NutriLeads
Ingredients for health

1·2 taste

Unlocking the Potential of Prebiotics

Prebiotic fiber structure holds key to robust, consistent gut and immune health benefits

Beneficaros
the precision prebiotic

Rising Consumer Demand for Prebiotics

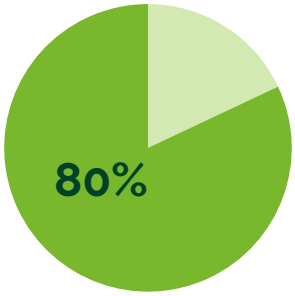
Gut health remains a top consumer priority. While there is substantial opportunity for education, consumers already understand the importance of gut health to their overall health and well-being. There is also growing recognition of the gut microbiome and its critical role in supporting major bodily functions and its strong connection to holistic wellness.

In fact, eight in ten global consumers recognize that a poor digestive system can have a direct impact on the immune system and vice versa.[1] Although many consumers may be unfamiliar with the gut microbiome, 67% say that they have heard of the concept of bacteria within the digestive system.[2]

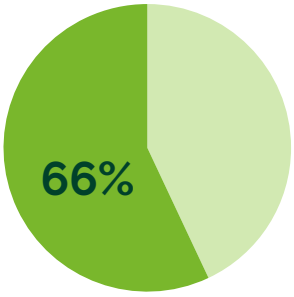
This awareness has driven the demand for products aiding digestive health, with two-thirds of consumers showing interest in these types of products, even if they are not suffering from specific symptoms.[3]

This has in turn impacted the prebiotics market growth: the global prebiotics market was valued at $6.76 billion in 2023, with a compound annual growth rate of 12.8%, and is expected to nearly triple in size to $20 billion by 2032.[4]

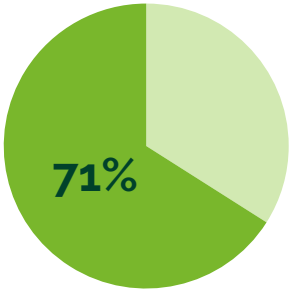
Consumer Gut Health Insights Source: FMCG Gurus



of consumers r**ecognize the relationship** between the gut microbiota and the immune system.



of consumers **have attempted to improve** their digestive health in the last two years.



of consumers say they find **upcycled ingredients appealing.**

Unlocking the Potential of Prebiotics

One of the greatest challenges for natural product formulators is developing prebiotic-enhanced foods, beverages, and dietary supplements that deliver robust and consistent gut health benefits to a diverse consumer base. The complexity lies in the nature of the gut microbiome.

The gut microbiome hosts a community of thousands of microbial species and trillions of microbial cells whose genes influence virtually every system in the body. Each individual's gut microbiome is uniquely shaped by factors such as diet, genetics, environment, and lifestyle. As a result, a prebiotic that works effectively for one person may deliver limited effects for another.[5]

Microbiome composition directly impacts the fermentation process—the mechanism by which prebiotics are broken down in the gut. Some dietary fibers, commonly found in fruits and vegetables, and prebiotics, are indigestible by human gastrointestinal tract enzymes but are fermented (degraded) by microorganisms in the gut.

This fermentation process leads to the production of active metabolites like short-chain fatty acids (SCFAs), which play vital roles in the body such as energy source for the cells lining the gut, metabolic and immune regulation, inflammation control, and nutrient absorption. In short, the intricate and diverse community of commensal bacteria in the gut significantly influences the functioning of nearly every major system in the body.

Fiber Structure Matters

Prebiotics with simple structures are often fermented by a wide variety of microorganisms, leading to competitive fermentation. The outcomes of this competition are highly dependent on the existing microbial composition, which can result in inconsistent responses across individuals.

Research indicates that prebiotic fibers with complex structures deliver more consistent effects[6] because these fibers exhibit high specificity, selectively promoting the growth of beneficial microbes within the core gut microbiome common to most people. Consequently, these fibers can deliver robust, consistent, and reliable gut health benefits, regardless of individual differences in microbiome composition.

Benicaros®: A Precision Prebiotic with Consistent Gut Health Benefits

Benicaros is a precision prebiotic from NutriLeads that is uniquely structured to deliver the same robust benefits, consistent, in every different type of gut microbiome ecosystem. Benicaros enables this by selectively promoting the growth of specific consortia of beneficial microorganisms common to most people. Its ability to provide reliable gut health benefits helps foster consumer trust and loyalty to brands that formulate with this innovative ingredient.

Benicaros is a pectin-derived polysaccharide known as rhamnogalacturonan-I or RG-I sourced from upcycled carrots. Its molecular structure comprises a main backbone of repeating units of galacturonic acid and rhamnose, the latter carrying side chains of different composition and complexity, with arabinan and galactan sidechains being the most abundant.

it's a precision prebiotic fiber that is plant-based and upcycled from carrot pomace - a side-stream of carrot juice production.

it's low dose with a daily serving size of as low as 300 mg*. It's also easy to formulate in a wide range of functional food, drinks and dietary supplements.

it trains the innate immune system to respond faster, smarter and stronger.

it specifically and consistently stimulates beneficial gut bacteria and their metabolites in every type of gut ecosystem. Leading to several health benefits and helping you to fulfill your brand promise to all your customers.

it's applicable to a broad range of products thanks to its favorable formulation properties: water soluble, heat and pH-stable with little to no negative impact on taste, texture or odor of the finished product.

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* 850 mg in the EU

Supporting Science

The benefits of Benicaros are supported by multiple (clinical) studies that demonstrate how this multifunctional precision prebiotic supports gut health and trains faster, smarter and stronger immune responses.

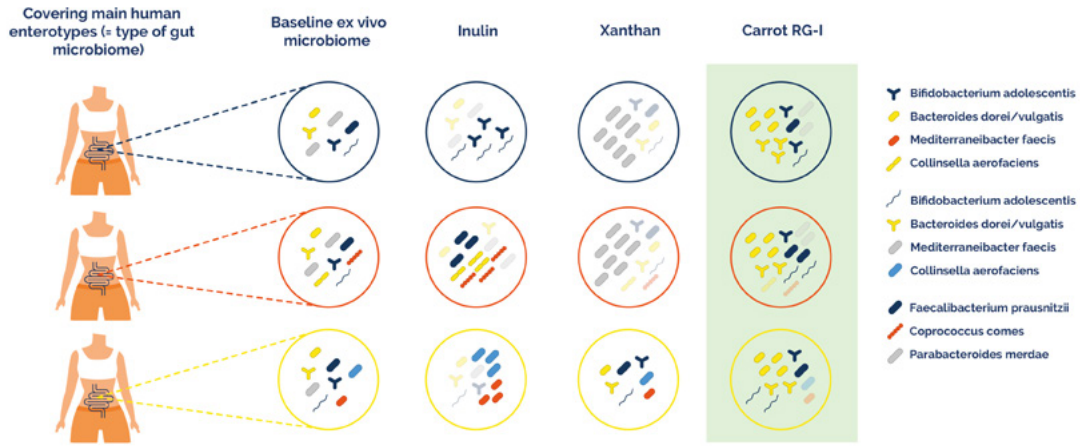
Preclinical Research Supports Benicaros' Mechanism of Action

Preclinical studies using advanced models like SHIME® and SIFR® have provided important insights into the mechanisms behind Benicaros' ability to deliver consistent gut health benefits across diverse populations, supporting its clinical findings.

- **SHIME® Study.** This *in vitro* study demonstrated that Benicaros undergoes rapid fermentation in the proximal colon, selectively increasing beneficial bacteria such as *Bifidobacterium* spp. Benicaros' side chains—arabinose and galactose—are preferential growth substrates for these bacteria. Over three weeks of supplementation, the fermentation process became consistent across donors with varying microbiota compositions, and led to increased production of SCFAs including acetate, propionate, and butyrate, which contribute to a resilient gut ecosystem associated with health benefits.[14]

- **SIFR® Study.** Using Cryptobiotix's SIFR® technology, this *ex vivo* study revealed that Benicaros selectively stimulates a broad spectrum of beneficial bacterial taxa commonly found in the core human microbiome, such as *Bifidobacterium longum* and *Bifidobacterium adolescentis*. Anti-inflammatory species like *Anaerobutyricum hallii* and *Faecalibacterium prausnitzii* were also increased. Unlike other fibers, Benicaros reduced interpersonal microbiota differences and consistently enhanced SCFA production, supporting its ability to provide reliable health benefits.[13]

Ex vivo study amongst 24 individuals



Minimized Gas Production

Remarkably, Benicaros supports both gut and immune health while producing significantly less gas—a common byproduct of fiber fermentation—compared to other prebiotics. For example, Benicaros generated 40% less gas than inulin on a per-gram basis.[13]

These studies highlight Benicaros' unique structure and precision targeting, which help ensure consistent gut health benefits across individuals, reinforcing its clinical efficacy.

Expanding the Potential of Benicaros
Additional research demonstrates that Benicaros can significantly increase the production of indole-3-propionic acid (IPA), a potent antioxidant and anti-inflammatory molecule.[15] IPA is known to protect the gut and other parts of the body from damage. Scientific studies have linked IPA to improved gut, immune, cardiovascular, brain, and metabolic health. By increasing IPA levels, Benicaros has the potential for broader benefits, including brain and heart health.

Clinically Proven Health Benefits

NutriLeads conducted a 8-week randomized, double-blind, placebo-controlled study with 146 healthy adults (aged 18-65, BMI 18.5-30 kg/m^2) to evaluate the effects of Benicaros on gut microbiota composition, immune responses, and quality of life. Participants received either a placebo (0 mg/day), low-dose (300 mg/day), or high-dose (1500 mg/day) of Benicaros for 8 weeks. Microbiota composition was monitored at baseline and after 8 weeks of dietary supplementation. Immune responses were monitored after a standardized rhinovirus challenge (at week 8) for a following 2 weeks, and quality-of-life measures were assessed to determine the effects of Benicaros on recovery from this mild viral infection.[17]

Gut health benefits:

Enhanced Beneficial Bacteria.
Benicaros supplementation significantly increased the abundance of beneficial bacterial species, including *Bifidobacterium spp*. (mainly *B. longum* and *B. adolescentis*)[7].

Supplementation with Benicaros also to a reduction in inter- and intra-individual microbiota heterogeneity and volatility, suggesting a stabilizing effect on the gut microbiota.[8]

Immune health benefits:

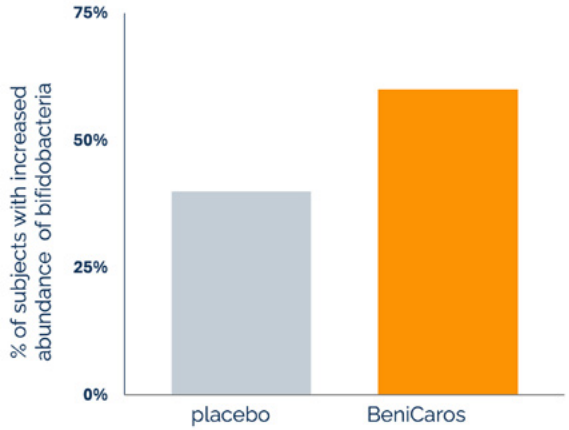
Symptom Reduction.
Participants in the 300 mg/day Benicaros group experienced significant reductions in symptom severity (20-33%) and duration (28-43%) compared to the placebo group. Symptoms included runny nose, sore throat, cough, and fatigue.[9]

Accelerated Immune Responses.
Benicaros accelerated the cascade of protective immune responses in the presence of an airway infection, including critical antiviral (interferon) gene expression, mobilization of innate immune cells, and enhanced responsiveness of natural killer cells.[10] Notably, in the absence of an immune challenge, Benicaros supplementation did not activate systemic immune responses.[11]

Improved quality of life.
Participants in the Benicaros group reported significantly better quality-of-life scores during the infection compared to the placebo group, including enhanced ability to think clearly, exercise, and perform daily activities and work both inside and outside the home.[12]

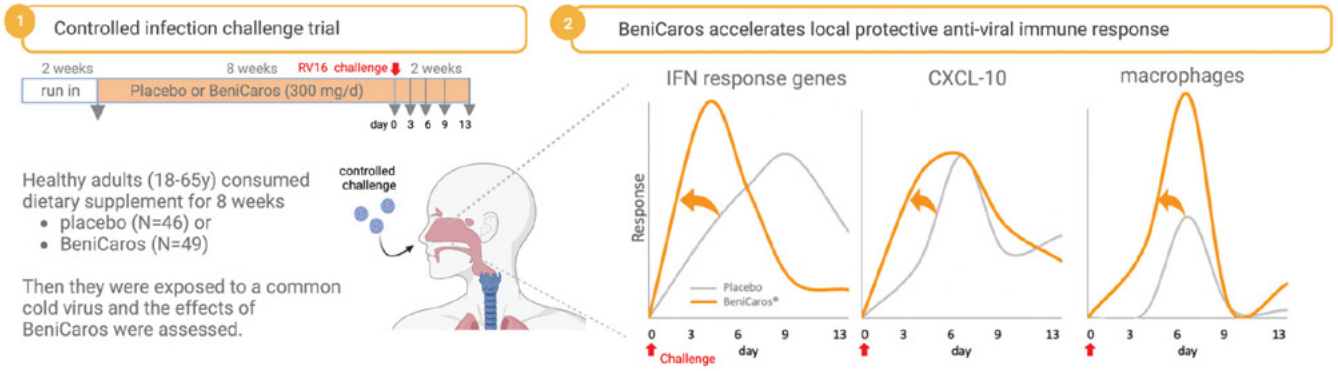
Benicaros trial

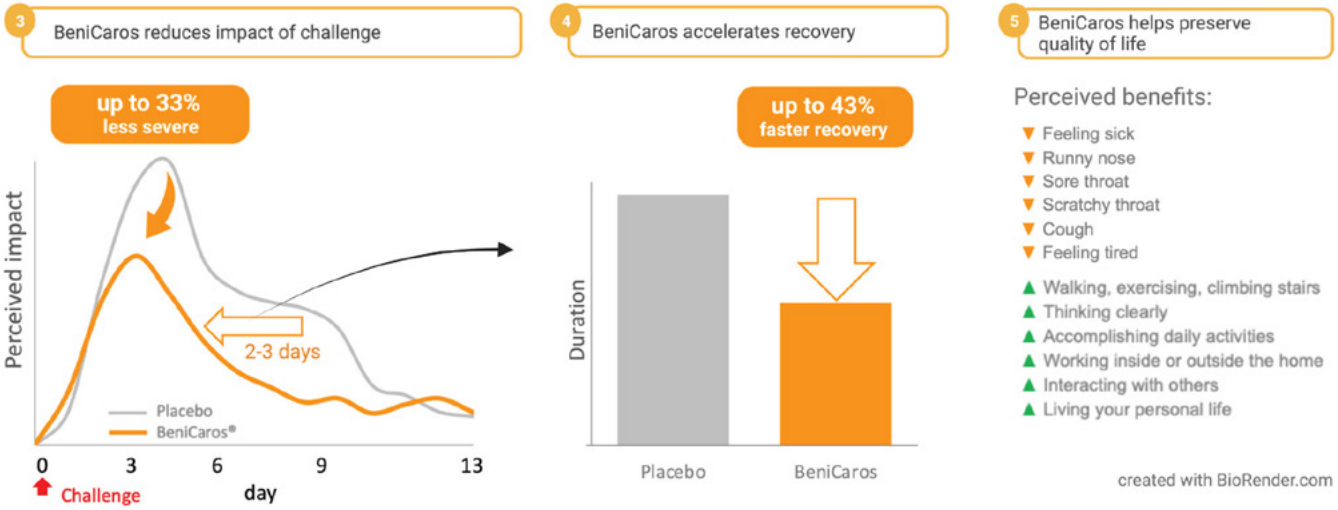
With healthy participants tested response to controlled virus challenge



Selective increase of:

- bifidobacteria (especially *B. longum and B. adolescentis)*
- bacterial species producing propionate or butyrate





Formulation Attributes Support Innovation

As a functional ingredient, the strong science of Benicaros is matched only by its favorable formulation characteristics that create numerous opportunities for product innovation.

Peer-Reviewed Research Supports Compelling Product Claims

- Trains the immune system to work smarter, faster, better.
- A precision prebiotic for improved gut health.
- A precision prebiotic for better gut health and stronger immunity.
- Strengthens the gut ecosystem and accelerates immune responses.
- The precision prebiotic. Better gut health, less gas.
- Supports a gut microbiome composition associated with better health.
- Protects the intestinal barrier to fortify gut health.
- Supports healthy immune function and general well-being.
- Strengthens resilience to help preserve quality of life.

*These statements are a sample of the numerous product claims that can be made in the USA market as reviewed by Covington & Burling LLP.

Minimal Serving Size. While most prebiotics require daily servings of 2 to 10 grams, Benicaros is effective at a serving size as low as 300 mg[ǂ], as confirmed by clinical studies.

Favorable Taste Profile: Benicaros has no impact on taste or smell, ensuring it seamlessly integrates into food, beverage, and supplement formulations without altering sensory experience.

Stability and Versatility: Benicaros is water-soluble, heat-stable, and pH-resistant, making it suitable for a wide range of product formats. Available in multiple powder and liquid forms, it provides exceptional formulation flexibility to meet diverse consumer needs.

Plant-based, Upcycled, Sustainable & Traceable. Benicaros is produced through a verifiable supply chain traceable from carrots in farm fields through the manufacturing process. This upcycled ingredient is unlocked from carrot pomace through a proprietary water-based extraction technology free of organic solvents.

A Clean Label Ingredient. Benicaros is produced through a verifiable supply chain traceable from carrots in farm fields through the manufacturing process. Plant-based Benicaros is U.S. FDA GRAS, Kosher, Halal, GMO-free, gluten-free, and free from additives or artificial ingredients.

ǂ 850 mg in the EU

Benicaros: A True 'Game Changer'

Benicaros is unique, multifunctional precision prebiotic designed to help food, beverage and dietary supplement manufacturers stand out in a competitive market. Backed by unmatched science, a low-dose format, upcycled, with versatile formulation options, Benicaros unlocks opportunities for product innovation and differentiation.

With its consistent and clinically proven health benefits, Benicaros meets the top claims that consumers look for on product labels:[16]

1. Scientifically validated, clinically proven – 82%
2. Multifunctional benefits – 79%
3. Helps lead a healthy lifestyle – 79%

Order a sample today at
www.12taste.com/product/nutrileads-benicaros-prebiotic-fiber/ and make your next product launch a success. Contact 1-2-Taste at sales-eu@12taste.com or +31 85 00 277 48 for more information.

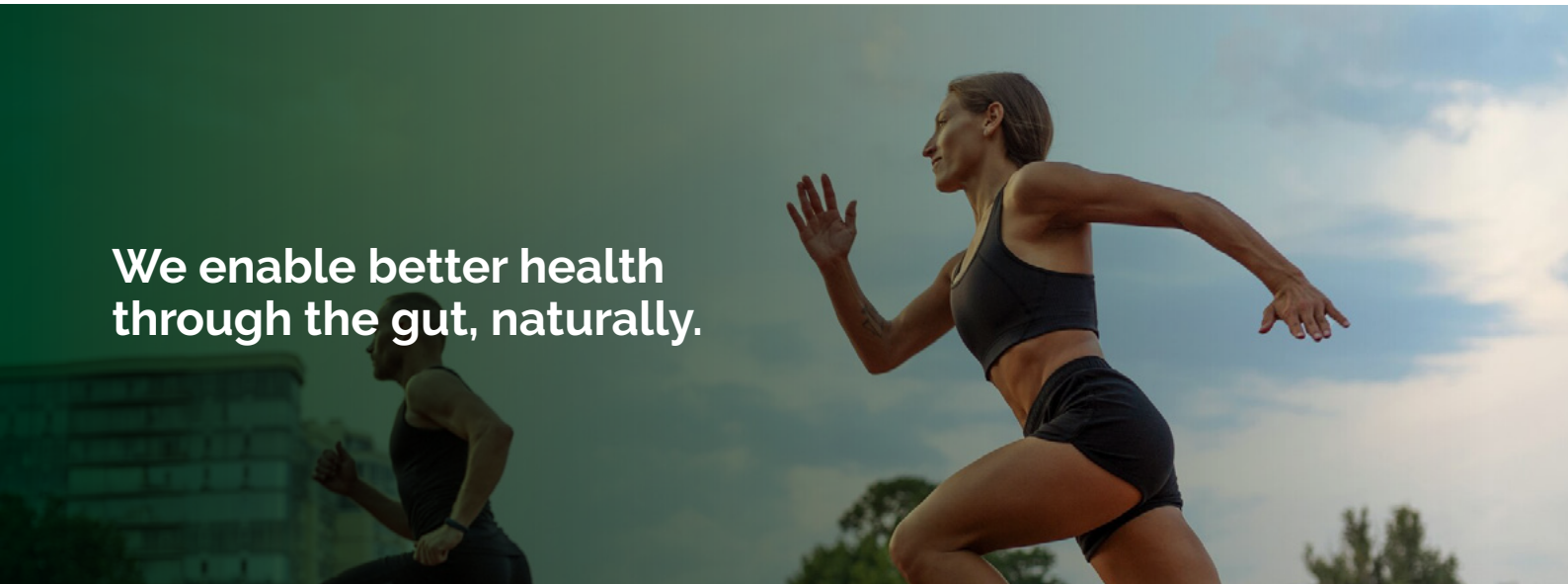
About NutriLeads B.V.

NutriLeads develops and supplies award-winning, plant-based, precision prebiotic fibers that improve human health. Our upcycled, science-based and low-dose precision prebiotic, Benicaros®, is clinically proven to train faster, smarter and stronger immune responses and specifically and consistently modulate the gut microbiome despite interpersonal differences in gut microbiome ecosystems, contributing to multiple health benefits.

We partner with customers to create innovative, science-based foods, beverages and dietary supplements that enable consumers to proactively improve their health, naturally.

NutriLeads - Bronland 12-N, 6708 WH Wageningen, the Netherlands

Disclaimer: This information is targeted for a B2B audience; it has not been evaluated by the Food and Drug Administration. Neither the information nor any formula(s) mentioned are intended to diagnose, treat, cure or prevent any disease.



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