Food
PROTEIN DIVERSIFICATION THINK TANK

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Food Consumer Observatory

Factsheet

Precision/ Biomass Fermentation

There is increasing demand for high-quality sources of protein that avoid conventional animal agriculture.

Fermentation-based proteins have emerged as a viable alternative, not only for food applications but also for pharmaceuticals, biomaterials and fuel production.

There are three main forms of fermentation:
traditional, precision and biomass fermentation. Traditional fermentation is an ancient food preservation and transformation process that uses naturally occurring or added live microorganisms (such as bacteria, yeasts, or molds) to break down sugars and starches in ingredients like milk, vegetables, or soybeans. This anaerobic process produces acids, alcohol, or gases that enhance flavor, texture, nutrition, and shelf life, creating foods like yoghurt, cheese, kimchi, sauerkraut and tempeh.

Precision fermentation (PF) often uses genetically engineered (GMO) microorganisms, such as yeast or bacteria, that have been modified to act as "mini-factories" for producing specific proteins or ingredients. The final purified ingredient (e.g. beta-lactoglobulin or rennet) usually contains no detectable modified DNA.

Precision fermentation products have many applications that can enhance foods by adding nutrients or functional qualities. For example, a PF-derived heme protein added to the Impossible Burger™ allows it to mimic the bleeding of an animal-based patty. PF can also replace hard-to-produce ingredients such as vanillin, the primary compound responsible for vanilla flavour.

Biomass fermentation (BF) uses fast-growing microorganisms, such as fungi, yeast or bacteria, to produce a nutrient-rich source of protein. Unlike PF, it does not focus on producing specific molecules but instead harvests the protein-rich biomass itself as a source of nutrients, primarily protein. Examples of biomass fermentation (BF) products include mycoproteins such as Quorn® and microalgae such as spirulina. In terms of environmental benefits, both biomass fermentation and precision fermentation are appealing due to their comparatively low land and water use. Both methods bypass the need for antibiotics and reduce the risk of contamination associated with conventional livestock farming.

Consumer research on precision fermentation and biomass Fermentation remains limited, as does overall consumer awareness.

- Findings on trust in PF products are mixed. In the 2024 Trust Tracker study, 33% of EU consumers stated they would try PF dairy. In other studies where consumers are informed about the benefits of PF, average openness is relatively high, with over 50% indicating a willingness to try such products. In separate PF cheese and egg trials, more than half of participants (ranging from 50–70%) were willing to try.

- Higher familiarity and awareness of food-related benefits increase consumers' willingness to try and purchase PF products.

- Consumers are far more likely to sample or consume a PF product as a one-off experience than to integrate it regularly into their diets. This may be due to difficulties in categorising PF products within existing labels such as vegan or vegetarian.

- Research suggests PF products are likely to face less resistance than cultivated meat products.

Demographics

- Flexitarians show the greatest potential for acceptance of precision fermentation and biomass fermentation ingredients. For PF egg products specifically, vegans display the highest level of enthusiasm.
- Young to middle-aged men, urban residents and individuals with higher levels of education are the most likely to try novel foods.
- In the UK and Germany, household income is the strongest determinant of acceptance, while in the US this group also includes urban dwellers and male consumers.
- Consumers in the US and Singapore tend to prioritise health benefits and nutrient availability, while consumers in Germany place greater emphasis on animal welfare and antibiotic use.

Strategies for increasing demand

- Connect precision fermentation and biomass fermentation to traditional fermentation, which enjoys high levels of consumer trust and can positively influence perceptions of PF and BF.
  Emphasise that these processes are well established and that PF, in particular, has been used in food and pharmaceutical production for decades.
- Avoid overly technical explanations and associations with highly scientific or technology-heavy language or imagery, such as laboratory settings or sterile environments.
- Avoid derogatory or negative references to conventional products.
- Use descriptors such as “animal-free” or “fermentation-derived”.
- Clarify that while the process may involve genetically modified organisms, the GMO component is not present in the final product.
- Position PF cheese as a mass-market product rather than a luxury or premium niche offering.

Unfamiliarity with precision fermentation and scepticism about its comparability to conventional products continue to hold consumers back.

- Consumers struggle to imagine how to integrate novel ingredients into their existing food habits and meals.
- The safety of PF and BF products remains a concern, particularly regarding the long-term effects of consumption.
- A tension exists between consumers appreciating the animal welfare benefits of PF while simultaneously rejecting it due to perceived threats to farmer livelihoods.
- Consumer hesitancy towards PF and BF is driven by their perceived “high-tech” nature and associations with “unnatural” foods.
- Some consumers – particularly those concerned about health and safety—are sceptical of the genetic modification often involved in PF and do not want their food to be scientifically manipulated.
- Health considerations can act as both a barrier and a motivator, depending on geographical context, trust in food system actors and perceptions of food safety.

Curiosity is a consistent driver of willingness to try PF and BF products.

- Taste and texture remain primary motivators for consumers.
- Consumers with higher levels of trust in national institutions and regulatory bodies show less aversion to technological interventions in food.

References/Extra resources

Banovic, M., Asioli, D., & Sogari, G. Cross-cultural consumer valuation of precision fermentation milk: effects of information, individual traits, and labelling preferences. (2025). Food Quality and Preference, 105570.

State of the Industry Report: Fermentation for meat, seafood, eggs, dairy, and ingredients. Good Food Institute. 2024.

Future Scenarios for Alternative Proteins. EIT Food Consumer Observatory

Trust Tracker Report 2024.