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UNIVERSITY

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**FOOD AND NUTRITION
INNOVATION INSTITUTE**

Q2

Insight Report

INGREDIENTS,
MANUFACTURING
& PROCESING

2025



01

Executive Summary

Introduction

In the second quarter of 2025, each of the six working groups of the Food and Nutrition Innovation Council (FNIC) convened with a focus on ingredients, manufacturing, and processing. Each group heard from field experts and engaged in discussions around challenges, tensions, and opportunities within their working group domain as it relates to ingredients, manufacturing, and processing.

This report encapsulates insights from the six FNIC working group meetings. It highlights where the distinct groups converged on core themes and how the diversity of thought surfaced tensions inherent to the steps forward. It also offers opportunities to explore these tensions through collaborative work. The purpose of this report is not only to inform, but to equip FNIC members with both strategic guidance and concrete concepts—enabling them to drive equitable and nutrition-driven transformation within their organizations and across the food system.

**FNIC
Working Groups**

- Bioactives**
- Biotech & Novel Ingredients**
- Food as Health**
- Precision Nutrition**
- Nutrition Security**
- Sustainable Nutrition**

High-Level Findings



Nutrition Must Anchor Sustainability

Foods that do not nourish cannot be considered sustainable. Whether through reformulation, ingredient innovation, or procurement, nutrient density and access emerged as the essential baseline for credibility and scale.



Trust Requires Shared Infrastructure for Evidence and Integrity

From bioactives to biotech proteins, discovery, often powered by AI, is accelerating, but validation and accountability systems lag behind. Without standardized claims, transparent surveillance, and adaptive trial models, consumer trust and regulatory confidence will remain fragile.



The Potential for Affordability and Acceptance

Affordability alone is not enough; foods must also deliver on taste, convenience, and cultural fit. System levers, such as procurement and reformulation strategies, can expand access to nutrition-forward foods and potentially make them more accessible, appealing, and trusted.

Key Tensions

Speed vs. Rigor

AI and biotech platforms are accelerating discovery, compressing timelines from years to months. Yet validation pipelines, regulatory frameworks, and consumer trust mechanisms remain slow to adapt. The result is a widening gap where innovation risks outpacing credibility.

Functionality vs. Familiarity

Reformulation often depends on technical ingredients that reduce sodium, sugar, or stabilize bioactives. While effective, these ingredients can appear “unnatural” on labels, conflicting with consumer expectations for clean, familiar foods and limiting adoption.

Efficacy vs. Efficiency

Whole-food matrices and staged-release formulations often preserve nutrition and bioactive function more effectively. But these approaches are harder and costlier to scale than isolates or simplified formulations, creating a trade-off between health outcomes and commercial efficiency.

Speed of Scaling vs. Supply Chain Complexity

Startups face steep capital requirements to move a product beyond a farmers market to a national or global market, which can slow the speed of innovation and cause positive disruptions to be met with friction.

Vision vs. Execution

Companies set ambitious sustainability and nutrition goals but lack shared frameworks, metrics, and infrastructure to implement consistently.

Core Themes* at a Glance

Theme	Why It Matters
Nutrition-First Sustainability	Without nutrient density and access at the center, foods marketed as sustainable risk undermining health outcomes and public trust.
Evidence & Integrity Systems	Shared standards for quality, validation, and claims are the foundation for scaling innovation without eroding consumer confidence.
Formulation & Delivery Drive Efficacy	The health impact of any ingredient depends on how it is processed, stabilized, and delivered, making formulation choices as critical as discovery itself.
Consumer Adoption and Structural Levers	Even the best-designed foods fail without consumer acceptance, and system-level levers like procurement and reformulation can support a wider variety of healthy options.

**Core themes were derived from the six working group meetings.*

Together, these four themes weave a coherent picture of both the challenges and the promise at the center of food and nutrition innovation today. They show how nutrition-first sustainability, evidence and integrity systems, formulation and delivery science, and consumer adoption shaped by structural levers can reinforce one another to create healthier products, more resilient markets, and stronger trust. This report offers a panoramic view highlighting the interdependencies and tensions that must be navigated, as well as the strategic opportunities that arise when innovation, credibility, and adoption come into alignment.

Q2 Speakers



Dr. Colin Kay
Arkansas Children's
Research Institute



Sofia Elizondo
Brightseed



Dr. Andrew Shao
Niagen Bioscience



Auroi Majumdar
CJ Cheiljedang



Dr. David Julian McClements
Univ Massachusetts Amherst



Dr. Lisa Dyson
Air Protein



Paul Schiefer
Amy's Kitchen



Dr. Parke Wilde
Tufts University



Dr. Will Masters
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Richa Mattu
Unilever North America



Nolan Lewin
Rutgers Food Innovation
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Dr. Harini Venkataraman
Lux Research



Dr. Martin Kussmann
Competence Center for
Nutrition (KERN)



Dr. Beth Bradley
Global Dairy Platform



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Griffith Foods

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The content of this report is an interpretation of conversations occurring between members of the Food & Nutrition Innovation Council and guest speakers. It does not necessarily represent the views of any one member of the Council, or those of the Food and Nutrition Innovation Institute, the Friedman School of Nutrition Science & Policy, or Tufts University.

Q2 Insight Report: Ingredients, Manufacturing & Processing

Introduction

Food and nutrition innovation is advancing rapidly, but progress is often determined less by what we discover than by how ingredients are processed, formulated, and delivered. This quarter, FNIC focused on the part of the system where science, technology, and consumer experience converge: ingredients, manufacturing, and processing. It is here that opportunities for healthier, more sustainable diets can be unlocked, but also where credibility and adoption are most at risk.

Signals Shaping the Food System

Consumer Trust Remains Fragile

While two-thirds of Americans say they trust food and nutrition science to some degree, fewer than 4 in 10 report strong trust. At the same time, demand for transparency is rising. Seventy-six percent of global shoppers now say clear product information is essential.^{1,2}

Processing is Under Intense Scrutiny

Over 50% of calories in the U.S. diet now come from ultra-processed foods,³ which has fueled debate about whether manufacturing can improve rather than erode nutrition.

AI and Biotechnology are Compressing Discovery Timelines

This has surfaced thousands of new bioactives and functional ingredients in months rather than years.

Procurement has Outsized Influence

At the system level, U.S. schools alone serve nearly 5 billion meals annually,⁴ underscoring the potential for institutional buying power to reshape markets.

While each group explored this quarter's theme through distinct lenses, clear patterns emerged across the conversations. This report synthesizes those threads into the key themes, tensions, and opportunities. Together, they reveal not just where innovation is happening, but what it will take for new ideas to scale credibly, equitably, and with lasting impact.

03

Core Themes



Each of the following cross-cutting themes contains key insights, tensions and challenges, and opportunities for action designed to spark the partnerships and collaboration required to reshape the food system.

01 Nutrition-First Sustainability

Across multiple reports, members stressed that sustainability cannot be separated from nutrition. A food system that reduces emissions but delivers empty calories is not truly sustainable. Centering nutrient density and access as non-negotiable anchors reframes “sustainable nutrition” as more than an aspirational value. It becomes a systems goal that must guide reformulation, procurement, and product innovation.

Key Insights

01. Nutrition as a Baseline, Not an Add-On

Foods cannot be considered sustainable if they fail to nourish. Several individual working group reports stressed that nutrient density and access must anchor sustainability frameworks, reformulation strategies, and procurement standards. This shifts the conversation from reducing harm (e.g., lowering emissions) to expanding value to ensure that sustainability efforts also improve public health outcomes.

02. Reformulation is Systems Work

Aligning nutrition and sustainability requires cross-functional coordination across R&D, sourcing, culinary science, regulatory standards, and consumer insights. Reformulation must simultaneously meet nutrition targets, maintain sensory appeal, and comply with labeling regulations, which means companies cannot treat it as a siloed technical challenge but as an integrated systems task.

03. Food Waste as Nutrition Loss

Food waste isn't only a climate issue; it represents lost access to nutrients. Upcycling and waste-stream valorization can reclaim both environmental and nutritional value. Positioning waste reduction as a nutrition strategy reframes the opportunity: rescued or upcycled foods don't just reduce emissions, they extend access to affordable, nutrient-dense inputs that otherwise go to waste.

Tensions & Challenges

Vision vs. Execution

Many companies have adopted ambitious commitments to “sustainable nutrition,” yet the lack of harmonized definitions, shared metrics, and operational toolkits makes consistent execution difficult. The gap between aspiration and practice means progress is often fragmented, with companies reinventing the wheel instead of advancing together.

Functionality vs. Familiarity

Reformulated or upcycled products may meet both nutrition and sustainability targets, but they often face consumer skepticism if taste, texture, or labeling feel unfamiliar. Even technically superior solutions can fail in the marketplace if they compromise on cultural resonance or conflict with expectations for “naturalness” and clean labels.

Opportunities

Embed nutrition into sustainability scorecards

Companies increasingly track carbon, water, and waste metrics, but few measure nutrient density or affordability with the same rigor. By integrating nutrition criteria into ESG and product scorecards, firms can ensure sustainability strategies deliver measurable health benefits alongside environmental gains.

Develop pre-competitive reformulation toolkits

Reformulation is complex, requiring trade-offs across taste, cost, regulatory standards, and cultural expectations. Shared resources, such as nutrient density benchmarks, ingredient swap libraries, or front-of-pack labeling templates, would lower duplication, build consistency, and help smaller players implement nutrition-forward strategies.

Advance circular nutrition strategies

Upcycling food waste and valorizing side streams can simultaneously reduce emissions and reclaim nutrients that would otherwise be lost. By framing these approaches as nutrition strategies, not just climate ones, companies can highlight dual value for consumers and policymakers, making adoption easier to justify and scale.

02 Evidence & Integrity Systems



Across several groups, a core message emerged: innovation without integrity will not last. The marketplace is flooded with products making bold claims, yet enforcement is weak, adulteration is widespread, and definitions remain unclear. At the same time, AI and biotech are opening new frontiers of discovery, but without rigorous

validation, consumer trust and regulatory acceptance lag behind. Building shared evidence and integrity infrastructure is no longer optional; it is the foundation for scaling credible nutrition innovation.

Key Insights

01. The Integrity Gap is Widening

Weak enforcement and fragmented oversight have allowed mislabeling, adulteration, and unsubstantiated claims to persist in both supplements and functional foods. Digital marketplaces in particular make it easy for low-cost, low-integrity products to gain share, while companies that invest in research and quality often struggle to compete.

02. Discovery is Accelerating, But Validation Lags Behind

AI platforms and biotech tools are beginning to surface new bioactives, peptides, and functional ingredients at unprecedented speed. While this creates exciting potential, evidence pipelines, from clinical trials to regulatory frameworks, remain slow and uneven. If they do not evolve, the field risks hype and consumer confusion outpacing credible proof.

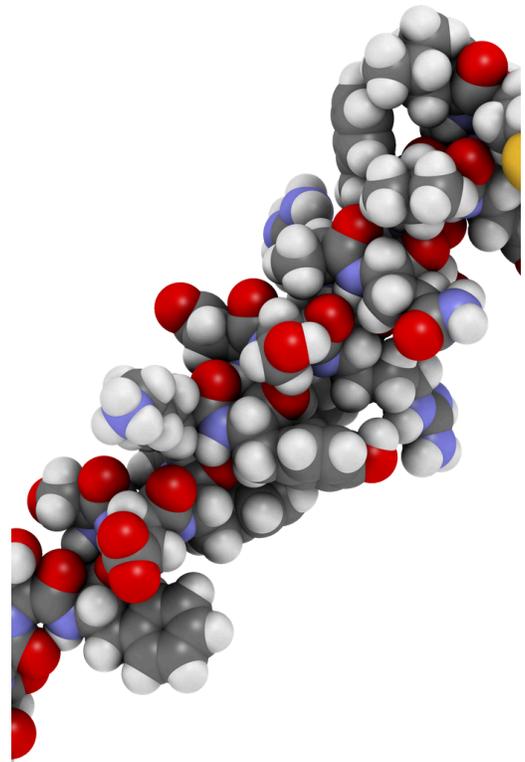
03. Definitions Shape Markets

Terms like “bioactive” or “sustainable nutrition” are increasingly used, but lack consistent definitions or claim frameworks. Without alignment, regulators have no clear baseline, companies interpret terms inconsistently, and consumers are left uncertain. Scientifically valid concepts risk being diluted if language is not standardized and tied to evidence.

Tension

Speed vs. Rigor

AI and biotech platforms are making it possible to compress discovery timelines by identifying promising bioactives, peptides, and functional ingredients in months rather than years. But the systems that establish trust, such as clinical trials, biomarker validation, regulatory approval, and consumer communication, remain slow, fragmented, and resource-intensive. The tension is not just about technology moving too fast, but about the lack of adaptive frameworks to keep evidence aligned with innovation. Without bridging this gap, the field risks hype cycles where discovery outpaces credibility, undermining both consumer trust and regulatory confidence.



SPOTLIGHT: ***AI as a Discovery Driver***

AI and computational tools are beginning to reshape nutrition innovation by rapidly surfacing new peptides, bioactives, and functional ingredients. Platforms like those highlighted in the Precision Nutrition and Biotech & Novel Ingredients groups can analyze millions of molecular sequences or predict protein functionality in months rather than years.

This speed opens exciting possibilities, but also intensifies the speed vs. rigor tension. Without validated biomarkers, adaptive trial models, or transparent “model cards” documenting inputs and outputs, AI-driven discoveries risk being perceived as black boxes. Industry leaders cautioned that while AI can expand the universe of possibilities, credibility depends on pairing computational discovery with rigorous, transparent validation pipelines.

Opportunities

Create a pre-competitive quality consortium

Weak enforcement and fragmented oversight cannot be solved brand by brand. A shared consortium for quality surveillance could pool funding for independent labs, coordinate third-party testing, and publish results to regulators and e-commerce platforms. This would help level the playing field, pressure platforms to delist fraudulent products, and give consumers a recognizable seal that signals integrity. **This idea was proposed by Dr. Andrew Shao during the Bioactives working group meeting. Refer to [this article](#) and his slides [here](#).*

Codify shared definitions and claim frameworks

Terms like “bioactive” or “sustainable nutrition” are already shaping markets, but inconsistent use risks consumer confusion and regulatory backlash. Establishing formal definitions and tiered evidence frameworks (e.g., structure–function vs. clinical outcome claims) would enable clearer marketing, stronger enforcement, and a more credible pathway for innovation.

Enhance transparency for trust

Even validated products struggle to differentiate in crowded markets if consumers cannot see or understand the evidence. Digital tools, such as QR-linked trial summaries, product “model cards,” or visible evidence tiers, can make validation accessible and digestible for consumers and buyers alike. This kind of transparency helps demystify science, strengthens consumer confidence, and rewards companies that invest in rigor.

03

Formulation & Delivery Drive Efficacy

What matters is not just what we eat, but how it is delivered. The same bioactive, nutrient, or ingredient can have very different effects depending on the food matrix, processing method, or release mechanism. Formulation choices, from whole-food matrices to staged-release systems, often determine whether a product achieves its intended impact, survives regulatory scrutiny, and earns consumer trust.



Key Insights

01. Form Matters as Much as Function

Stability, absorption, and efficacy are not inherent to an ingredient, but rather they are shaped by how it is delivered. For example, whole-food matrices or acidic environments can protect fragile compounds like anthocyanins, while isolated extracts often degrade quickly. This means formulation is not a technical afterthought, but a strategic determinant of performance.

02. Processing Can Enable or Erode Value

Food manufacturing methods such as encapsulation, fermentation, or pH buffering can enhance stability and bioavailability, while excessive processing can strip away nutrients or compromise integrity. The same processing step that creates shelf stability or lowers cost may also reduce nutritional value, highlighting the need for closer alignment between processing choices and health outcomes.

04. Delivery Systems are Evolving

New approaches are embedding efficacy directly into the product rather than relying on dosage alone. For example, in the Bioactives group, Dr. McClements showed how food matrices and acidic environments preserve fragile compounds like anthocyanins, enabling multi-phase absorption across the gut. In the Precision Nutrition group, psychobiotics and synbiotics were highlighted as promising interventions, but to realize their impact, they must be delivered in real-world formats such as snacks or chocolates that protect viability and fit consumer routines. These examples underscore how formulation can be a driver of both scientific credibility and consumer adoption.

Tension

Efficacy vs. Efficiency

Formats that best preserve nutrition are often more expensive and harder to scale than simplified isolates or additives. This creates a trade-off between health impact and commercial feasibility.



Opportunities

Develop predictive modeling for efficacy

Many current approaches to food innovation operate as “black boxes”: ingredients and processes are mixed, outputs are measured, and iterations continue until something works. This trial-and-error method has produced commercial successes but is inefficient and limited in scope. Both the Bioactives group (highlighting how absorption varies across food matrices) and the Biotech & Novel Ingredients group (describing black box approaches to plant-based proteins) pointed to the same need: better tools to predict how ingredients behave within complex food systems. Emerging approaches, from AI platforms that correlate inputs and outputs, to soft matter physics models and in silico simulations, could allow innovators to design products with greater precision. These models would reduce wasted R&D cycles, speed up development, and ensure efficacy is built into formulation from the start.

Use formulation as a differentiator

Communicating how design choices enhance outcomes, such as timed-release capsules or foods that preserve microbial viability, can build consumer trust and provide credible points of differentiation. Making formulation visible, rather than hidden, reframes it as part of the product’s value proposition instead of a behind-the-scenes cost.



04

Consumer Adoption & Structural Levers

Even the most scientifically rigorous or sustainably designed foods will fail if people do not choose and consume them. Presentations and discussions across groups underscored that affordability, while essential, is only part of the picture. For nutrition-forward foods to succeed, they must also deliver on taste, convenience, and cultural resonance. System-level levers, such as institutional procurement and regionalized production and distribution, have the potential to reshape the food environment so that healthier choices become the easier, more familiar ones.

Key Insights

01. Taste and Trust Remain Central to Adoption

Even well-designed, nutrition-forward products can struggle if they compromise on flavor, texture, or familiarity. Reformulation strategies that are gradual or silent, such as small, phased reductions in sodium, tend to be more successful than abrupt changes. Trust is also shaped by label language and cultural fit, not just by nutrient profiles.

02. Affordability is Necessary But Not Sufficient

Pricing remains a barrier, particularly for low-income consumers, but cost alone does not explain adoption. Foods that are affordable but inconvenient to prepare, or that diverge from cultural norms, often fail to gain traction. This suggests that interventions must pair affordability with attention to how people actually eat day to day.

03. System Levers Can Shift Demand

Procurement standards and institutional buyers (schools, hospitals, retailers) were repeatedly identified as important drivers of change. When these actors prioritize nutrient density or ingredient integrity, suppliers often adapt, creating ripple effects in the broader market. Similarly, regional infrastructure, from co-manufacturing spaces to local distribution networks, can lower barriers for startups and improve access in underserved communities.

Tensions & Challenges

Functionality vs. Familiarity

Technical solutions such as salt or sugar substitutes, stabilizers, and bioactive carriers can improve nutritional quality, but they often introduce “unnatural”-sounding ingredients that conflict with consumer expectations for clean labels. Innovators are caught between designing for efficacy and maintaining consumer trust in familiar, simple ingredient lists.

Desire for Change vs. Resource Availability

Startups and smaller companies can drive a nutrition-forward innovation economy, but are limited by the large cost for formulation, pilot production, and consumer education. This ultimately can make it challenging to move a local product beyond a farmers market to a national or global market, which can slow the speed of innovation and food-related economic development.



Opportunities

Reframe procurement as a nutrition lever

Institutional buyers, from schools to hospitals to workplaces, can influence what foods are produced and normalized. By incorporating nutrient density, ingredient transparency, and cultural relevance into contracts, they can create demand signals that ripple through the supply chain. Procurement standards can thus become a powerful way to mainstream reformulated or novel products.

Build regionalized infrastructure

Shared regional co-manufacturing facilities, cold chain systems, and micro-distribution networks could potentially lower barriers for startups while increasing access in underserved areas. These systems could also allow for culturally tailored products to be produced and distributed locally, strengthening both resilience and equity.

Connect innovators to food systems experts

Many startups advancing nutrition-forward products struggle to move beyond pilot stage because they lack access to co-manufacturing, regulatory support, and institutional buyers. At the same time, midstream actors such as processors, aggregators, and anchor institutions hold the systems knowledge but are not always accessible. Creating structured programs that link early-stage innovators with co-manufacturers, procurement offices, and incumbent partners for mentoring and knowledge exchange can support innovation and accelerate adoption into mainstream markets.



Conclusion

This quarter's insights reveal that the future of food innovation will be determined not only by what we discover, but by how we design, validate, and deliver it.

- **Nutrition must anchor sustainability** so that environmental gains are matched with measurable improvements in public health.
- **Shared systems for evidence and integrity** are needed to protect against erosion of trust and to ensure innovation translates into credible, verifiable claims.
- **Formulation and delivery decisions** are proving just as critical as discovery itself, shaping whether products deliver on their intended impact.
- **Consumer adoption depends on both individual and structural levers:** taste, culture, and trust matter, but so do procurement standards and reformulation strategies, which could set the conditions for healthier choices to succeed.

Together, these themes highlight a clear mandate: to move beyond isolated innovations and toward coordinated systems change. The tensions identified, from speed versus rigor to functionality versus familiarity, are not barriers but entry points for collaboration. For FNIC members, the opportunities are tangible: embedding nutrition into sustainability scorecards, codifying definitions and claims, advancing formulation science, and reimagining procurement as a nutrition lever.

The work ahead requires bridging disciplines by linking scientific rigor with market realities, and pairing technological breakthroughs with cultural and policy insight. Advancing progress will depend on partnerships across research, policy, and industry to accelerate solutions that are both innovative and credible, adoptable and equitable. Ultimately, reshaping the food system to consistently deliver on its promise — to nourish people, build trust, and sustain the planet — will require collective effort well beyond any single organization.

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3. Williams AM, Couch CA, Emmerich SE, Ogburn DF. Ultra-processed food consumption among youth and adults: United States, August 2021–August 2023. NCHS Data Brief. 2025 Aug;(536)1–11. DOI: <https://dx.doi.org/10.15620/cdc/174612>.
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