



PREBIOTICS

The Rapidly Rising and Effective Key Nutrient for Digestive and Skin Health

Consumers Seek
New Solutions in the
Health and Wellness
Digestive Category

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INTRODUCTION

Gut and digestive health are cornerstones of systemic health. The process of keeping both on track and in balance is impacted by a wide array of genetic, environmental, dietary, hormonal and microbial influences. Each of these factors contributes to the growing problem of gut dysbiosis, an imbalance of gut microbiota, which contributes to short-term and chronic gastrointestinal conditions. As the science evolves, there is growing evidence that digestive health also affects metabolism, glucose markers, lipid levels, immunity, inflammation and skin.¹

We used to think of the gut as simply playing an important role in digestion. Today, we know there is a great deal of interaction between the digestive system and the immune system, as well as the brain for cognition and mood. As this

paper will show, there is even more to learn about the way gut health affects metabolic and glucose markers, weight management, inflammation and the skin.

Though probiotics and fiber have gained a bulk of the attention in the digestive category for individuals seeking gastrointestinal relief, for many, probiotics may or may not work, and high-fiber options may be too aggressive and come with unwanted and socially uncomfortable side effects. As science shows, the limitations to probiotics are likely because the diet lacks their equally important bioactive counterpart, prebiotics. Numerous studies provide evidence of the health promoting benefits of novel prebiotic fibers for their ability to stimulate the production of beneficial bacteria, which leads to long-term systemic health benefits.

GASTRO-NATION: A COUNTRY IN DYSBIOSIS

According to a 2018 study by Mintel, total U.S. retail sales for the conventional digestive health market exceeded \$4.9 billion.² The market increased 11.7% between 2013 and 2018, largely attributable to Rx-to-OTC transitions in the antacid segment during this time period. Gastrointestinal illness in the United States affects more than 70 million people, representing 48.3 million ambulatory care visits and 21.7 million hospitalizations. A majority, 36.6 million, receive a diagnosis during an office visit.³⁻⁷ The direct financial burden is significant, exceeding \$97.8 billion, plus \$44 billion in indirect costs including disability and mortality.⁸

Among the primary digestive health conditions in the United States, constipation is near the top of the list with 63 million people suffering from a chronic

Top Digestive Conditions in the United States¹³⁻¹⁷

- Gastrointestinal Reflux - 65.4 million
- Constipation - 63 million
- Irritable Bowel Syndrome & Crohn's - 15.7 million
- Peptic Ulcer - 15.5 million
- Liver Disease - 3 million
- Pancreatitis - 1.1 million
- Ulcerative Colitis - 619,000
- Related Metabolic Conditions*- 113 million

*(overweight, obesity, impaired glucose and lipids)

Microbiome Glossary

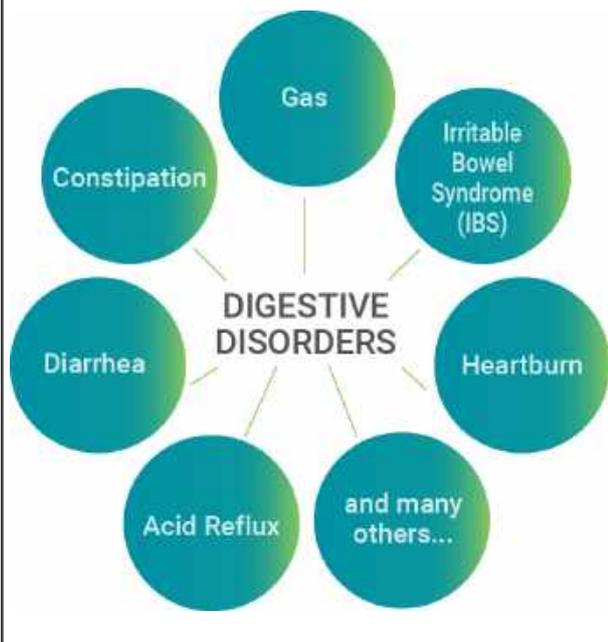
Microbiota: Collection of all taxa constituting microbial communities, such as bacteria, archaea, fungi and protists. When referred to a specific environment, the term is preceded by the said location, for example, 'the gut microbiota' refers to the intestinal tract and the 'oral microbiota' is used when speaking about all the microbes from the oral cavity.

Microbiome: commonly used to refer to the microorganisms themselves (ie, the microbiota).

Probiotics: These are good bacteria i.e. live microorganisms that, when administered in adequate amounts, confer a health benefit to the host.

Prebiotics: Food ingredients that support the growth of probiotic bacteria. These fermented fibers allow for specific changes in the composition and activity within gastrointestinal microflora.²⁴⁻²⁷

Globally, a number of people suffer from a variety of digestive disorders, such as...



form of the condition.⁹ The number of physician visits has risen significantly from 2.5 million annually from 1956-1986 to 22 million in 2016.¹⁰ The reason for the increase is largely attributed to a lack of fiber in the American diet. On average, 6% of American women and only 3% of men currently meet dietary dietary-fiber intake recommendations of 25 – 30 grams per day.¹¹ Researchers found that if 50% of American adults increased dietary fiber intake by as little as 3 g/day, the annual medical costs savings would exceed \$2 billion.¹²

It is exceedingly clear that most Americans may want to but are not able to achieve the recommended dietary intake of fruits, vegetables and fiber to regulate their digestion. Meanwhile, some who try to eat more high fiber foods are often plagued with unwanted discomfort.

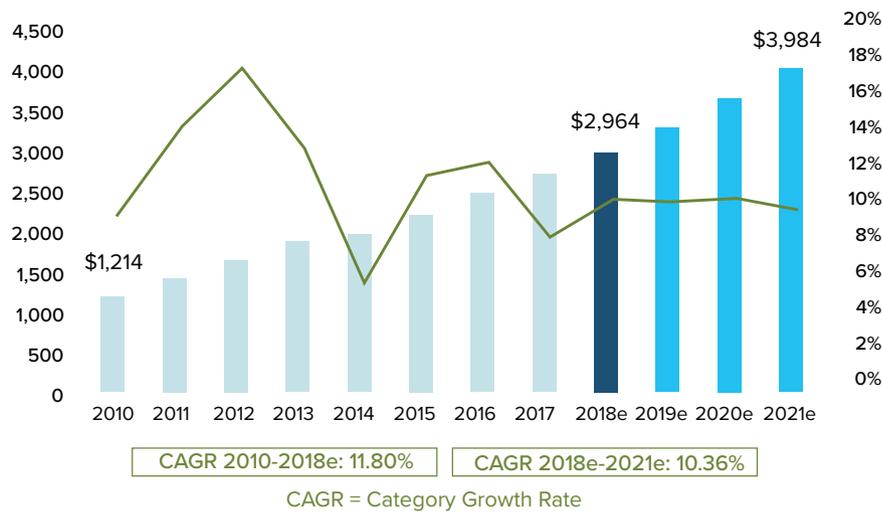
According to two 2018 consumer surveys (KIND Nutrition Collective, Consumer Reports), Americans have “a new-found appreciation for the microbiome,” and are becoming well-versed in the value of fibers that promote beneficial bacteria.^{18,19} This is why prebiotic fibers are uniquely poised as a convenient solution for more fiber in the diet, phenolics for immune response, enzymes for enhanced digestion and beneficial bacteria to provide the gut microbiome with what it needs to flourish. Best of all, prebiotics come from food sources, the very solution that most consumers strive for when seeking digestive health support.

Within the health and wellness category, the digestive market is flourishing because consumers are accepting the fact that gut health is more complex than simply taking a probiotic. This means there is a great deal of opportunity for scientifically proven compounds like prebiotics designed to make a significant difference in digestive health support.

According to an NBJ report, in 2018, prebiotics deserved the spotlight. “For 2018, sales of prebiotics were up 130 percent. The prebiotics market could look

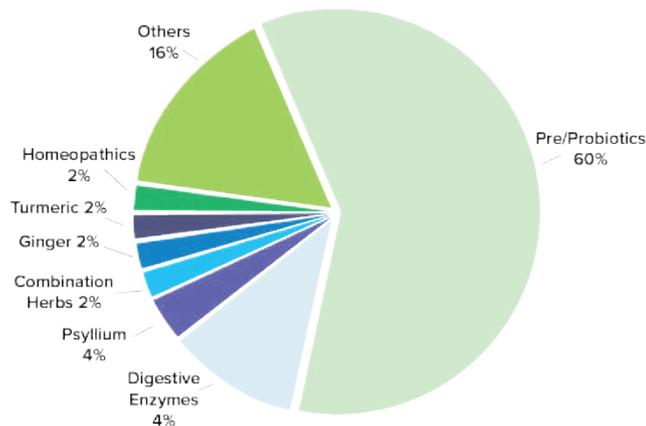
For 2018, sales of prebiotics were up 130 percent.²⁰

Prebiotics and Probiotics Represent Half of All Gastrointestinal Health Sales



Gastrointestinal Health sales grew 8.2% in 2017, reaching \$2.7 billion. In 2021 annual sales are projected to reach \$4.0 billion.

\$3.0B GI (Gut/Microbiome) Health Sales by Product Category, 2017



Pre/Probiotics represented over half of total Gastrointestinal Health sales with \$1.6 billion in annual sales in 2017. This market share has increased significantly from 33.4% in 2007, as Pre/Probiotics has experienced one of the strongest growth rates in the industry over the past decade.

Source: NBJ 2018 Condition Specific Report.

small at \$96 million, but keep in mind that in 2016 that number was \$18 million,” the report said.²⁰ Over the next five years, the prebiotics market is expected to reach \$7.91 billion by 2025 with a growth rate of 10.5% in the fastest growing regions.

New technologies and greater consumer awareness about prebiotics and synbiotics are driving the growth. As consumer knowledge grows, so does the science that supports this category.

“The traditional targets for synbiotics are gut infections and diseases, but we are widening the spectrum,” says Glenn Gibson, Ph.D., of the University of Reading and cofounder of the International Scientific Association for Probiotics and Prebiotics (ISAPP). “The most massive areas moving forward will be the role of gut flora in obesity and metabolic syndrome, as well as the gut-brain axis.”²⁰

THE GUT-HEALTH CONNECTION

If we look at the most basic of definitions, digestive health is defined as the body's ability to absorb and assimilate food through our digestive system. Simplistically, nutrients in, waste out. As we know, there is so much more to it.

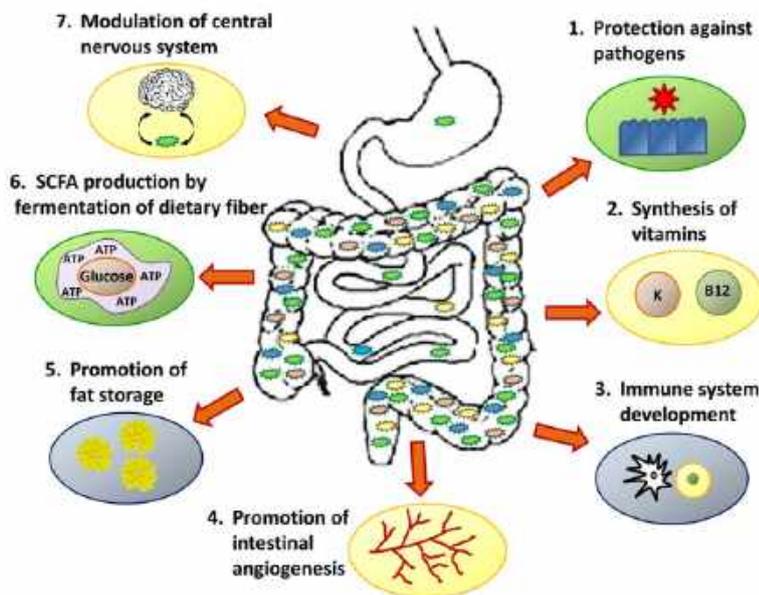
The composition of the gut microbiome influences every aspect of our physiology and regulatory processes, which affects not only digestive health but also systemic health and one's risk for developing diseases.²¹ At one time it was believed that the gut-axis was only linked to the brain, but there is growing evidence that this bidirectional gut-axis is also connected to the immune, metabolic and endocannabinoid systems, as well

as the skin. The microbiome is dynamic and, as we learn more about how to manipulate the microbiota to address dysbiosis, we are also learning how to reduce the risk of certain conditions and diseases. See Figure 1.

This gut interconnectedness means that a large number of conditions and diseases do have their origins in the digestive system and, if left untreated, result in a sub-standard quality of life.

Figure 1

The Human Microbiome: Beyond the Gut



The human microbiome plays an important role in control of vital homeostatic mechanisms in the body. These include enhanced metabolism, resistance to infection and inflammation, prevention against autoimmunity as well as an effect on the gut-brain axis.²³

WHAT IS A PREBIOTIC?

While probiotics get most of the spotlight, prebiotics are the workhorse of the microbiome.²² These fibrous, non-digestible carbohydrates act as a food source for probiotics in the gut. Found mostly in plants, prebiotics use soluble fibers to stimulate the growth and proliferation of beneficial bacteria (probiotics) by selectively altering the composition of the gut microbiota.

The lining of one's gut is covered in bacteria that create a mini-ecosystem called the microbiome. There are more than 1,000 unique species of bacteria in your gut, most of which are closely aligned with the immune system. Also, an individual's microbiome is so unique that randomly adding probiotics may not be beneficial. There are two ways to maintain balance within the microbiome – ingesting probiotics and helping the microbes that are already there to grow, by feeding them prebiotics.

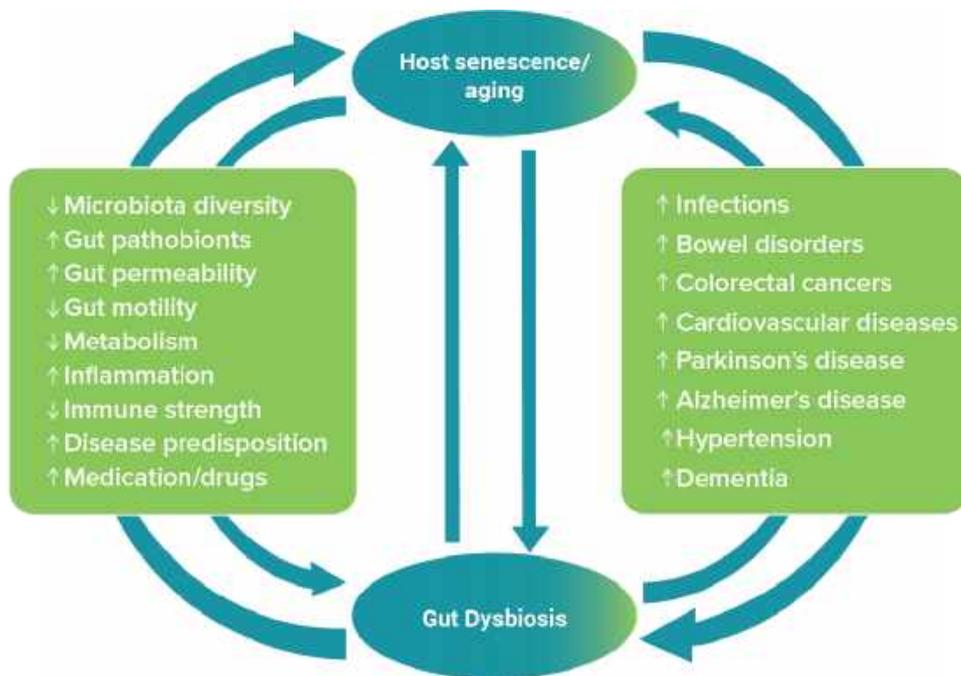
Probiotics contain live organisms of specific strains of microbes or blends of microbes. The diversity of the specific bacterium(a) are so vast that it is often difficult, if not impossible, to identify which probiotics should be consumed to target specific gastrointestinal issues. The other issue is product integrity as probiotics pass through the gut. The safe passage of these microbes can be impeded by heat, stomach acid and time.

On the other hand, prebiotics are not as fragile. It is safe, easy and effective to stimulate the growth of your own probiotics in the gut with the help of prebiotics. Foods like kiwi fruit, onions, Jerusalem artichokes and chicory contain prebiotic fibers. Unfortunately, it's difficult to regularly consume enough of these beneficial fibers to counteract bacterial imbalances in the gut that may be causing gastrointestinal problems and other health issues.

Then there is age. With it comes changes in the gut microbiome. The gut microbiome goes through the most dramatic changes in two stages of life – infancy and old age. Though the diversity of the microbiome fluctuates, by the age of three, a child's microbiome is very similar to its future composition in adulthood. However, with age, the immune system begins to weaken and becomes unstable.²⁴ Gut microbes do not age per se, but comorbidities related to imbalances in gut microbiota do increase with age. While it is unclear if the alterations are “cause or consequence,” there is an impact on health and disease. Research by Nagpal et al. 2018 notes: “For decades, it has been known that the aging process involves attenuation of the host's ability to sustain a robust and efficient immune response and metabolic health.”²³ These disturbances may be primary risk factors for predispositions to cardiovascular disorders, infections, bowel diseases, autoimmune diseases, cancers, diabetes, obesity and neurodegenerative diseases. See Figure 2.

Figure 2

Aging and Gut Dysbiosis



The two-way connection between human gut microbiome and host aging, and the potential underlying and/or associated elements.²⁴

OPTIMIZING GUT FLORA

Advantages of Prebiotics for Gut Health

Every day there is a balancing act going on in one's gut between generally non-pathogenic bacteria and potentially pathogenic microorganisms. How these bacteria shift, change and thrive provides valuable insight into how to attain health or fall victim to illness. Studies support the concept that individuals with impaired digestion, reduced immunity and unhealthy metabolic system may have a microbial signature that is different than healthy subjects. How to modulate these imbalances and leverage the positive impact of probiotics and prebiotics are at the core of optimizing gut flora.

Though probiotics have gained much of the spotlight for their ability to manage gastrointestinal symptoms, there are limitations. Laboratory studies often show great promise, but consumption shows that the environment in the human gut may not always be conducive to strain survival. Additionally, not all strains are viable as probiotic supplements due to their anaerobic nature. Prebiotics may be easier to integrate into the human digestive system, all the while providing the same, if not more benefits, as probiotics.



PreticX® for Gut and Metabolic Reconditioning

To date, most of the prebiotics on the market are fructooligosaccharide (FOS-) and galacto-oligosaccharide (GOS-) based ingredients. A newcomer, called PreticX®, shows great promise for its low-dose efficacy (1g per day), high tolerability and positive safety record. Above all, PreticX has a unique ability to promote a superior microbiome balance by increasing Bifidobacterium, while optimizing the Firmicutes/Bacteroidetes ratio.^{28,29} This balanced ratio has been found to affect weight management and metabolic health.

The role of the gut microbiota for weight management is a much needed and exciting new direction of inquiry. Research from 2006 concluded that gut microbiota is a determining factor in healthy weight management.³⁰ More specifically, an increased Firmicutes to Bacteroidetes ratio increases an individual's capacity to harvest energy from the diet. This study supported the theory that a diet high in saturated fats and low in fruits and vegetables allows microbes which support a healthy weight to be overtaken by microbial colonies that promote weight gain.³¹⁻³³

Given the unlikelihood that people will consume adequate amounts of fruits and vegetables for healthy microbe development, specialty prebiotics like PreticX are gaining greater interest. A

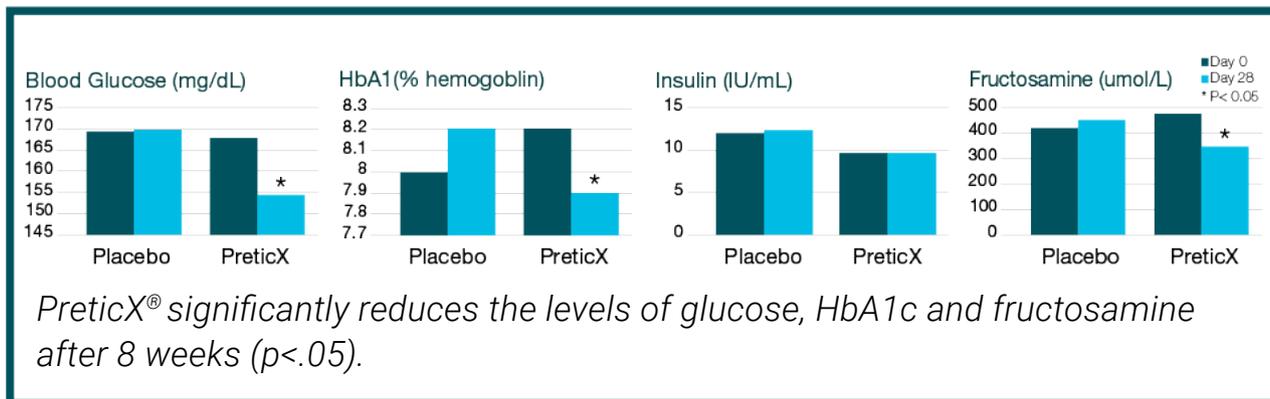
small population study of healthy and prediabetic individuals showed that 2g/day of PreticX decreased the abundance of *Howardella*, *Enterorhabdus* and *Slackia* strains (genera associated with pre-diabetic conditions) in all participants.

Improve Gut Health, Reduce Diabetes Risk

Ongoing research suggests that metabolic disorders, such as type-2 diabetes, are associated with inflammation and gut dysbiosis. With as little as 2g/day (8 weeks) of a specific prebiotic (xylooligosaccharides or XOS) the gut is able to reduce the risk of inflammation and four bacterial taxa that promote the development of pre-diabetes. Researchers conclude that XOS prebiotics, the active ingredients in PreticX, can “potentially promote an optimal gut microbiota profile,” and thus reduce the risk of pre-diabetes in healthy individuals and those at risk for pre-diabetes.⁸⁷

PreticX also increased the abundance of *Blautia hydrogenotrophica*, a genus associated with glucose intolerance. A follow-up study, using 4g of PreticX, saw significant reduction in blood glucose, HbA1c, and fructosamine after eight weeks.³⁴ See Figure 3.

Figure 3



Recommended Advantages of PreticX® Prebiotic:

- Increases the number of Bifidobacteria in the colon
- Provides metabolic reconditioning by optimizing Firmicutes/Bacteroidetes ratio
- Positive impact on serum cholesterol, triglycerides and glucose concentrations
- Well tolerated to promote intestinal regularity and maintain good digestive health



Formats and Applications for PreticX®:

- Human clinical studies support low dosage of 1g/day
- Suitable for capsules, tablets, stick packs and liquids
- Mild, neutral and slightly sweet flavor
- Stable at broad pH (2.3-8.0) and temperature range (80-120° C)
- FDA GRAS and EFSA Novel Food Approved
- Food, bakery and functional beverage applications



Livaux® and Golden Kiwi's Bioactive Prebiotic Fibers

Since 1977, a significant number of peer-reviewed studies have been published that report the health benefits of gold kiwi fruit. Among those benefits: improved immune health in older men and women, increased antioxidant status in healthy test subjects, mood improvement in young men with elevated mood disorder scores, and

normalized iron status in women with reduced iron stores.³⁵⁻⁴⁵

There is more. Kiwi fruit fiber acts as a fecal bulking agent because of its high-water retention capabilities. For instance, kiwi fruit contains 12-13 g water/g insoluble fiber, which is twice that of an apple and four times that of

wheat bran. These unique properties are due to its 1/3 soluble fiber content, made up of mostly pectic polysaccharides, and 2/3 insoluble fiber, from cellulose, hemicelluloses and pectin.⁴⁶ The prebiotic fibers are also completely fermentable by the gut microflora, and thus play a significant role in microflora composition. Recent science supports the role of kiwi fruit as a prebiotic substrate. Studies show that fecal fermentations in vitro of gold kiwi increased the growth of *Bifidobacterium* spp., as well as *Bacteroides* spp. and *Parabacteroids* spp.^{47,48} Another unique feature of gold kiwi fruit is its ability to increase the level of *Faecalibacterium prausnitzii* (*F. prau*), a beneficial bacterium to the human intestine. *F. prau*, which resides primarily in the large intestine, readily ferments soluble fiber and polyphenolic compounds. It is responsible for increased production of butyrate, a short-chain fatty acid that has beneficial anti-inflammatory and immune-enhancing activities.⁴⁹⁻⁵²

Livaux[®], a food quality ingredient derived from the New Zealand gold kiwi fruit, is supported by pre-clinical and clinical data. Its bioactive composition has been tested to support the digestion and laxation process. The constituents include:

1. Soluble and insoluble fiber
2. Polyphenolic compounds that act as direct or indirect antioxidants, via

upregulation of the transcription factor Nrf2.⁵³

3. Prebiotic substrates including fiber, carbohydrates and polyphenolics that act as microbiome modulators that promote beneficial bacterial growth and/or inhibit the growth of pathogenic bacteria.

Livaux[®]'s Clinical Evidence

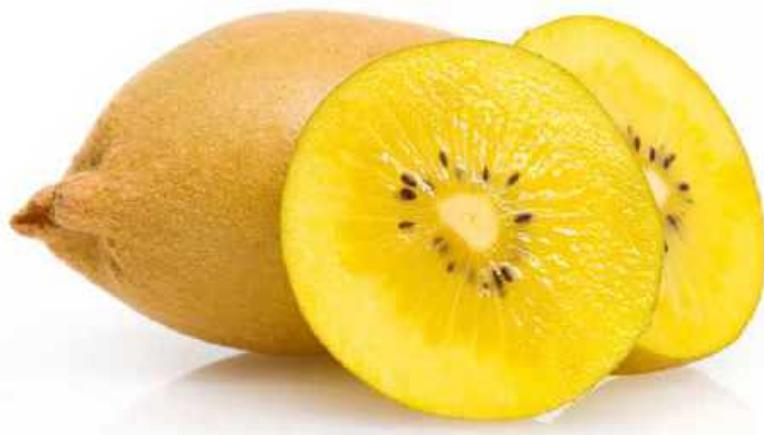
One of the primary benefits of Livaux is its role as a prebiotic substrate that is selectively used by host microorganisms to shape the gut microbiota into a healthy environment. The following is a scientific summary review of the benefits of the golden kiwifruit.

- Increases the levels of *Faecalibacterium prausnitzii* (*F. prau*), a beneficial bacterium in the human intestine.⁵⁴ Livaux has a unique ability to increase the ratio of *F. prau*, which has multiple beneficial effects including anti-inflammatory and immune enhancing activities.
- Reduces levels of *F. prau*, which are associated with constipation, allergies and other digestive issues.⁵⁵ Since *F. prau* is highly anaerobic, it cannot be replenished as a probiotic, and therefore must be consumed as a prebiotic fiber.
- A single dose of Livaux given to healthy and functionally constipated individuals showed marked abundance of *F. prau*, by two-fold, in the functionally constipated group.⁵⁶

- Another study showed that a dose of 2,400mg/daily* of Livaux over a four-week period increased the number of bowel movements when compared to washout at baseline.⁵⁷ In a symptomatic population, it is considered clinically meaningful when individuals experience an increase in > 1 bowel movement per week, which is statistically significant.

Given golden kiwi fruits' nutrient qualities – including vitamin C, folate, beta-carotene, lutein and potassium – combined with a stellar safety record, Livaux is suitable for all age groups seeking a product that increases F.

prau—those seeking to support healthy bowel frequency, immune health and antioxidant intake.



* Recommended dose for Livaux is 600 mg - 2400 mg. Correct BU dose with synbiotics is 50 mg.

Recommended Advantages of Livaux® Prebiotic:

- Increases number of F. prau
- Supports healthy gut modulation
- Gently facilitates bowel regularity
- Ingredient derived from whole golden kiwi fruit
- Natural source of fiber, vitamin C, and polyphenolics
- Safe, no side effects, natural, clean label ingredient
- Excellent organoleptic properties in taste, aroma, texture, and mouth feel



Compatible Formats and Applications:

- Digestive health
- Detoxification
- Mild, neutral and slightly sweet flavor
- Pairing with probiotics
- Fruit, veggie, and green food blends
- Whole food vitamin and mineral complexes
- Enzyme formulations
- Fiber products
- Super-fruit brands

Though one may surmise that gold and green kiwi fruits are biologically similar, green kiwi has unique properties that give it remarkable bioactive properties over its golden cousin. For instance, green kiwi contains actinidin, a highly proteolytic enzyme. Using in-vitro gastric digestion models, studies show that actinidin-containing extracts enhance digestion of proteins, including caseins (milk proteins).⁵⁸

The food-quality ingredient, Actazin®, derived from New Zealand green kiwi, contains a number of bioactive nutrients that effectively and gently support digestion and the laxation process. They include: soluble and insoluble fiber, polyphenolic compounds that can act as direct or indirect antioxidants (via upregulation of the transcription factor Nrf2); prebiotic substrates of fiber, carbohydrates and polyphenolics that promote the growth of beneficial bacteria or inhibit pathogenic bacteria growth; and, as mentioned, actinidin which enhances protein digestion.

There is evidence that green kiwi's phenolic compounds can affect regularity by influencing colonic microflora. Early studies show that Quercetin, the most notable bioactive, may have the ability to inhibit pathogenic bacteria.⁵⁹

- A number of studies in fresh and freeze-dried green kiwi show that it modulates gut microbiota.⁶⁰⁻⁶⁴ Studies showed that Actazin supported the growth of two probiotic strains, Bifidobacteria and Lactobacillus species, while inhibiting the growth of pathogenic bacteria (Escherichia coli, Staphylococcus aureus, Salmonella enterica). The prebiotic also increases butyrate, a key metabolite in the human colon that provides an energy source for the colon's epithelial cells and contributes to gut-barrier function, which has immunomodulatory and anti-inflammatory properties.⁶⁵⁻⁶⁷
- A 2,400 mg dose* of Actazin increased stool frequency and improved stool form. Participants reported improved quality of life scores for inflammatory bowel syndrome scores.⁶⁸ Actazin also supports higher short-chain fatty acid (SCFA) levels vs control.⁶⁹ And, when combined with Lactobacillus probiotic, the combination yielded an intermediate level of SCFA, as compared to Lactobacillus alone, which yielded the lowest SCFA.

* Recommended dose for Actazin is 600 mg - 2400 mg.

Advantages of Actazin® Prebiotics and Enzymes:

- Promotes and facilitates bowel regularity
- Natural source of fiber, polyphenols and proteolytic-protein digestive enzymes
- Safe, no side effects, natural, clean label ingredient
- Excellent organoleptic properties in taste, aroma, texture and mouth feel

ACTAZIN[®]

Compatible Formats and Applications:

- Digestive health formulations
- Detoxification formulations
- Prebiotic and probiotic formulations
- Green food blends (capsules, tablets, powders)
- Fruit and veggie formulations
- Whole food vitamin complexes
- Enzyme formulations
- Super-fruit products
- Fiber formulations



Among the variety of prebiotics known for their ability to grow beneficial bacteria from their host microbiome, the most studied include Galacto-oligosaccharides (GOS). GOS are prebiotic fibers made up of chains of galactose sugars of variable lengths. These short-chain dietary fibers, which are undigestible in humans, nourish the intestinal lining and create healthy gut flora.

AIDP's NeoGOS™ is a patented form of GOS that selectively stimulates the growth and activity of beneficial bacteria in the colon. Its unique properties beneficially affect the host by selectively stimulating the growth and activity of

limited number of beneficial bacteria in the colon.

NeoGOS is developed by a unique process that yields a high-purity, low-glycemic GOS. The short-chain dietary fibers that comprise NeoGOS resist gastric acidity and are fermented by the intestinal flora, yielding production of short-chain fatty acids, which are critical to healthy colon cells and provide immune regulation, enhanced energy and metabolism. NeoGOS provides the oligosaccharides that are naturally occurring in human milk, making it a safe, effective and highly tolerable prebiotic suitable for adults, children and infants.

Advantages of NeoGOS™

- Low glycemic form of GOS
- High purity
- Improves gut environment
- Enriches lactic acid bacteria and Bifidobacteria
- Increases beneficial bacteria and decreases harmful bacteria
- Supports a healthy immune system
- Pleasant tasting and palatable
- Low water activity
- Heat resistant



Compatible Formats and Applications:

- Gut health prebiotics
- Infant nutrition
- Children's prebiotics
- Gut health balance



BeautyOLIGO® Skin-Gut Connection

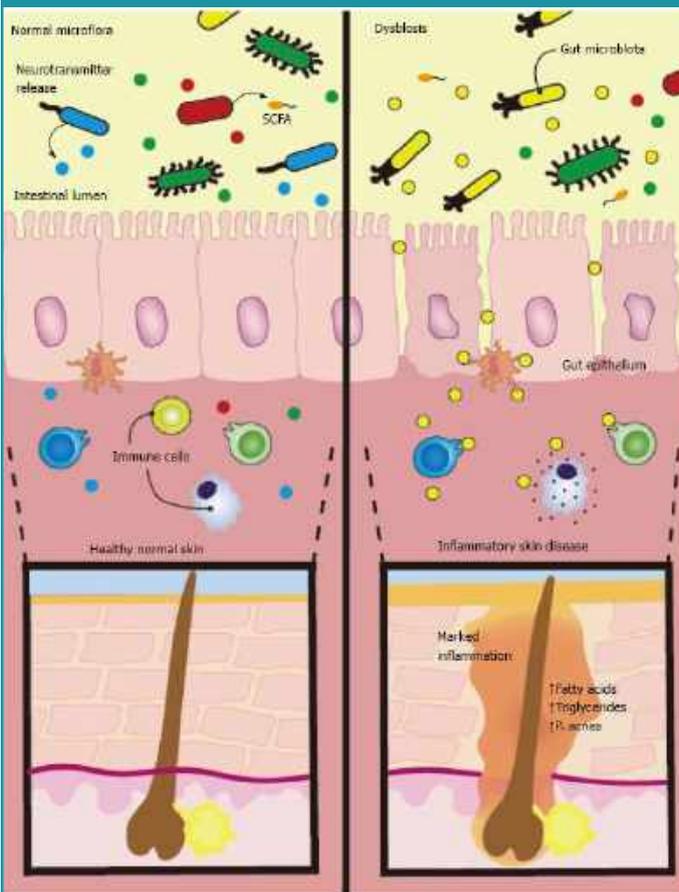
Both the skin and digestive tract form the largest organs of the body. They share a unique responsibility to provide nutrients and information. The intestine, the body's primary immune organ, along with the mucosal immune system of the gut, are linked to the skin's immune system through the migration of immune cells. As noted by Vaughn, 2017, "Although the mechanisms for how the gut and skin communicate are not fully understood the association likely involves a complex connection between the nervous, immune, and endocrine systems as well as environmental factors."⁷¹ t role in this process because they influence the bioavailability of

nutrients both in the gut and the skin that influence this complex communication system.

The GOS prebiotics affect not only digestion, but the skin as well. BeautyOLIGO® is a natural form of GOS with demonstrated benefits on skin health (hydration and wrinkles) with a low dosage (2 g/day), as shown in a clinical trial performed in healthy volunteers. Through a gut connection, BeautyOLIGO works on the skin by improving moisture, inhibiting water loss, and decreasing erythema and wrinkles on the skin. See Figure 4.

Figure 4

Proposed Mechanism of Action for Skin-gut Axis⁶⁹



There is emerging evidence linking dermatological disorders to alterations in gut bacteria. Researchers hypothesize intestinal flora produce neurotransmitters in response to stress that can modulate skin function. These neurotransmitters cross the intestinal epithelium, enter the bloodstream, and induce systemic effects. Along with neurotransmitters, the gut microflora releases short chain fatty acids (SCFAs), which can also enter systemic circulation and affect the skin. Additionally, diet may influence inflammation in the skin through nutrient signaling and release of long chain fatty acids, leading to excessive stimulation of sterol regulatory element-binding protein 1 and increased synthesis of fatty acids and triglycerides promoting *Propionibacterium acnes* overgrowth.

BeautyOLIGO® meets a growing demand for consumers seeking products that improve skin and support healthy aging. “More than ever, consumers are subscribing to the concept that beauty truly starts from within—if you provide your body with the right nutrients and create a healthy internal environment, it will show on the outside,” says Samantha Ford, business development director, California-based AIDP.

By way of providing digestive support, BeautyOLIGO® exhibits properties that are beneficial to the skin. For instance, BeautyOLIGO enhances the activity of TIMP (tissue inhibitor of the metalloproteinase) and inhibits matrix metalloproteinases (MMP-2 and MMP-9).⁷⁰ This action improves skin hydration by improving the water holding activities of the skin and inhibiting water loss in the skin.⁷¹ Another benefit is its ability to decrease melanin and erythema on skin, which boosts collagen production, thus decreasing the depth and appearance of wrinkles.⁷²

Advantages of BeautyOLIGO®

- Improves skin hydration
- Supports appearance of healthy skin
- Strengthens immune system
- Supports healthy gut balance
- Low glycemic form of GOS
- High purity
- Pleasant tasting and palatable
- Heat resistant



Compatible Formats and Applications:

- Compatible Formats and Applications:
- Gut health prebiotics
- Skin Care
- Beauty from Within
- Digestive health formulas
- Immune and inflammation support



Gutgard™, the Flavonoid-Rich Bioactive for Gut Health

The Glycyrrhiza glabra root has a long history of use for gastric disorders. Most are familiar with licorice, made from the extract of the G. glabra root. The root is rich in flavonoids but more often than not the extraction process (found in deglycyrrhized licorice (DGL)) destroys the beneficial flavonoids. The ingredient Gutgard® is made from a soft and unique extraction process that captures the bioactive flavonoid chemistry of the plant. GutGard is standardized to contain $\geq 10\%$ flavonoids with $< 0.5\%$ glycyrrhizin to avoid undesirable side effects.

Functional dyspepsia affects a significant number of North Americans and Europeans, 20% of whom have consulted with either physicians or hospital specialists. More than 50% of patients with functional dyspepsia are on medications and 30% of dyspeptics reported taking days off work or schooling.⁷³⁻⁷⁵ In a study of 50 participants [Raveendra et al., 2012], all diagnosed with functional dyspepsia, GutGard (75mg twice daily) or a placebo was given for 30 days. GutGard showed beneficial effects by reducing the symptoms of functional dyspepsia

(GutGard: 51% Vs. Placebo 29%) and by improving their quality of life (GutGard: 55% Vs. Placebo 19%).

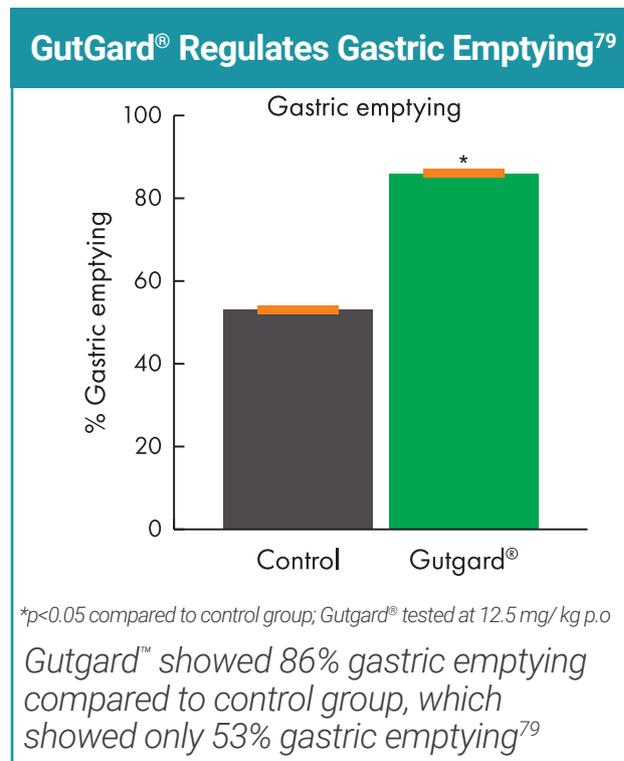
“Changes in total symptoms scores from baseline values were evaluated, and GutGard supplementation has shown to considerably improve the total symptoms scores.”⁷⁸

A common issue with functional dyspepsia is gastric emptying and gastrointestinal transit. Gastric emptying (GE) is defined as the process of transferring the gastric content to the small intestine, by way of motor activity of the stomach, pylorus, and duodenum under the control of inhibitory and stimulatory mechanisms. Disturbances of GE are common among people with functional dyspepsia.

Previous studies show that *G. glabra* root may support the process of GE because of antispasmodic and prokinetic effects from the blockage of the calcium channels.⁷⁷ A Wistar rat study using GutGard found that the percentage gastric emptying and gastrointestinal transit were dose dependently enhanced by GutGard, as compared

to the control.⁷⁸ (See FIGURE 5) The researchers believe that the gastric motility effects of GutGard may be from the presence of the flavonoids glabridin and isoliquiritigenin.

Figure 5

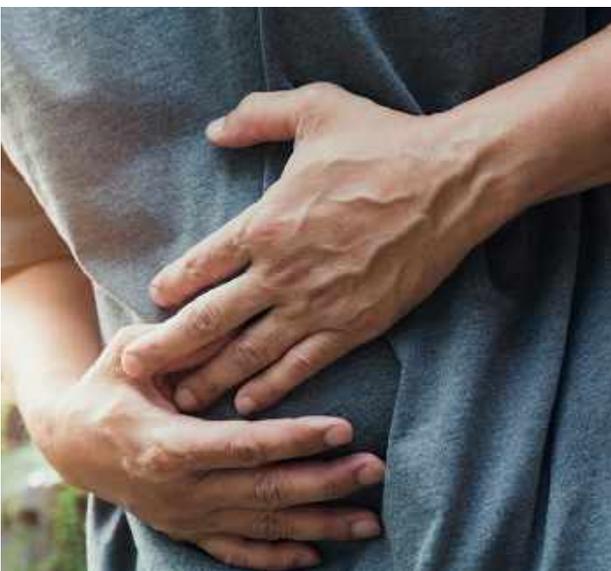


Unhealthy levels of *Helicobacter pylori* (*H. Pylori*) can create a significant problem in gastrointestinal health. This gram-negative spiral, or helical shaped bacteria, inhabits the gastric epithelial cells in nearly half of the world's population.⁷⁹ There is evidence that *H. pylori* could affect anywhere from 7% to 95% of populations within industrialized countries.⁸⁰

More than 50 flavonoids have been retained and identified in GutGard, which have been shown to have beneficial

properties for gut health, particularly for functional dyspepsia, gastric emptying and protecting the stomach from discomforts caused by *H. pylori*.

As compared to aqueous based DGL extracts, GutGard has been shown to be far superior for anti-*H. pylori* activity. And, as a result of the concentrated nature of the flavonoids present in GutGard, the efficacious intake levels are much lower than other commonly used compounds. For instance, DGL is commonly formulated at a recommended intake of 1500 mg/day while GutGard is only 150mg/day. This smaller dosage does not sacrifice efficacy. A study investigated the anti-*H. pylori* properties of GutGard using animal models infected with the bacteria.⁸¹ The study found that within eight weeks following GutGard treatment, the level of *H. pylori* colonization in the stomachs of the laboratory animals was notably decreased. GutGard exerts gut health benefits possibly by protecting gastric mucosa and by regulating bowel



movement. Gastric mucosa is known to get compromised by excessive inflammatory mediators, free radicals and *H. pylori*. GutGard normalizes inflammatory mediators [Chandrasekaran et al., 2011; Thiyagarajan et al., 2011], exhibits antioxidant activity [Mukherjee et al., 2010] and controls *H. pylori* [Asha et al., 2013; Kim et al., 2013; Puram et al., 2013]. Bowel movement is found to be altered in people with symptoms of indigestion and *H. pylori*.

Gut microbiota is increasingly recognized to play a critical role in gut health. Imbalance in the gut microbiota has been identified in individuals suffering from irritable bowel syndrome. Inhibition of disease-causing pathogens without affecting beneficial bacteria of the gut microbiota is vital for gut health.

Symptoms of Functional Dyspepsia

- Upper abdominal fullness
- Upper abdominal pain
- Belching
- Bloating
- Early satiety
- Nausea
- Vomiting
- Regurgitation
- Heartburn
- Loss of appetite

Advantages of GutGard™

- Management of H. pylori bacteria
- Manages common discomforts of functional dyspepsia
- Regulates bowel function
- Gastroprotective
- Supports Immunity
- Balances inflammatory mediators
- Ultra-low glycyrrhizin
- Safe, efficacious with strong scientific support



Compatible Formats and Applications:

- Compatible for combining with probiotics, prebiotics, and digestive enzymes
- Suitable for a wide-range of delivery systems, chews, gummies, beverages and powders
- Low-water activity
- Low-dose ingredient
- Neutral tasting

CONCLUSION

Gut and digestive health are central to systemic health. Yet Americans continue to suffer from a host of digestive disorders, including bloating, constipation, diarrhea, gas, heartburn, acid reflux, irritable bowel syndrome, H. pylori, and many others. It is no wonder that health care providers are seeing an increase in chronic conditions related to metabolism, glucose markers, lipid levels, immunity, inflammation and skin.

To date, digestive health products have been largely focused on probiotics and fiber. As this report shows, there are newly found solutions in prebiotics that support the growth of beneficial bacteria and compounds high in flavonoids, such as *Glycyrrhiza glabra* root, which improves motility and reduce symptoms of dyspepsia.

When seeking new and novel ingredients in the digestive and skin category, it is vital to choose products that are scientifically proven. Consumers are looking for solutions and, in this category, they know fairly quickly if the products are helping them, or not. This is why AIDP is a proven leader in the ingredient category for advanced compounds that are scientifically supported, and provide the benefits consumers expect.

The future of gut health is one that supports the gut-brain axis, the gut-skin axis, the gut-immune axis, the gut-metabolic axis and a healthy microbiome. As shoppers gain a stronger understanding as to how these important systems are interconnected and how they communicate vital information to one another through the microbiome, the importance of prebiotics and supporting ingredients cannot be underestimated.

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AIDP Inc.(Advanced Ingredients for Dietary Products) is a leader in functional ingredients with a focus on extensively researched products. We provide cutting edge solutions that meet consumer demand for wellness and healthy aging. AIDP, identifies trends early, provides unique solutions and works with customers to formulate strong market potential end products. Our commitment is to source high-quality ingredients and provides proprietary solutions that address formulation challenges.

AIDP has an extensive prebiotic portfolio that includes PreticX®, Livaux®, Actazin®, GutGuard® and BeautyOLIGO® for digestive health. AIDP's success is grounded in our depth of experience and commitment to strong science for functional food, nutritional and beverage product development.

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