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## Dear Readers,

The variety of plant-based alternative products is growing all the time. Even though the market share of these alternative products is still comparatively low compared to conventional dairy products, accounting for around 8 per cent of the volume and 14 per cent of sales in the overall market for dairy products and dairy alternatives in Europe. More and more consumers are willing to experiment or are at least considering the consumption of plant-based alternatives.

Finding the right flavour is still of central importance, as this is the most important factor in the purchasing decision. For example, two out of three consumers are looking for alternative dairy products that offer them a flavour experience comparable to conventional dairy products.

Interesting developments such as precision fermentation or cell cultivation are emerging for the future with regard to milk substitutes. Although these processes are still in their infancy, they could harbour considerable potential for innovation and growth. Ultimately, however, consumer acceptance is the deciding factor here.

This special is intended to provide you with an overview of the market for alternative dairy products from the supply industry, science and technology sectors.

**Your IDM editorial team**





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## Imprint

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# The best of both worlds

Plant and dairy 'hybrid' foods



**T**he rise of the protein transition offers new opportunities for the food industry. In addition to the focus on creating vegan options, there's a shift toward crafting 'blended' or 'hybrid' foods that merge the benefits of animal-based and plant-based elements. This article elaborates on the need for a comprehensive approach to maximize these benefits.

## Hybrid foods

Hybrid or mixed products combine animal and alternative components, such as proteins, fats and carbohy-

drates. While products that combine both already do exist, these hybrids target consumers who want to reduce meat or dairy intake without sacrificing the familiarity of animal-based originals. Achieving this similarity is difficult with 100% plant-based ingredients due to differences in taste, texture and amino acid profile.

## Advantages of hybrid products

With hybrid products, manufacturers can overcome some of the issues or challenges around either

purely animal-based or alternative products, to offer 'the best of both worlds' and to reach new markets. For instance, plant proteins can lack solubility, resulting in gritty textures in dairy alternatives, rather than a smooth, rich creaminess. By adding animal-based components, manufacturers can maintain familiar flavours and textures while boosting digestible proteins and amino acids. Conversely, adding plant ingredients to dairy stretches resources, appealing to eco-conscious consumers. On the other hand, by adding plant ingredients to dairy products, manufacturers can make



their costly or less sustainable animal-based ingredients go further, for example, enabling them to reach those new (flexitarian) customers who are interested in a more sustainable diet.

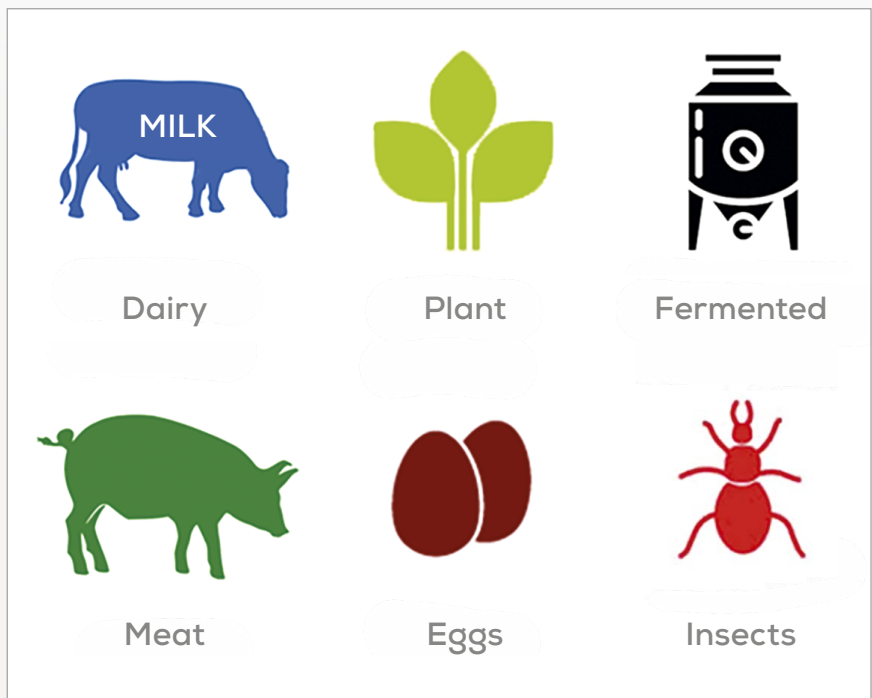
However, creating the ideal 'fusion' product requires more than simply mixing, for example, a dairy product with a plant-based product. Firstly, because this approach requires two separate production channels for the individual components. But also because it does not address the main challenges associated with hybrid products.

### Challenges in developing hybrids

Plant-based proteins often bring undesirable flavours and textures, such as "beaniness" or "grassiness" that clash with dairy-like products. Simply blending will not erase these negatives. Furthermore, textural issues need to be considered. Plant proteins are generally globular and often have low solubility, which has a significant influence on mouthfeel. Dairy caseins, by contrast, are open or 'unfolded', resulting in attractive gelling and textural properties. But what happens when you combine them? We know from previous studies that there can be unexpected – and often surprisingly strong – effects when you mix proteins in a product. These can impact nutrition, sensory features, functionality and food safety. But they are hard to predict precisely, and that has to be kept in mind during development.

### Food safety is a particular challenge

Obviously, it's essential to address the unique food safety risks associated with both animal and plant ingredients. When combining these elements, it's crucial to assess how this merging impacts your production



Sources for hybrid foods

process and the potential introduction of harmful microorganisms. While dairy-related safety concerns are well-established, our understanding of plant ingredient safety is still evolving. Plant-based ingredients host a diverse range of contaminants, expanding the risk spectrum. Additionally, toxin-producing bacteria spores can constitute a significant portion of the microorganisms in plant products. These resilient spores might withstand manufacturing conditions like heat and acidity, surviving the process. If conditions favor their activation, they can spoil the product by becoming metabolically active again.

### Solving the challenges

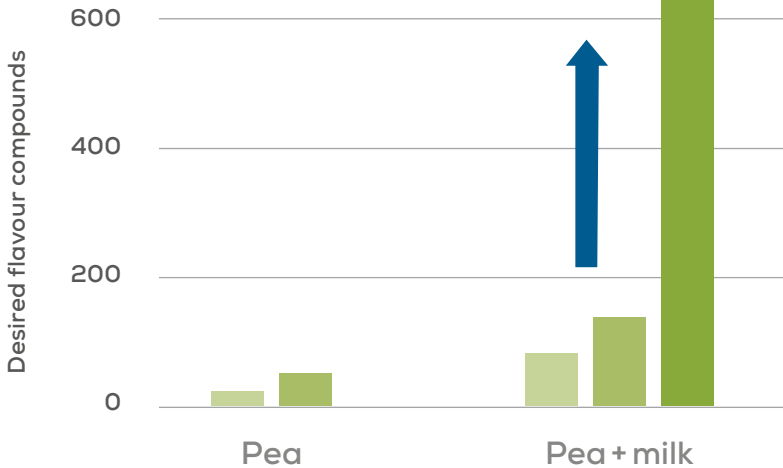
To unlock the potential of a promising hybrid and address both sensory and safety concerns, a strategic approach to processing, preparation and product design is critical. It starts with a holistic development phase, integrating plant and animal components from the start.

Gradually, it's about tackling each potential problem systematically. This includes not only choosing optimal ingredient combinations, but also adapting processing methods. Furthermore, utilizing fermentation becomes crucial, improving both the flavour profile and safety measures of the product.

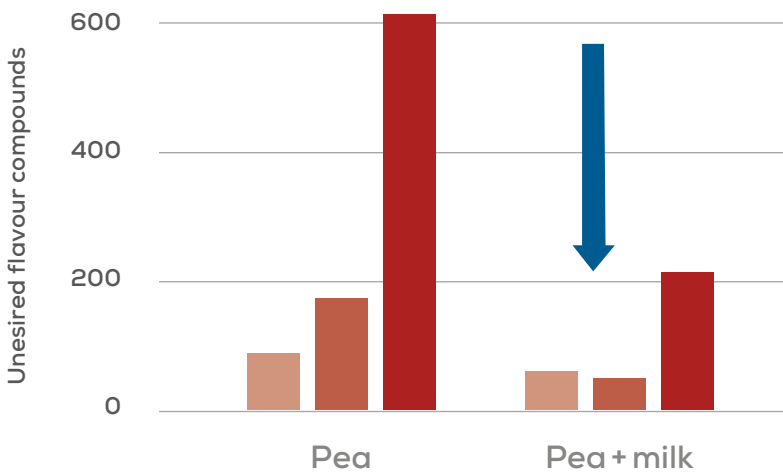
### Dairy fermentation versus plant-based fermentation

In principle, the process remains the same: a mix of sugary substrate and microorganisms initiates fermentation under suitable conditions. What is different is our level of knowledge. We have thousands of years of experience with dairy fermentation, making cheese and yoghurt. But when it comes to fermenting plant components in similar products, our knowledge is evolving. Making a plant-based yogurt alternative requires pinpointing the precise sugars and amino acids to cultivate the desired "yogurt-like" flavours. Adding dairy milk, which naturally

**Increase of desired volatile flavour compounds during fermentation**



**Decrease of undesired volatile flavour compounds during fermentation**



**Fermentation of hybrid dairy products can improve flavour.**

contains lactose and citric acid, helps achieve that desired flavour. In addition, dairy fat serves as an excellent medium for those different dairy flavours.

Choosing specific bacterial strains tailored to the product is crucial. For instance, using strains accustomed to dairy fermentation might yield

more familiar flavors that consumers prefer. Conversely, certain bacteria excel at removing off-flavours from plant proteins. Fermentation, therefore, provides a spectrum of options to fine-tune your product—it’s about finding the right balance. If avoiding a ‘fermented’ taste is your goal, bio-purification steps in. It employs established fermentation methods

without inducing acidification, resulting in a neutral taste and aroma.

**How do we know fermentation works?**

We have been working on a proof of principle at NIZO. Our tests with a hybrid drinking yoghurt showed promising results: we observed general acidification, bacterial growth and a reduction in vegetable off-flavours due to fermentation. Dairy flavours were created by adding milk components to a plant-based product and fermenting it. These findings strengthen our confidence in fermentation as a solution to many hybrid food challenges. However, unlocking these benefits and improving the sensory experience requires a scientific and multidisciplinary approach. As part of the EU-funded E-MUSE project, aimed at exploring complex microbial systems such as those in fermented foods, NIZO aims to rigorously collect data during model hybrid cheese fermentation trials.

**The future of hybrid foods**

Our focus has been on merging a dairy or meat element with a plant-based component, but that’s just the beginning. Our range of protein ingredients for blending covers a broad spectrum: from eggs to insects, lab-grown animal-free proteins and precision fermentation-based proteins. These diverse options offer manufacturers attractive opportunities to strengthen sustainability in the food industry, ensure food equity and simultaneously manage costs effectively.

Furthermore, hybrid foods are not limited to just two components; there may be three or more. What happens when we put three or more elements together? The possible are nearly endless.

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# Innovative product solutions from Döhler

Plant-based drinks and desserts with impressive taste, texture and mouthfeel

**T**he trend for plant-based nutrition continues unabated. The reasons behind it are as diverse as the lifestyles and preferences of the consumers: vegetarian or vegan diets, health aspects, religious beliefs, ethical and environmental considerations and sustainability. In recent years, individual decisions to consume fewer dairy products – or none at all – have led to a global rise of 32% in product launches in the dairy alternatives segment. Plant-based dairy alternatives, which achieved a global retail market volume of around EUR 18.7 billion in 2022, are forecast to grow by up to EUR 24.6 billion by 2027. That is equivalent to mean annual growth of 5.7% or a total increase of just under 32%.

## So many opportunities – all from dairy alternatives

Alternative dairy beverages are the largest sub-segment of plant-based dairy products in terms of predicted growth in the period from 2022 to 2027, accounting for a market volume of more than 10 million tonnes and total growth of 13%. However, plant-based yoghurt alternatives and desserts promise even higher growth rates of 28%. These came in second place in 2022, with 286,000 tonnes. The global market for plant-based cheese alternatives is already growing just as fast, and is forecast to grow by an impressive 48% in future. The plant-based ice product segment reports similar figures. As plant-based dairy alternatives gain an ever greater presence in traditional supermarkets, discount chains and the growing DTC (direct to consumer) channels, acceptance of these products will continue to grow rapidly. This highly dynamic market will increasingly give rise to new products that will further fragment the market – an opportunity for producers of classic dairy products in particular.

## Plant-based desserts and yoghurt alternatives for greater indulgence

The market segment for plant-based spoonable products is growing all the time, promising good growth rates and an increasing market volume. Next-generation yoghurt alternatives, creamy and indulgent plant-based desserts, mousses, puddings and other dessert variants can all be implemented with ingredient concepts from Döhler, as can Greek-style products and skyr alternatives, for example. Plant-based alternatives to classic drinking yoghurts, which are rapidly taking over the market and for which Döhler already offers a huge range of product solutions, are also a key trend. With comprehensive expertise in plant-based raw materials, bases and other ingredients and their application, especially in the dessert segment, plant-based product developments are an integral part of Döhler's portfolio. When they are combined with carefully selected starter cultures for fermented products, fruit preparations, natural flavours and many other natural ingredients, the result is market-ready product concepts with impressive taste, texture and mouthfeel. Smart ideas and innovative products, outstanding quality and reliable delivery for sustainable market success – Döhler always goes one step further in order to reach these goals. From a wide range of plant-based raw materials and bases to the latest trends and regional consumer preferences, from individual natural ingredients to comprehensive solutions for the various industries with extensive services and promising product concepts, Döhler helps its customers bring their products to market quickly.





**Milchalternativ-Getränke bilden mit einem Marktvolumen von über 10 Mio. t und 13% Gesamtwachstum das größte Subsegment im Bereich der Mopro-Alternativen (Foto: Döhler)**

### From plant bases to the finished market product

Nuts, seeds, pulses, coconut or grains such as rice and oats: all these products are potential protein sources and natural bases for plant-based dairy alternatives, and are combined and optimised to form bespoke product solutions for the respective customer application. Döhler supplies all ingredients from its own production facilities, while state-of-the-art processing technologies guarantee authentic taste, product stability and optimum quality of all ingredients in the application recipe. The portfolio also contains natural taste solutions such as flavours, extracts, sweetening concepts and solutions to optimise texture, mouthfeel and colour, or to mask unwanted taste components. Preparations with sweet, fruity or savoury components can also be provided for many applications. The goal of any recipe development is always to create the optimum multi-sensory experience with enhanced nutritional value, so that the product fully meets consumers' expectations and regularly lands in their shopping trolley.

### Essential for high market acceptance: optimised taste profiles

A company that wants to assert itself on the plant-based dairy products market in the long term needs to win over consumers via their taste buds by matching the indulgent properties and taste profile of the original. Global data collected by the in-house market research unit Döhler Market Intelligence shows that taste is the decisive purchase criterion for 88% of consumers. If the ice cream is not creamy enough, the oat milk has a cereal-like mouthfeel or the plant-based yoghurt alternative has an unwanted and unpleasant note, consumers will immediately continue their search for the right alternative elsewhere. Separately from price considerations, sensory aspects like taste, texture and mouthfeel are the key to long-term market success in dairy alternatives and ensure that consumers choose plant-based alternatives more often.

With potential for various off-tastes, formulations centred on plant-based recipes can present significant chal-

lenges for product development. Not only do these off-tastes often need to be masked, but a host of sensory aspects also need to be coordinated, including the overall taste profile and the desired creaminess. The latter is crucial in determining the mouthfeel. Both aspects need to be as close as possible to the original dairy product in order to create the authentically fresh, creamy and altogether appealing sensory impression. With consumers becoming ever more discerning, the mass market will accept no compromise when it comes to taste, texture and mouthfeel. But because every starting raw material is different, there is no one-size-fits-all solution: highly professional solutions and comprehensive experience are needed. Döhler meets these complex challenges with extensive technology-based application expertise, including everything from natural ingredients to ingredient systems as fully integrated product solutions. In raw material sourcing and during every step of production, the focus is always on sustainability in line with the principle of "Sustainable by nature®".

### Fermentation technology unlocks new possibilities in product optimisation

Fermentation of food and ingredients is one of the oldest biotechnological processes used by humans. Without this enzymatic process, most dairy products would not exist. And, alongside classic flavours, the process is also immensely helpful in developing plant-based dairy, yoghurt and cheese alternatives. Fermented oats or

rice extracts, for example, can be used to improve the taste and mouthfeel of the plant-based alternatives and adapt them to the original products. They also help to reduce or even completely mask unwanted off-notes such as grain-like, bitter or hay-like notes. The natural acidification needed in many dairy products can also be taste-matched and improved in this way. Döhler has developed the specific fermentation processes in a targeted way in order to also produce ingredients that are used for fermented desserts and cheese alternatives. There, they create certain sensory properties and typical cheese taste profiles: a complexity of taste that more than holds up to comparison with conventional dairy products. The ingredients appear in the ingredient declaration as "fermented oats" or "fermented rice extract" – healthy ingredients that are expected to meet further increased acceptance among consumers.

Döhler's comprehensive portfolio of natural health ingredients also allows plant-based product concepts to be boosted with healthy added value and positioned in a market environment that is growing all the time. Some 58% of consumers worldwide want to consume foods that improve their health. To support this positive development with attractive offers, Döhler uses the latest discoveries of nutritional science and takes into account current consumer trends like health, naturalness, plant-based nutrition and sustainability to constantly optimise all products and services with the aim of guaranteeing nutritional excellence at all times.



**Milchalternativ-Getränke bilden mit einem Marktvolumen von über 10 Mio. t und 13% Gesamtwachstum das größte Subsegment im Bereich der Mopro-Alternativen (Foto: Döhler)**



# Alternative proteins

Global revenues projected to surpass \$290bn



*Author: Ali Al Suhail, Associate at DAI Magister*

In a world grappling with a pressing need to preserve resources and mitigate global warming, the alternative protein market has emerged as a transformative force with the potential to substantially reduce emissions and create a more sustainable food ecosystem.

Despite the market downturn, the sector is resilient and investor appetite remains healthy as demonstrated by start-ups securing \$3.5 billion in funding in 2022. Supported by the growing demand for alternative proteins – projected to surpass \$290 billion by 2035 and good exit prospects, Nadim El Khazen, Partner at PeakBridge VC, commented, “Large food players use M&A as a key to innovation within the space, averaging lower R&D spend than other industries”.

## Dissecting the alternative protein market

The alternative protein market can be segmented into four sectors – each representing different approaches and avenues within the broader alternative protein landscape and offering unique opportunities and challenges.

### Plant-based proteins

Beyond Meat and Impossible Foods are the two most prominent players in the plant-based protein segment. Beyond Meat, in particular, has been a pioneer in the field and played an instrumental role in raising public

awareness about plant-based meat and the impact of the \$1 trillion meat industry.

While these leading players and others have made significant technological advancements and demand continues to rise in the US and other Western markets, resistance to plant-based proteins persist in countries where plant-rich diets are prevalent and meat consumption is considered a status symbol.

There are also sustainability and affordability concerns around certain plant-based proteins. One example is the water-intensive nature of almond farming for milk alternatives. Plant-based alternatives presently carry a higher price tag than traditional animal products. For example, plant-based meat is priced at twice the cost of beef, more than three times pork, and over four times the cost of chicken per pound.

**TurtleTree** has developed a precision fermentation technology that produces milk-based products, the world's first precision fermentation-produced lactoferrin –LF+–a high-value bioactive milk protein and one of the most powerful parts of cow's milk. Another company, **Imagindairy**, uses precision fermentation to produce non-GMO and animal-free dairy products from microorganisms through its proprietary precision-fermentation technology and has recently received an investment from Danone.

# Cheese without a cow?

How cellular agriculture raises old and new questions



**Author:**

**Associate Professor Julia Keppler, Functionality-oriented protein processing group Laboratory of Food Process Engineering, Wageningen University & Research, The Netherlands**

The world's population is expected to grow significantly and reach the 9.7 billion mark by 2050. This demographic change will pose immense challenges for global food production. At the same time, the ecological consequences of current food production, especially animal husbandry, are increasingly taking centre stage in the sustainability debate. In view of these developments, it is becoming increasingly urgent to research alternative strategies.

The use of plant-based materials for the production of milk and meat substitutes, such as oat drinks or plant-based extrudates, now offers consumers in Europe significantly more choice than 10-20 years ago. Nevertheless, these plant-based analogue products differ from animal products both in terms of their nutritional properties and taste, especially as plant proteins have a different amino acid profile compared to animal protein and their low technical functionality limits their possible applications.

Cellular agriculture is another option to meet the increasing demand for animal or animal-like products, for example through the production of milk proteins from yeasts or fungi (often referred to as "milk protein without cow"). These proteins are most likely just as digestible and functional as milk proteins from cow's milk.

However, before such products are available in European retail outlets, some research questions still need to be answered.

After a brief introduction to cellular agriculture, some of the upcoming research steps are presented from a food technology perspective, such as the production of artificial casein micelles or new protein structures. In addition, an outlook is given on which other research disciplines could be of importance for cellular agriculture.

## What is cellular agriculture?

Cellular agriculture is a technology for obtaining food components from cells. This enables the production of, for example, meat, which is referred to as a "cellular product", or milk proteins, which are referred to as "acellular products". The distinction between cellular and acellular is shown in Figure 1: In the production of meat-like products, stem cells are first taken from an animal and then multiplied. These cells mature into muscle cells under continuous stimulation. Muscle and fat cells form the basis for cell-based meat (e.g. substitute for beef, pork, fish, also called cultivated meat). Since in this case the cells form the basis of the consumed product, this technology is referred to as "cellular".

In "acellular" production, on the other hand, the genetic information for the production of animal proteins is incorporated into host cells such as yeasts, bacteria or fungi in order to produce the desired target molecules such as milk or egg proteins. As the cells themselves are not part of the end product, this production is also referred to as acellular, and the cells can be regarded as so-called "cell factories" that produce the target molecules. In addition to milk proteins, research is also being carried out on other products from cellular or acellular production, including microbial egg proteins, microbial gelatine, spider silk, leather substitutes, animal feed substitutes and so on.

small quantities of protein for basic research purposes, such as the investigation of structure-function relationships. Large-scale production was too costly to produce food economically. Microbial production of proteins has therefore established itself primarily in the field of high-priced pharmaceutical products and enzyme technology. For example, the peptide hormone insulin for the treatment of diabetes has been produced using microorganisms for many decades instead of extracting it from the pancreas of pigs. The production of many enzymes, including enzymes for detergents and food (e.g. microbial rennet for cheese making), is also usually conducted via precision fermentation.

The production of food proteins using modified cells sounds innovative, but has been researched for over 40 years. Initially, the focus was mainly on the production of

Technological progress in recent years has significantly reduced the costs of precision fermentation, which means that the first companies are now producing

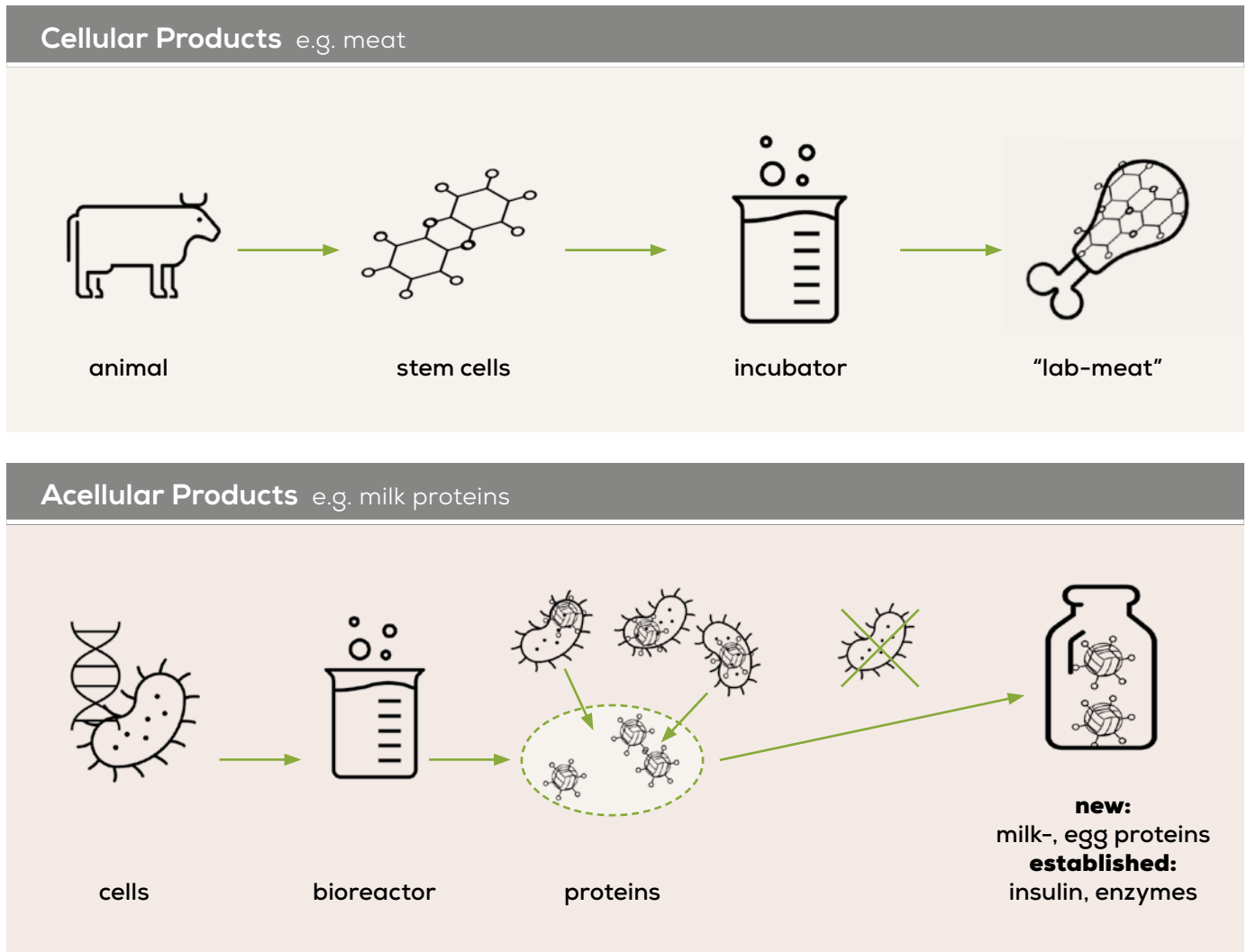


Figure 1  
Schematic representation of cellular and acellular production of animal products



microbial milk proteins commercially. Corresponding products are available in the USA, such as microbially produced milk protein beta-lactoglobulin in drinks or ice cream from "Perfect Day". In Europe, on the other hand, no comparable food product has yet been authorised due to the stricter regulations for food authorisation in Europe. However, it is only a matter of time before these products are also launched on the European market.

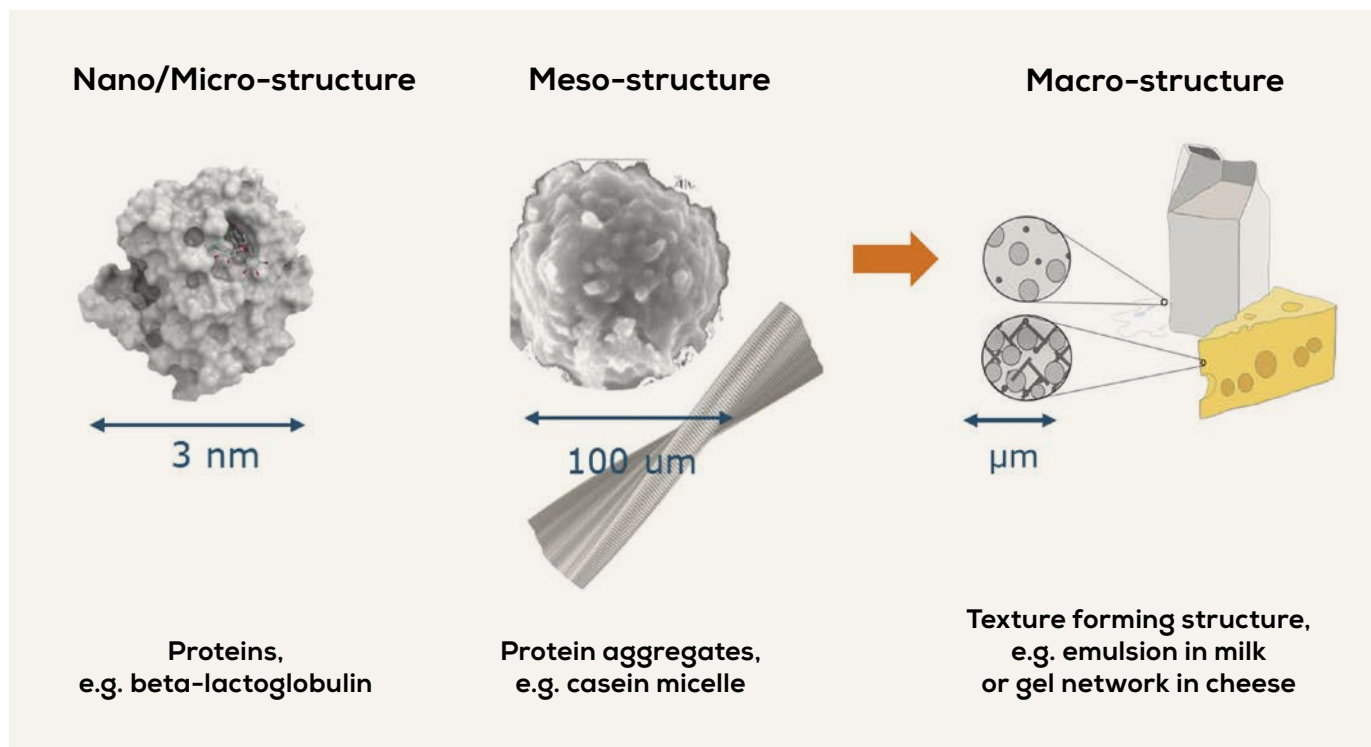
### Structuring of microbial milk proteins: casein micelles

The large-scale production of individual milk proteins through precision fermentation raises the question of how these individual food components can be combined into high-quality dairy products. Researchers need to find ways to combine the individual molecules into texture-giving mesostructures such as casein micelles or other aggregates in order to subsequently achieve the desired macrostructure of the end product, for example a creamy yoghurt or a firm cheese (see Figure 2).

One challenge is that the milk proteins obtained are not always identical copies of the original protein. Due to

the production process, it can happen that the microbial proteins are not folded correctly or that glycosylations or phosphorylations are missing. Therefore, the structure and target functionality of microbially produced proteins should be checked first. For example, we were able to show that although the whey protein beta-lactoglobulin produced by bacteria has minor deviations in the amino acid sequence at the N-terminus, these had no influence on the tertiary structure of the protein or its emulsifying capacity. We were therefore able to produce a model drink based on microbial whey protein that had similar physical properties to whey protein drinks made from cow's milk (Keppler, et al., 2021). However, a sensory evaluation is still pending.

In contrast to the whey protein beta-lactoglobulin, the microbial production of caseins (alpha-S1-, alpha-S2-, beta-, kappa-casein) is extremely complex, as these proteins are additionally glycosylated or modified with phosphate groups, which are known as post-translational modifications. These modifications cannot be easily produced by bacteria, yeasts or fungi. Nevertheless, caseins are essential components of casein micelles (see Figure 2), which in turn are essential for the



**Figure 2**  
 Individual proteins are nanostructures. They can be assembled into protein aggregates, so-called meso-structures such as casein micelles or fibrils. These structures are the basis of certain texture providing structures of foods (macro-structures), e.g. emulsions for milk, gels for cheese.

texture of some dairy products (Kyriakopoulou, Keppler, van der Goot, & Boom, 2021). This is why recombinant caseins and artificial casein micelles have recently become the focus of much research.

The first question that arises is whether it is even possible to produce artificial casein micelles. In fact, this research question was already investigated 40 years ago, and approaches to the production of artificial casein micelles were described by Schmidt (1979). This method still forms the basis for numerous experiments today, in which microbially obtained caseins are assembled into various micelle structures in order to subsequently test the coagulation properties.

The second question is whether it is possible to produce micelles from structurally modified caseins, as acellular production does not always yield animal-identical proteins. Recently, we have shown that caseins that do not contain phosphorylations cannot be easily integrated into artificial micelles, which significantly affects the coagulation behaviour of such mixtures (Antuma, Steiner, Garamus, Boom, & Keppler, 2023). Therefore, it is crucial to produce the microbial caseins structurally correct or to find ways to structure such modified caseins.

In addition to researching the formation of artificial micelles under different conditions, we are also working on the development of new methods for the production of casein micelles that enable the continuous production of artificial micelles and are scalable. This is because as soon as microbial caseins are produced on a large scale, suitable methods for their structuring should also be available if products with micelles are desired. It should be noted that non-micellar casein can also be functional for many applications. Another important aspect is that the production of complex dairy products such as cheese requires not only proteins but also certain fats. The choice of fat phase has a significant impact on the texture and flavour of the final product and could also be obtained from cell cultures or plant sources.

### Using alternative structures for texture

Looking further into the future, however, precision fermentation also opens up completely different possibilities for protein functionalisation by specifically developing new protein structures with improved properties. The idea behind this is to make proteins more functional and therefore more efficient for specific applications, which would then require less protein to obtain the target functionality. A current example from our research again concerns beta-lactoglobulin. Together with colleagues, we have produced modified microbial

## HYDROSOL

### Solutions for vegetable fat and mixed fat creams

Cooking and whipping cream based on vegetable fat and milk protein have several advantages over conventional cream. The final products are more stable and feature attractive properties. What's more, vegetable fat is generally available at all times. Stabilizing specialist Hydrosol has developed a whippable vegetable fat cream to which a fruit juice concentrate can be added while whipping, for a fruity cream alternative with stable foam that is ideal for desserts, cakes, and cupcakes.

With the Stabimuls ICR stabilizing and texturing systems, manufacturers can make whipping creams that have substantially higher whipping volume and a firmer foam structure than conventional cream. Freeze-thaw-stable variants are also possible. The systems in the Stabisol Vega range give cooking creams with flexible 10-30 percent fat contents. They are heat- and acid-stable and won't flock out, even in the presence of alcohol. There is also a version that combines both benefits – i.e., is good for cooking as well as whipping.



*With stabilizers it is possible to make vegetable fat creams that can be stored at room temperatures of up to 25°C and can even be whipped at room temperature (photo: Hydrosol)*

beta-lactoglobulin in which the cysteines have been removed (Brune, et al., 2023). As a result, this protein has a more open fold than conventional whey protein, which normally contains five cysteines. When heated under neutral pH conditions, the cysteine-free beta-lactoglobulin forms long, filamentous aggregates of several micrometres, which could have a positive effect on texturization (Hoppenreijns, et al., 2023, Hoppenreijns, et al. 2022). However, this is still the subject of ongoing studies and authorisation for food is still a long way off. But such fundamental experiments also provide us with valuable insights into which protein structures have good functionalities. With this knowledge, we can then specifically search for corresponding protein structures in nature.

### What still needs to be done?

The successful establishment of cellular agriculture depends on various factors. Firstly, production must be organised in such a way that the food is not significantly more expensive than conventional animal products. But even more important is the sustainability of this production method compared to conventional animal husbandry, as it is intended to be a more environmentally friendly alternative.

However, this cannot yet be clearly determined as the technology is not yet fully developed. A significant factor in the sustainability of production is the type of sub-

strate that provides nutrients to the yeasts, bacteria or fungi. Sugar (glucose) is often used as a carbon source. This sugar is obtained from agricultural products such as sugar beet and maize and requires arable land and water (Bijl and Keppler, 2023). However, alternative options are also currently being explored as a carbon source for precision fermentation, such as sources from industrial side streams, which could significantly reduce the environmental footprint. In addition to the substrate, downstream processing also plays a decisive role in the sustainability and cost-effectiveness of production. The minimisation of product losses and the use of innovative, resource-saving extraction processes are areas that are being intensively researched in our research group.

Furthermore, current research questions focus on the social acceptance of these microbial proteins by consumers, the naming of such products, health effects and their nutritional equivalence compared to milk proteins (Bijl and Keppler, 2023). Close collaboration between multidisciplinary teams consisting of biotechnologists, food technologists, nutritionists, sociologists and many other disciplines is required to clarify the research questions described above. And many fascinating new insights are opening up along the way. This knowledge will undoubtedly be of great relevance when it comes to exploring efficient alternatives in food production, be it plant, animal or cellular - or possibly a combination of all three.

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# Those Vegan Cowboys open €15 Million financing round

**B**elgian biotech Those Vegan Cowboys has opened a financing round to raise €15 million to further advance and scale its precision fermentation platform (named Margaret) to develop casein for animal-free cheese.

After selling The Vegetarian Butcher to Unilever, Jaap Korteweg and Niko Koffeman founded Those Vegan Cowboys in 2020 to make grass-fed dairy products using microbes instead of cows. With the funds, they assembled a talented team of scientists and established a “milk lab” in Ghent, Belgium.

Last year, the company successfully developed a batch of caseins and crafted its first proof of concept, a cheese prototype made with dairy-identical caseins. Now, the company states that it is ready for its next phase of growth, which involves a significant scale-up of its operations.

“We gave ourselves 7 years to build Margaret. Today we are 4 years in, and she is a reality. She has already achieved the impossible: real casein, the most difficult and essential ingredient for cheese. It is now a matter of refining and upscaling. A feat we can only accomplish by building dedicated plants,” Korteweg shares.

According to Those Vegan Cowboys, its casein platform is five times more effective than traditional milk production, providing the necessary proteins to produce the cheese consumers love.

The European Union, through its European Innovation Council (EIC) Work Programme 2024, has recently committed €50 million to help precision fermentation start-ups scale their production.



# Vegetarians can't get no satisfaction

New research by Ingredient Communications

**T**he number of vegetarians satisfied with the choice of food products available to them has suffered a dramatic decline, according to the findings of new research commissioned by Ingredient Communications.

The online poll of 1,000 consumers in the USA and UK<sup>1</sup> found that the net satisfaction rate<sup>2</sup> among vegetarians was +8%. This was a significant fall on 2018, when the same survey recorded net satisfaction among vegetarians at +47%.

In the US, net satisfaction among vegetarians has slumped from +38% in 2018 to -10% now, a negative swing of 48%.

In the UK, meanwhile, net satisfaction among vegetarians has suffered a negative swing of 35%, from +55% in 2018 to +20% in the latest survey.

In stark contrast, net satisfaction among vegans has risen from +2% in 2018 to +17% today. Net satisfaction among US vegans now stands at -3%, versus -9% in 2018. Among UK vegans, net satisfaction is +25%, compared with +28% five years earlier.

## Plant-based is more appealing to vegans

The survey was conducted in September 2023 by market research experts at SurveyGoo, who also asked respondents about their perceptions of specific plant-based products. The findings offer some possible clues as to why dissatisfaction levels among vegetarians are trending higher.



When asked to rate how appealing they found plant-based meat products, 95% of vegan respondents said they looked tasty, compared with 56% of vegetarians. Meanwhile, 91% of vegans said they found alt-dairy products appealing, compared with 60% of vegetarians.

Richard Clarke, Managing Director of Ingredient Communications, commented: "High levels of dissatisfaction and declining net satisfaction rates among vegetarians indicate a concerning trend that needs further scrutiny. Of particular interest is that fewer vegetarians find plant-based meat and dairy products appealing. This might help to explain why net satisfaction levels are so much lower among these consumers."

He added: "There are many benefits to a vegan lifestyle, and there are lots of great products out there to cater for the needs of vegans. But the question has to be asked: in the rush to go 100% plant-based, have brands and retailers neglected the needs of vegetarians, who are usually happy to eat dairy and egg ingredients? If so, are more hybrid products the answer?"

He concluded: "In any case, the findings of our survey reinforce the golden rule of food manufacturing: that it's essential to use the very best ingredients to deliver an excellent eating experience. The days have long gone when vegans and veggies were simply grateful to have something – anything – they could eat. They want and expect the best."



- 1 *SurveyGoo, September 2023*
- 2 *Net satisfaction = % dissatisfied subtracted from % satisfied*

**Growing numbers of vegetarians are dissatisfied with the products available to them (photo: Stokkete/Shutterstock.com)**

## PLANT-BASED MILK MARKET Global Forecast to 2030

According to a report by Research and Markets, the global plant-based milk market will be worth \$47.55 billion by 2030, growing at a CAGR of 11.7%.

The high prevalence of lactose intolerance and milk allergies will be a key market driver, along with increased health awareness. Environmental concerns and increased support from governments and investors will also benefit the industry.

However, fluctuating raw material prices and consumer preferences for animal-based dairy products could restrain the market. Allergies to soy, nuts, and grains could also pose a challenge.

By type, oat juice is expected to register the highest growth rate over the forecast period, as it is soy-free, low in fat, and can be made gluten-free. Its neutral taste and rising consumer awareness of the health benefits of oats are also likely to play a role.

Going forward, emerging economies in the Asia-Pacific and Latin America are expected to generate new growth opportunities for the plant-based milk market. The Asia-Pacific has an increasing vegan and flexitarian population, and Western-style diets are growing in popularity in the region.

The B2C segment is expected to have the largest market share, as stores – particularly supermarkets and hypermarkets – allocate more shelf space to milk alternatives. Flavored plant-based milks will see a higher CAGR than unflavored products, largely driven by the increasing demand for ready-to-drink beverages.

The report is supported by recent figures which indicate that European alt milk sales grew by a huge 49% between 2020 and 2022, with particularly strong growth in Germany. Other dairy alternatives, such as plant-based yogurt and butter, are also poised for significant market growth.





# Shaping the future of plant-based fermented functional food products

Food Cultures selected for functional Plant-based food products should confer a pleasant aroma and survive at high cell density in refrigerated storage conditions.

**H**ealth-conscious consumers are aiming for better and more convenient options to fulfill their nutritional needs and are increasingly doing so by opting for whole plant-based fermented food products.

Fermentation represents an effective biotechnological tool to enhance the nutritional features (e.g., high protein digestibility and synthesis of essential amino acids, fatty acids, and vitamins) as well as the health benefits (e.g., through health-promoting compounds including phytochemicals, phytonutrients and antioxidants) of consuming plant-based food products.

Biological acidification plays a crucial contribution to the potential decrease of several antinutritional factors (e.g., raffinose, phytic acid, condensed tannins, saponins,  $\alpha$ -galactosides, and trypsin inhibitors) naturally present at high concentration in plant-based food products, such as legumes, pseudocereals and whole grains, which reduce the bioavailability of nutrients (mainly proteins and minerals).

Fermented foods prepared using plant-based raw materials such as soya, barley, and alfalfa have proven to have a positive impact on gut microflora, thus preventing type 2 diabetes mellitus and gestational diabetes (Baruah et al., 2022).

The process of fermentation in plant-based sources enhances the bioavailability of vitamins

especially the B-group as well as that of several minerals (Gustaw et al., 2021).

Foods containing high amounts of carbohydrates, such as starch, are causing blood glucose levels to rise after ingestion. Fermentation reduces glycaemic index (GI) by converting glucose, formed from the breakdown of starch, to short-chain organic acids such as propionic, acetic, and lactic ones. There is also another explanation of this effect that involves a decrease in pH by lactic acid and, consequently, a reduction in the activity of starch hydrolyzing enzymes (Nilsson et al., 2020).

Food Cultures are living microorganisms (bacteria, yeast, and moulds), carefully selected for their beneficial effects, intentionally added to food for a technological purpose. While their specific function and mode of action depend on the food matrix and to their application, Food Cultures are normally consumed as food, and used as a characteristic ingredient of food.

Food Cultures selected for functional Plant-based food products should confer a pleasant aroma and survive at high cell density in refrigerated storage conditions.

Fermentation of cereal-based food with certain probiotics offers a series of health benefits and enhances the bioavailability of essential compounds naturally present in the fibrous bran of the cereals (Lamsal et al., 2009; Russo et al., 2017).





Legumes contain relevant concentrations of  $\alpha$ -galactosides which are not degraded in the upper gastrointestinal tract and generally ferment in the large intestine, often causing gastrointestinal symptoms, including abdominal discomfort, flatulence, and diarrhea. Studies have shown that *Bifidobacterium lactis* has the highest  $\alpha$ -galactosidase activity among *Bifidobacterium* and, by catalyzing the hydrolysis of galacto-oligosaccharides in soybean fermented alternatives, eliminates flatulent effects (Havas et al., 2010).

*Bifidobacterium* can increase the crude protein content of soy-based fermented drinks, by improving plant protein solubility and amino acid availability. (Wang et al., 2003).

One unique aspect of *Bifidobacterium* is that all the lactic acid produced is in the L(+) form which is more easily metabolized.

A study demonstrated that SACCO's *Bifidobacterium animalis* ssp. *lactis* BLC1, contained in a Yogurt-like soybean product, can survive and proliferate in the gastrointestinal tract of healthy adults. Moreover, its ingestion altered the composition of fecal microbiota in a manner that exerted a beneficial effect on human health (Wanatabe, H. & Isono, Y. 2012).

The fermentation of soy using bacteria with  $\alpha$ -glucosidase ability enables the conversion of glucoside isoflavones into aglycone isoflavones characterized by higher bioactivity and bioaccessibility (Pyo et al., 2005).

Studies have shown how fermentation of soy-based products with *Lactiplantibacillus plantarum* resulted in a beneficial increase in essential amino acids such as L-lysine (Song et al., 2008).

It is also reported that *Lactiplantibacillus plantarum* is able to transform sesaminol triglucoside of sesame milk into bioactive sesaminol aglycone with enhanced radical scavenging activity (Ulyatu et al., 2015).

Our primary goal is to offer starter culture solutions which will satisfy all the consumers' needs in terms of texture and flavours, concurrently keeping and maximising the nutritional benefits of consuming fermented products. Sacco srl has been working on these topics for almost 15 years, continuously widening and enriching its knowledge and know-how through on-going as well as new collaborations with National and International leading Universities, ingredients' producers, and customers.



# Foodiq introduces MLC-Technology

## Creation of dairy-free products

**F**oodiq, a Finnish company known for its plant-based food innovations and co-manufacturing services, has introduced its Multi-Layer Cooking (MLC) technology. This advanced technology is tailored for the creation of dairy-free products, such as fermented yogurts, spreadable cheeses, drinkable products, crème fraiche, quark, spreads and similar. “MLC’s core market is driven by increased consumer focus on health and sustainability and a generational shift to plant-based foods. We are not only providing tech, we also help food companies to transform plant-based helping them in recipe (product) development,” explains Jari Karlsson, Chief Marketing Officer Foodiq.

The technology is versatile enough to process various raw ingredients, including oats, hemp, rice, and fruits. This broad spectrum of options enables the production of personalized products tailored to specific preferences, such as those with high protein content, minimal sugar, or a focus on clean labeling, as explained by the Finnish innovator.

Karlsson adds: “MLC uses gentle processing methods, enabling use of natural flavours and nutrients that are eliminated in the traditional processes. Conventional production requires abrasive processing methods, eliminating flavouring and nutrients of natural fruits – E-codes and aromas are used for flavouring instead. The gentler processing methods applied with the MLC allow us to use real fruits and natural ingredients for flavouring, enabling better-tasting, clean-label products.”

### The MLC System

The System includes a processing tank and automation system to control the production process. The MLC tank provides precise control over temperature, pressure, and cooking times, ensuring consistent cooking and flavor infusion. It can produce a wide range of products

using a single system, offering manufacturing flexibility and standardizing processes like mixing, homogenization, heating, and pasteurization within a single unit. This eliminates the need for separate equipment or processes.

Designed for scalability, the system maintains product quality while accommodating varying production volumes. Its efficient design optimizes resource usage,





*The MLC tank provides precise control over temperature, pressure, and cooking times, ensuring consistent cooking and flavor infusion (photos: Foodiq)*



reducing production time and energy consumption. It occupies a compact 30-square-meter footprint, significantly smaller than traditional systems, simplifying expansion through the addition of more MLC systems. A single MLC system can handle up to 20,000 kilograms per day, ensuring substantial production capacity.

To meet specific product requirements the MLC system can be tailored, allowing for adjustments in cooking parameters for different plant-based dairy products. "There's no need for specific product specifications when ordering the equipment, streamlining procurement and enabling immediate production of new products or product variations", says Karlsson.

To ensure consistent product quality, the MLC system incorporates robust quality assurance mechanisms. It minimizes waste, with negligible waste per batch, promoting sustainable and efficient production.

"The MLC system offers a swift turnaround time, typically around four months from order placement to installation, ensuring quick deployment and the initiation of production. We also offer comprehensive technical support, including system installation, training, and ongoing maintenance. Our team collaborates closely with clients to integrate the MLC system seamlessly into existing production lines, ensuring a smooth transition and optimal utilization of this cutting-edge technology. We have developed MLC technology over 3 years now, made commercial products (POC) and developed hundreds of recipes. We have a line operating in Finland and now we are ready to start offering the concept to other food companies as well," concludes Karlsson.



*We are not only providing tech, we also help food companies to transform plant-based helping them in recipe (product) development*

Jari Karlsson  
Chief Marketing Officer Foodiq



# FMCG Gurus:

## Dairy Products and Dairy Alternatives



Consumer Experts, Insight Driven

**T**he food and drink industry are currently facing a challenging situation due to the impact of climate change. Notably, the industry itself is a significant contributor to this issue. Therefore, it is crucial for the industry to implement changes in its supply chains and prioritize alternative protein sources, fermentation, fortification, and cultivation as essential strategies to address potential food shortages.

Consumer concerns regarding food shortages are on the rise. Insufficient food supply chains and the possibility of shortages make the plant-based market a more necessary option than ever before. Consequently, plant-based brands need to shift the perception away from the idea that their products are exclusively for young, environmentally-conscious consumers, in order to combat the notion of ethical elitism associated with the industry. This presents an opportunity for the plant-based market to provide an alternative protein source amid these food shortages.

However, many consumers may feel that plant-based products are not suitable for them. To tackle this, brands must emphasize that the plant-based market has expanded beyond being a niche market solely for those following a strict dietary plan. It is important to reassure consumers that they do not have to be flexitarians (those who occasionally eat meat) to enjoy plant-based products. Instead, it is about normalizing the rotation between animal and plant-based products to enhance the mass appeal of plant-based offerings.

### Environmental Concern

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Consumers who prioritize environmental protection are actively searching for sustainable products and brands.

As they witness first-hand the consequences of global warming, their concerns about environmental damage and the potential for reversal are escalating.

Recent focus has been placed on the carbon emissions associated with dairy farming and its detrimental impact on the environment. Consequently, many consumers have shifted towards dairy alternatives as a means to address these concerns. For instance, FMCG Gurus' consumer insights reveal that 60% of global consumers believe plant-based diets are better for the environment. In order to meet the expectations of environmentally-conscious consumers, plant-based brands must adopt a proactive approach to not only eliminate their carbon footprint but also mitigate more carbon emissions that they generate by implementing carbon offset strategies.

### Back-to-Basics Nutrition

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Consumer attitudes towards the dairy sector are evolving, as people are increasingly realizing that dairy products can have positive health effects when consumed as part of a well-rounded diet. For example, FMCG Gurus' market research highlights that 56% of global consumers turn to milk to boost their health. This shift in perception is driven by the trend of adopting a more back-to-basics approach to nutrition, with consumers seeking out familiar and trustworthy everyday food and drink products that are considered natural.

The dairy industry can take advantage of this desire for comfort and nostalgia by positioning their products accordingly. There is also an opportunity for the dairy sector to cater to consumers' growing interest in digestive health by promoting dairy products that contain ben-



eficial bacteria, offering potential health benefits. For instance, FMCG Gurus' consumer insights reveal that 53% of consumers like to see claims around products improving digestive health.

Overall, as consumer preferences align towards nutritional value and trusted ingredients, the dairy industry has an opportunity to meet these demands and capitalize on the changing perceptions and interests of consumers.

### Adopt Storytelling and Transparent Supply Chains

Consumers today have a growing desire to understand the origins of the products they purchase. This increased focus on transparency highlights the importance of where products come from and how they are made. To meet this demand, it is crucial for brands to be open and honest about the sourcing of their ingredients. By pro-

viding this level of transparency, brands can empower consumers to make informed choices that positively impact both the environment and their personal health.

In addition to transparency, consumers are seeking products that not only introduce new tastes and flavors but also contain real, high-quality ingredients that have a minimal negative impact on their health and the environment. To appeal to consumers who value authenticity, brands can further enhance consumer experience by sharing the story behind the formulation of their products. This approach helps to reinforce that these brands are offering a premium experience, attracting consumers who are willing to invest in products they perceive as genuine and trustworthy.

This article is based on FMCG Gurus: The Rise of Alternative Dairy Sources – Global Report 2022 & FMCG Gurus: Health & Wellness Trends in the Dairy Market – Global Report 2023.

photo: Natalia Klenova\_stock.adobe.com



# Consumers want more from plant-based cheeses – here's how brands can deliver



**Author:**

*Kees Muijlwijk, principle application expert plant-based dairy, at dsm-firmenich*

**C**heese; moreish, comforting, and indulgent, it's a favorite food staple all over the world – even for those avoiding animal products. Once considered a niche product, the plant-based cheese category has leapt into the mainstream recently, with major brands launching vegan versions of their classic products. Though highly successful by many metrics, vegan cheese's growth has been less meteoric than other plant-based categories. In the USA for example, 17.5% of households reported regular purchases of meat alternatives, versus just 5% who said the same for plant-based cheese. In this article, we will explore the barriers holding plant-based cheeses back from runaway success, and what brands can do to finally put them front-and-center in consumers' refrigerators.

## Understanding the market: Why the hesitation?

Plant-based cheeses are growing in popularity, especially among younger consumers, but they remain far from ubiquitous. The issue doesn't appear to be low demand; among German cheese consumers, 42% of

Gen Zs (aged 25 and under) and 32% of Millennials (aged 26-41) said they ate more plant-based cheese in the last 12 months. So, why the reticence when it comes to making repeat purchases?

Some of this can be attributed to choice – or lack thereof. The plant-based segment made up just 0.6% of the €128,535 million cheese market value in 2022, and consumers are taking note of this discrepancy. Well over a third of respondents to a recent Mintel survey said there should be a greater variety of plant-based cheeses available in UK supermarkets. As is often the case in emerging food categories, however, the real explanation comes down to overall enjoyment. When asked what factors made them select dairy 'block' cheeses over plant-based alternatives, 46% of German consumers cited a better taste as their primary motivator, with texture and mouthfeel coming in second with just over a quarter naming it as important. For food brands then, boosting consumer acceptance is a deceptively straightforward task – simply improve the sensory profile of plant-based cheeses. In reality, of course, taste and texture optimization involves a complex balance of factors working in





photo: iStock

harmony to produce an exceptional result. Let's discuss the four most important of these pillars; taste, texture, color and nutrition, and the solutions producers need at each stage to satisfy consumer demand.

### 1. Taste: Everyone's top concern

When it comes to cheese, taste is certainly the factor that keeps people coming back for more. For plant-based cheeses specifically, the key challenge is replicating the authentic flavor and aroma of traditional cheeses, for enjoyment's sake and to allow consumers to easily add vegan alternatives to their favorite recipes. In the past, brands have found it difficult to build the distinctive flavor of conventional cheese, leaving plant-based options tasting bland or marred by beany or vegetal off-notes.

The headline solution here is taste layering – a technique that helps recreate the flavor complexity of dairy cheese in four main steps. After the base protein and/or fat is selected, the first task is adding salt and yeast extracts. These seemingly simple ingredients are criti-

cal for building foundational flavor to support the next addition – lactic taste notes, which turn the formulation from generally savory, to distinctly cheesy. Producers can then add variety-specific top notes to complete the flavor profile, creating a robust, complex, dairy-like flavor that can be tailored to a specific cheese 'direction'. Finally, underpinning all these steps is the more holistic process of taste masking, which ensures any rogue off-notes do not distract from the desired cheese flavor – from gouda to parmesan and everything in between.

### 2. Texture: Recreating the 'feel' of classic cheese

Evoking the freshness of cream-cheese or smooth bite of young gouda is also paramount for attracting consumers to plant-based cheeses. Texture is not just a sensory consideration either – it often has a highly functional element. In popular applications such as pizza or plant-based cheeseburgers for instance, stretchiness and meltability are key, leaving consumers disappointed if the experience can't live up to traditional dairy options.

*Evoking the smooth bite of young gouda is also paramount for attracting consumers to plant-based cheeses (photo: dsm-firmenich)*



In this arena, hydrocolloids like gellan gums and pectin are the star solutions. Naturally derived and approved for use by all major food standards, these ingredients promote flexibility and sliceability in plant-based cheese, perfect for analogues like Gouda.

### 3. Color: First impressions matter

The old saying goes ‘we eat with our eyes’ – and while that’s not the whole truth, appearance is an essential element of the authentic cheese eating experience. One of the main draws of cheese is its variety, in color as much as in taste. Replicating the precise shade of creamy pale yellow for a plant-based parmesan or the perfect deep russet for a vegan matured gouda is therefore much more than a surface level concern.

With their ability to create a rainbow of shades from yellow to orange,  $\beta$ -carotene pigments are a great option for plant-based cheese producers. Natural, nature identical and produced by fermentation, these solutions are also available in liquid or powder form, making them suitable for a huge variety of formulations and production processes.

### 4. Nutrition: Perfecting the profile

Last but no means least, the vitamin, mineral and protein content of plant-based cheese is a key focus for a growing number of consumers. Comparing the nutritional

profiles of vegan and dairy products is a topic that could fill an entire series of articles by itself, but in its simplest form; the belief is that plant-based options lack the level of vitamins, minerals and protein found in their traditional counterparts. While it’s true that cheese is not usually considered a ‘health food’, this perceived shortcoming could lead a consumer to choose conventional cheese over a vegan alternative.

One of the best ways to overcome this challenge is by working with a full-service ingredients supplier able to provide complete nutritional solutions like premixed vitamin and mineral blends specifically designed to fill nutritional gaps in plant-based cheeses. The most common micronutrients featured in these mixes are vitamins A, B2 and B12 as well as calcium, iodine, selenium, and zinc, which together create a well-rounded nutritional profile to bring vegan cheeses closer to dairy-based originals.

Exciting advancements in the arena of protein-enrichment for plant-based cheeses are also making an impact. Until now, producers have been faced with the dilemma of increasing protein content to meet nutritional goals at the expense of certain taste, texture and functional properties. For instance, some plant-based proteins can produce beany off-flavors, while increasing





**When it comes to cheese, taste is certainly the factor that keeps people coming back for more (photo: iStock)**

the ratio of protein in a vegan cheese recipe can result in a dry, chalky or rubbery texture. Recent breakthroughs in plant-based protein formulation – including the refining of enzymes, cultures and amino acids specifically designed for plant-based cheeses, the rise of precision fermentation and launch of innovative solutions like dsm-firmenich’s Vertis™ range of faba, pea and canola proteins – are beginning to change this picture enabling brands to deliver vegan cheeses that look, perform and nourish just like their conventional counterparts.

### Partnering for plant-based perfection

Looking back on this brief overview of how producers can optimize their plant-based cheeses, a common theme emerges, balance and harmony. All vital in their own right, each of the solutions we have discussed find their true purpose as part of a larger whole. What producers need therefore, is a formulation partner that can supply all the ingredients needed for great plant-based cheese and offer expert advice on how to combine them for the best results.

With years of expertise and an extensive portfolio encompassing flavor, color and texturizing solutions, fermentation cultures, enzymes, nutritional premixes and proteins to tackle the segment’s next big challenge, dsm-firmenich is the partner for plant-based innovation. Working in concert with brands around the world, we’re here to help the industry deliver what shoppers want from plant-based cheeses. Who knows, in a few years we may not be able to tell if our favorite cheese came from a cow, or a cashew!

- 1 *Plant Based Food Association, The Story of Plant-Based Foods in 2022: Resilience, Growth Trends, and Engaged Consumers, April 2023, <https://www.plantbasedfoods.org/plant-based-foods-state-of-the-marketplace-2022-report/>*
- 2 *Kantar Profiles/Mintel, January 2022*
- 3 *Euromonitor, 2023.*
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- 5 *dsm-firmenich, 2023.*

# FMI

## Plant-based Yogurt Market

**T**he global plant-based yogurt market size stands at a valuation of US\$ 4,489.87 million in 2023. Forecasts suggest a consistent upward trend as consumers have become informed that plant-based alternatives can deliver the same or even more minerals and protein than dairy products. Therefore, the market is on track to surpass US\$ 15,398.39 million by 2033, with a projected CAGR of 13.1%.

**Rising Health Awareness Fuels Growth in Plant-based Dairy Market:** Although dairy products continue to dominate the market, plant-based alternatives have grown in prominence in recent years. Consumers are growing more health-conscious, searching for alternatives to dairy products. The plant-based dairy market developed at a 7.9% CAGR from 2018 to 2022. There are signs of a sustained trend toward plant-based alternatives: about 45% of consumers who eat plant-based products intend to expand their consumption in the years to come. Rising awareness among consumers of the benefits and applications of vegan yogurt is a significant factor driving future market development. Veganism and plant-based diets have grown in popularity in the modern period, paving the opportunity for vegan yogurt market players to establish themselves.

**Vegan Yogurt Varieties Find Favor in Developed Nations:** The vegan yogurt market is still in its early stages in many countries. However, it is a widely recognized sector in developed nations in North America and Europe. High-protein yogurt varieties such as chocolate, strawberry, and blueberry have become popular in developed nations. Dairy consumption has been declining for decades, with each generation consuming less milk than before. Millennials have been at the forefront of the vegan revolution since the beginning. For instance, the out-of-home consumption trend is gaining traction among younger consumers in the MEA plant-based yogurt market. The global increase in the vegan popula-

tion is expected to be the primary demand driver for vegan yogurt and other plant-based food items in the future. According to a Globe Animal Foundation report, there are projected to be about 88 million vegans globally by 2023-end.

### Plant-based Yogurt Market Trends & Opportunities

#### Trends Opportunities

- » Consumers are seeking different and unique flavors beyond traditional options, leading to innovation in flavor offerings.
- » Consumers are gravitating toward products with minimal, natural ingredients, free from additives and artificial preservatives.
- » With a growing desire among consumers to personalize their yogurt experience, there has been a notable surge in demand for yogurt makers, while brands are offering options for consumers to customize their cultured yogurt.
- » Incorporating probiotics for digestive health benefits is a growing trend, appealing to consumers seeking functional foods.

### Plant-based Yogurt Market Statistics by Key Countries

#### Rising Popularity of Veganism Sparks Promising Future for Plant-based Yogurt in the United States

The United States continues at the top of plant-based food production as well as consumption. According to the Plant-Based Foods Association, overall plant-based sales in retail stores hit US\$ 7.4 billion in 2021, and this figure is expected to get higher as plant-based diets become more popular among consumers. The rising frequency of lactose sensitivity in the United States is a promising possibility to boost vegan yogurt shipments



photo: colourbox

in the future. A strong emphasis on health and fitness is encouraging consumers to use functional food products to supplement their nutritional diet. The growing popularity of veganism and a preference for plant-based cuisine are expected to enhance dairy-free yogurt market expansion in the country during the forecast period.

### Plant-based Milk and Yogurt Dominate Germany's Dietary Preferences

Plant-based dieters account for 10% of consumers in Germany (including vegetarians and vegans). According to a study of the drivers and constraints of plant-based dairy consumption in six European nations, Germany has the maximum sales and the leading market potential. As a result, Germany has the top proportion of plant-based consumers in Europe. Regarding animal-based products, consumers here drink plant-based milk the most (28% of the time), followed by plant-based yogurt (21% of the time). The plant-based yogurt dips market has experienced significant growth lately as well.

### Competitive Landscape of the Plant-based Yogurt Market

The global plant-based yogurt industry is very concentrated due to the presence of multiple behemoths. Tier 1 corporations control around 70% of the market. Asia Pacific, Europe, and North America are where the maximum businesses are found. Many businesses are modi-

fying their strategies to remain competitive in a changing market. This could consist of new product creation and purchasing current plant-based alternative manufacturers. Increasing their portfolio and growing their distribution networks are two significant methods used by businesses to become more competitive. The global plant-based yogurt market is growing remarkably as a result of multinational corporations focused on acquiring and establishing production facilities in developing nations.

### Recent Developments in the Plant-based Yogurt Market

- » In July 2023, Müller, a well-known dairy brand founded in Germany, confirmed the introduction of plant-based versions of its famous products in the United Kingdom. The products that were introduced were corner yogurts and rice pudding.
- » In February 2023, WayFare, a manufacturer of plant-based dairy products, revealed the introduction of its fresh yogurts in more than 100 Jewel Osco locations in Illinois, Iowa, and Indiana. The yogurts are crafted with oats, butter beans, and pumpkin seeds.

These insights are based on a report on Plant-based Yogurt Market by Nandini Roy Choudhury, Principal Consultant, Future Market Insights.



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