2. **Nutrition & Health:** Functional foods, nutritional bioavailability, and diets for chronic disease prevention.
3. **Innovative Analytical Methods:** Spectroscopy and traceability tools combat food fraud and enhance quality.
4. **Plant-Based Foods:** Alternative proteins, taste/texture innovations, and sustainable agriculture.
5. **Food Safety & Quality:** Rapid testing and blockchain technology for safety assurance.
6. **Functional Ingredients:** Focus on bioactive compounds like phenols and antioxidants for health.
7. **Sensory Science:** Enhancing taste, texture, and aroma to meet consumer expectations.
8. **Gut Health:** The role of microbiomes, dietary fibres, and probiotics in health and wellness.
9. **Animal Proteins:** Immunological and physiological benefits of protein-derived compounds.
10. **Thermal Processing:** Balancing texture, nutrient retention, and additive reduction.
11. **Microbial Biotechnology:** Fermentation and metabolic engineering for food innovations.
12. **Phenolic Compounds:** Antioxidant properties in disease and inflammation prevention.
13. **Oxidative Stability:** Natural antioxidants minimise spoilage while aligning with consumer trends for “clean label” preservatives.
14. **Carbohydrates:** Multifunctional roles in energy, satiety, and glycemic management.
15. **Food Economics:** Efficient resource allocation, affordability, and market trends.
16. **Biology & Physiology of Nutrition:** Understanding the metabolic effects of nutrients.
17. **Taste & Texture Engineering:** Rheological insights improve sensory food properties.
18. **Beverage Innovation:** Health-focused drinks, low-sugar options, and novel flavour developments.
19. **Lifecycle Nutrition:** Tailored nutrition for different life stages, from infancy to old age.
20. **Genetics in Food Science:** Nutrigenomics and personalised dietary strategies.

Read on for a deeper exploration of the trends that will shape the future of food science in 2025 and beyond.

FSTA ANALYSIS: SPOTLIGHTING EMERGING RESEARCH TRENDS IN FOOD SCIENCE

As 2024 draws to a close, the global food science landscape is evolving rapidly. From innovative technologies to fundamental questions about nutrition, the research published in the **Food Science and Technology Abstracts (FSTA)** database this year highlights the dedication and creativity of scientists working to tackle key challenges in food production, sustainability, and health.

To recognise these contributions, the team at **IFIS Publishing** have analysed keyword data from the hundreds of thousands of articles indexed in FSTA this year to identify the top 20 research themes shaping the field.

This provides a comprehensive global picture of the latest developments in food science, drawing on FSTA's extensive reach to compile data published in 91 countries and 43 languages, including scientific journals, patents, conference proceedings and more.

As we look ahead to 2025, these research trends will undoubtedly shape the trajectory of food science, paving the way for groundbreaking innovations that will address global challenges in nutrition, sustainability, and food security.

Whether you're a food scientist, product developer, or simply interested in food innovation, this guide provides valuable insights into the trends that will define the future of food. While the research itself is serious, we believe that exploring it should be both informative and enjoyable.

Join us as we delve into these findings, highlighting the significant research that is influencing advancements in the food sector.





TRANSFORMATIVE FOOD TECH

Food Technology was a popular research theme in 2024, linking to 34.17% of the content added to FSTA. The subject is at the forefront of innovation, reshaping food production, preservation, and delivery. Breakthroughs in equipment and machinery, nanotechnology, packaging, and preservation techniques are revolutionising how we produce and consume food.

KEY INSIGHTS:

- **Equipment Optimisation:** Enhancing processing efficiency and product quality through advanced machinery.
- **Nanotechnology Applications:** Improving food safety, extending shelf life, and enhancing nutritional value.
- **Smart Packaging Solutions:** Developing active and intelligent packaging systems for better food preservation.

IN PRACTICE:

Advanced processing equipment is being deployed to improve quality, consistency, and efficiency in food manufacturing while reducing energy consumption. Researchers are exploring nanotechnology-based edible films to protect foods from environmental factors and extend shelf life. Industry leaders are integrating smart sensors into packaging to monitor food quality and freshness.



NUTRITION AND HEALTH

Frequently used keywords such as Nutrients (27.5%) and Health (20.66%) highlight the critical relationship between diet and wellness. Research is uncovering the role of specific foods in preventing chronic diseases and promoting health.

KEY INSIGHTS:

- **Functional Foods:** Probiotics, prebiotics, postbiotics and bioactive compounds for health benefits.
- **Nutritional Bioavailability:** Maximising the uptake of essential nutrients.
- **Chronic Disease Prevention:** The role of diet in mitigating risks such as heart disease and diabetes.

IN PRACTICE:

Academic institutions are studying nutrient interactions with human physiology, while food companies develop fortified products tailored to health-conscious consumers. Collaborative efforts aim to create personalised nutrition plans leveraging data-driven insights.



INNOVATIVE ANALYTICAL METHODS

Analytical Techniques (21.77%) are critical for ensuring product quality, safety, and traceability. Innovations in spectroscopy, chromatography, and imaging methods are advancing food analysis.

KEY INSIGHTS:

- **Spectroscopy Advances:** From hyperspectral imaging to Raman spectroscopy.
- **Food Authenticity:** Combating fraud in high-value products like olive oil and honey.
- **Traceability:** Enhancing supply chain transparency with advanced analytical tools.

IN PRACTICE:

Academics are refining chemical profiling techniques to detect bioactive compounds, while manufacturers leverage these methods to validate ingredient authenticity and regulators ensure compliance with food standards.



POWERING PLANT FOODS

Plant Products (17.89%) research emphasises the shift toward healthy and sustainable diets. Innovations are enhancing plant-based protein textures, flavours, and nutritional profiles.

KEY INSIGHTS:

- **Alternative Proteins:** Exploring sources like chickpeas, lentils, and algae.
- **Sensory Improvements:** Addressing taste and texture challenges in plant-based products.
- **Environmental Benefits:** Promoting regenerative agricultural practices.

IN PRACTICE:

Researchers are optimising underutilised crops for industry applications, while food companies collaborate to refine sensory qualities of plant-based alternatives. Sustainability experts promote regenerative farming techniques to lower environmental impact.



FOOD SAFETY AND QUALITY

Food Safety (16.29%) research focuses on contamination detection and traceability, safeguarding consumer health. The frequency of keywords associated with this topic demonstrates the importance food scientists place on protecting consumers to ensure safety and trust.

KEY INSIGHTS:

- **Rapid Testing:** Advances in detecting pathogens like Salmonella and Listeria.
- **Traceability:** Blockchain solutions for transparent supply chains.
- **Emerging Risks:** Addressing concerns like nanoplastics and mycotoxins.

IN PRACTICE:

Academics are refining models for contamination risk prediction, while industries integrate rapid testing technologies to comply with safety standards. Regulators use these insights to shape global food policies.



FUNCTIONAL INGREDIENTS & BIOACTIVE COMPOUNDS

Research into Phenolic Compounds (10.41%) and Antioxidative Activity (10.16%) underscores the importance of bioactive ingredients in functional foods.

KEY INSIGHTS:

- **Phenolic Compounds:** Their role in antioxidant activity and disease prevention.
- **Emerging Ingredients:** Probiotics, polyphenols, and other health-promoting compounds.
- **Functional Beverages:** Targeting health with bioactive-rich drinks.

IN PRACTICE:

Researchers are profiling bioactive compounds for functional food applications, while industries develop innovative products leveraging these findings. Collaborative projects explore the scalability of bioactive-rich ingredient production.



MAXIMISING CONSUMER APPEAL WITH SENSORY SCIENCE

Research into Organoleptic Properties (10.4%) highlights the importance of sensory attributes such as taste, texture, and aroma in food development. Research in this area has concentrated on consumer preferences, with high levels of activity on reformulation efforts and product development in the Plant Based Food segment.

KEY INSIGHTS:

- **Aroma, Taste and Texture:** Innovations for plant-based and alternative protein products.
- **Consumer Insights:** Understanding sensory preferences to drive innovation.
- **Behavioural Science:** Linking sensory experiences with emotional connections and consumer loyalty.

IN PRACTICE:

Sensory scientists collaborate with industries to optimise texture modifiers and flavour profiles. Academic research informs how sensory attributes can influence healthier food choices.



GUT HEALTH AND THE MICROBIOME

Biology (22.53%) and Physiology (14.15%) studies are increasingly focused on gut health. There has been a jump in the amount of research exploring the microbiome and health, highlighting the benefits of prebiotics and probiotics.

KEY INSIGHTS:

- **Microbiome Research:** Exploring the role of gut flora in health and disease.
- **Dietary Fibres:** Developing fibre-enriched products for digestive support.
- **Functional Foods:** Formulating foods that promote gut health.

IN PRACTICE:

Academic projects are elucidating prebiotic mechanisms, while food companies translate these findings into functional snacks and drinks.



NUTRITIONAL POWER OF ANIMAL PROTEINS

Animal Protein research (12.93%) has investigated its crucial role in nutrition, health, and wellbeing, with particular emphasis on immunology and physiology due to the rich content of lipids, peptides, amino acids, and enzymes.

KEY INSIGHTS:

- **Immune Modulation:** Exploring how animal proteins enhance immune function.
- **Physiological Impact:** Investigating the effects of protein-derived bioactive compounds.
- **Dairy Innovation:** Leveraging milk proteins for functional food development.

IN PRACTICE:

Researchers are uncovering the immunomodulatory properties of specific amino acids like arginine and tryptophan. Industries are developing protein-fortified products to support immune health, while academic institutions explore the potential of dairy proteins in enhancing gut immunity and tumour suppression.



ADVANCES IN THERMAL PROCESSING

Thermal processing (9.69%) research focuses on optimising physical properties, organoleptic/sensory properties, nutrient preservation, and the reduced need for additives in thermally treated products.

KEY INSIGHTS:

- **Texture Optimisation:** Developing heat treatments that maintain desirable mouthfeel.
- **Flavour Retention:** Techniques to preserve organoleptic qualities during processing.
- **Nutrient Stability:** Exploring methods to minimise vitamin and mineral degradation.

IN PRACTICE:

Researchers are evaluating the impact of various thermal processes on sensory attributes and nutrient profiles. Food manufacturers are exploring the potential to adopt innovative heating technologies to reduce reliance on additives while ensuring product safety and quality for cleaner labels.





MICROBIAL BIOTECHNOLOGY IN FOOD SCIENCE

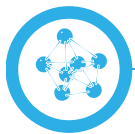
Research in Microorganisms (12.14%) and Bacteria/Eubacteria (8.6%) explored the vast potential of microbial processes like fermentation in food production and enhancement. Key themes indexed in FSTA during 2024 included physiology and metabolism alongside research into phenols and amino acids. Sensory properties in plant products, prepared foods, and fungi were important benchmarks in development.

KEY INSIGHTS:

- **Metabolic Engineering:** Optimising bacterial strains for improved nutrient profiles.
- **Flavour Modulation:** Utilising eubacteria to enhance sensory properties in fermented foods.
- **Bioactive Compounds:** Extracting valuable phenols and amino acids from microbial sources.

IN PRACTICE:

Researchers identify novel microbial strains with unique metabolic capabilities for food applications. Companies leverage biotechnology to develop functional foods with enhanced nutritional and sensory properties. Academic institutions explore the potential of fungi and plant-microbe interactions to create innovative food products.



PHENOLIC COMPOUNDS

Research on Phenolic Compounds (10.41%) underscores their significant role in human health, particularly through antioxidant activity and disease prevention. Understanding their antioxidative and health-promoting benefits emerged as a significant research trend in 2024.

KEY INSIGHTS:

- **Antioxidant Properties:** Combat oxidative stress and reduce inflammation.
- **Disease Prevention:** Linked to reduced risks of chronic conditions like cancer and cardiovascular disease.
- **Food Applications:** Enhance shelf life and nutritional value in food products.

IN PRACTICE:

Academics are isolating and studying phenolic compounds from plant sources, while manufacturers are exploring their potential in functional foods and beverages.



OXIDATIVE PROCESSES FOR STABILITY AND HEALTH

Reducing food spoilage has been identified as a critical global concern in the transition towards a sustainable food system. The scientific community has responded by producing a significant body of research on Oxidation (12.79%) and Antioxidants (10.16%), focusing on minimising spoilage and improving food health benefits.

KEY INSIGHTS:

- **Oxidation Control:** Preventing degradation of fats and nutrients.
- **Natural Antioxidants:** Exploring plant-based compounds like tocopherols and polyphenols.
- **Consumer Trends:** Increasing demand for "clean label" antioxidant solutions.

IN PRACTICE:

Academics are refining methods to measure oxidation rates in food systems. Food processors are adopting natural antioxidants to replace synthetic options, aligning with consumer preferences for clean-label products.



ROLE OF CARBOHYDRATES

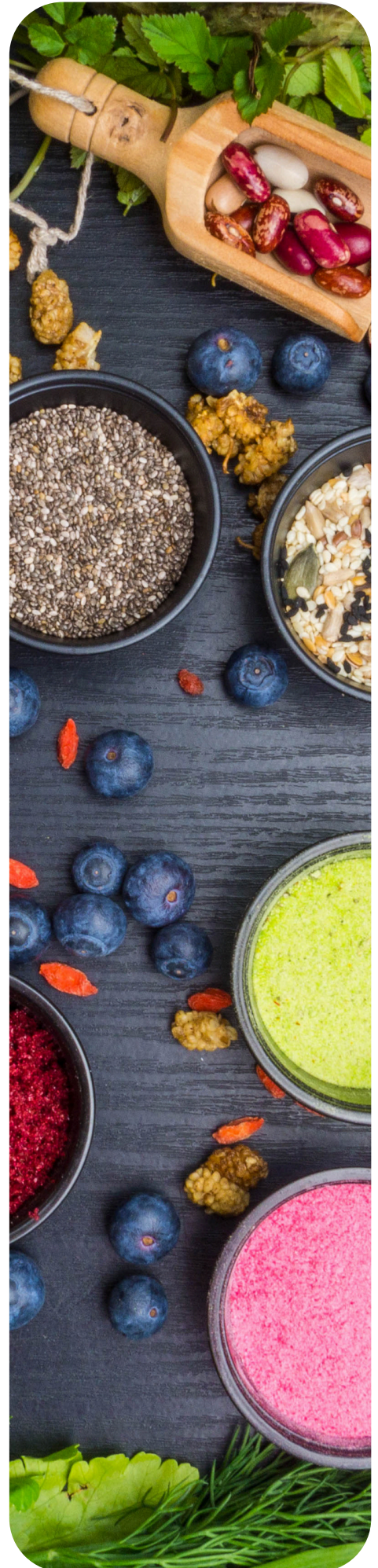
Carbohydrates (10.18%) are pivotal not only as energy sources but also for their structural, functional, and prebiotic roles in food systems. In 2024, researchers focused on their multifunctional applications beyond energy provision.

KEY INSIGHTS:

- **Dietary Fibres:** Promoting gut health and satiety.
- **Functional Ingredients:** Using starches for texture modification and stabilisation.
- **Low-Glycemic Innovations:** Developing carbohydrate solutions for diabetes management.

IN PRACTICE:

Researchers are exploring novel carbohydrate sources and their functional benefits while innovating with resistant starches and other modified carbohydrates for health-conscious products.





ADVANCES IN FOOD ECONOMICS

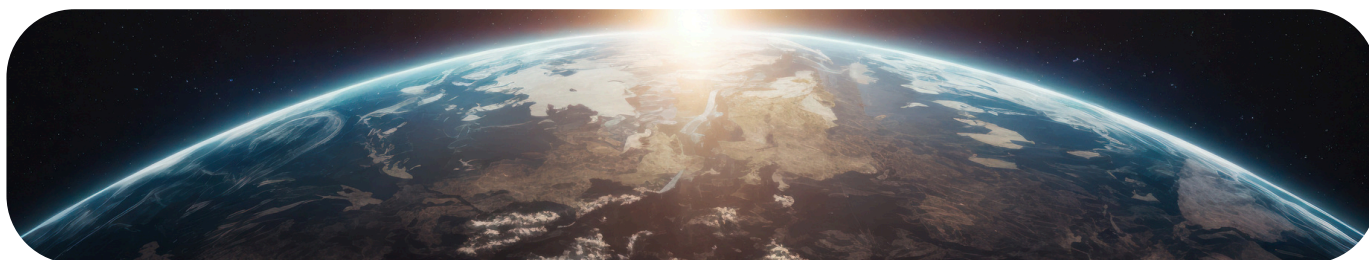
Throughout 2024, research in Food Economics (11.68%) explored the intersection of production efficiency, resource allocation, and market dynamics to meet global food demands. Researchers have worked on issues ranging from resource optimisation to understanding consumer behaviour.

KEY INSIGHTS:

- **Economic Sustainability:** Reducing waste and improving supply chain efficiency.
- **Consumer Trends:** Analysing preferences to guide product development.
- **Global Challenges:** Addressing food availability, affordability and equitable distribution.

IN PRACTICE:

Academics study cost-effective production methods and food affordability, while industry players leverage market data to predict consumer behaviour and reduce supply chain inefficiencies. Policymakers focus on sustainable practices that balance economic and environmental goals.



BIOLOGY AND PHYSIOLOGY OF NUTRITION

Research in Biology (22.53%) and Physiology (14.15%) of nutrition deepens our understanding of how nutrients impact metabolic processes, growth, and overall wellbeing.

KEY INSIGHTS:

- **Nutrient Metabolism:** Investigating how macronutrients and micronutrients are utilised by the body.
- **Nutritional Deficiencies:** Identifying and addressing global malnutrition challenges.
- **Personalised Nutrition:** Tailoring diets based on genetic and physiological differences.

IN PRACTICE:

Academic research focuses on the physiological effects of diet on chronic diseases, while the food, beverage and nutraceutical industries develop fortified and bioavailable products targeting specific populations. Collaborative projects seek to enhance nutritional literacy and health outcomes globally.



ENGINEERING TASTE AND TEXTURE

Research in Mechanical Properties (7.16%) and Machinery (7%) has centred on physical properties, rheological properties, thermal processing, nutrients, organoleptic properties, polysaccharides, and glycans with the aim of enhancing the sensory qualities and nutritional value of food products.

KEY INSIGHTS:

- **Texture Engineering:** Manipulating rheological properties for the desired mouthfeel.
- **Thermal Optimisation:** Improving nutrient retention during processing.
- **Flavour Enhancement:** Exploring the role of polysaccharides and glycans in taste.

IN PRACTICE:

Researchers are developing predictive models for sensory attributes based on molecular interactions. These insights can be leveraged to create innovative food products with enhanced textures and flavours.



A REFRESHING TAKE ON HEALTH

Research in Beverages (7.68%) added to the FSTA database in 2024 reveals a strong focus on health and wellness, as well as growing interest in plant-based drinks, alcohol, tea, and soft drinks. Studies on organoleptic properties and consumer attitudes also emerged as central themes, underscoring the importance of flavour, aroma, and texture in driving consumer choices.

KEY INSIGHTS:

- **Health and Wellness Trends:** Development of beverages aligned with wellbeing and lifestyle preferences, including low-sugar and plant-based options.
- **Alcohol and Tea Innovation:** Exploring traditional and alternative methods to enhance taste, reduce environmental impact, and incorporate natural ingredients.
- **Soft Drinks Evolution:** Research into sugar reduction strategies and novel flavour profiles to appeal to health-conscious consumers.

IN PRACTICE:

Food scientists investigate the sensory characteristics and acceptability of beverage innovations while exploring sustainable production techniques. Food and beverage manufacturers focus on creating appealing, health-forward products. Insights into organoleptic properties and market preferences ensure that new product development aligns with both scientific advancements and consumer expectations.



LIFECYCLE NUTRITION

Lifecycle research constitutes 7.85% of content added to the FSTA database in 2024. This area examines the evolving nutritional requirements of individuals across different life stages and population demographics, addressing metabolic nuances to optimise health outcomes.

KEY INSIGHTS:

- **Infancy and Childhood:** Research explores the role of nutrients like DHA, iron, and calcium in supporting growth and cognitive development.
- **Adolescence:** Studies focus on energy, protein, and vitamin demands during periods of rapid physical and hormonal change.
- **Adulthood:** Investigations centre on maintaining metabolic efficiency and preventing chronic diseases through balanced diets.
- **Aging Populations:** Content emphasises reduced metabolic efficiency and the need for targeted nutrient intake, including Vitamin D and Calcium supplementation.
- **Special Populations:** Research includes dietary needs for athletes, pregnant women, and individuals with chronic conditions.

IN PRACTICE:

Academics leverage these insights to identify nutritional deficiencies and tailor interventions for specific life stages. Food manufacturers utilise this data to develop innovative products like fortified infant formulas, protein-enriched snacks for adolescents, and nutrient-dense foods for older adults. Public health campaigns integrate lifecycle nutrition findings to shape dietary guidelines addressing both global undernutrition and overnutrition challenges.



GENETICS IN FOOD SCIENCE

Genetics (9.674%) research is transforming food science as scientists explore how gene expression, physiology and metabolism impact our understanding of nutrition, health, and disease mechanisms.

KEY INSIGHTS:

- **Gene Expression Analysis:** Studying transcriptional responses to dietary factors.
- **Nutrigenomic Insights:** Exploring food-gene interactions in non-communicable diseases.
- **Metabolic Regulation:** Investigating the impact of nutrients on cellular processes.

IN PRACTICE:

Academic institutions are pioneering nutrigenomic approaches to identify biomarkers and therapeutic targets, while industries integrate these insights to develop personalised nutrition strategies.



2024'S NEED TO KNOW INSIGHTS

These trends highlight the need for stakeholders to:

- Invest in technological innovation and research & development
- Focus on developing healthier, more sustainable food products
- Prioritise food safety and traceability
- Consider consumer preferences for clean-label and functional foods
- Explore the potential of microbial biotechnology and bioactive compounds
- Address global food challenges through sustainable practices and improved resource allocation



UNLOCKING FOOD SCIENCE INSIGHT

As we move into 2025, global food scientists will continue to push the envelope with their cutting-edge research. Through the FSTA database, academics and industry professionals can access a wealth of data supporting these developments, including research on novel ingredients, processing technologies, and formulation strategies. This invaluable resource supports product innovation, market differentiation, and sustainable practices.

FSTA compiles scientific data from 91 countries in 43 languages, including patents and continuously updated publications. Every entry undergoes rigorous vetting, ensuring quick access to high-quality, relevant information. By leveraging FSTA's comprehensive resources, the food science community can stay at the forefront of food, beverage and ingredient innovation.

WANT TO KNOW MORE?

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