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# GPA HEALTH CARE PROFESSIONAL GUIDE TO PREBIOTICS

Developed by the Global Prebiotic Association
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# INSIDE THE GUIDE

This guide was developed to help provide education and resources on prebiotics. As science evolves in this emerging category, the guide will be updated. It will also be further developed based on field feedback and engagement.

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PrebioticAssociation.org

# About GPA

The Global Prebiotic Association (GPA) is non-profit trade association comprised of scientifically-validated prebiotic ingredient manufacturers, brand holders, retailers, and service companies. GPA is the only global trade association focused on prebiotics and their applications and science. GPA is committed to raising awareness about prebiotics, their emerging and well-established health benefits, and prebiotic product integrity and efficacy.

## Core Focus Areas

- Education
- Science
- Industry Growth

Icon credit: Flaticon.com

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# What is a prebiotic?

The term prebiotics has been used for almost three decades; however, a globally unified definition is still a work in progress despite numerous efforts to reach a global consensus. In its own submitted definition paper, GPA builds on previous prebiotic definitions to propose the following expanded definition for a prebiotic:

**Definition:**
*a product or ingredient that is utilized by the microbiota producing a health or performance benefit." This definition considers additional locations of action besides the gut and highlights prebiotic performance benefits.*

**Prebiotic Effect:**
*a health or performance benefit that arises from alteration of the composition and/or activity of the microbiota, as a direct or indirect result of the utilization of a specific and well-defined product or ingredient by microorganisms.*

# WHY CONSUMERS TAKE PREBIOTICS (SUPPLEMENTS)

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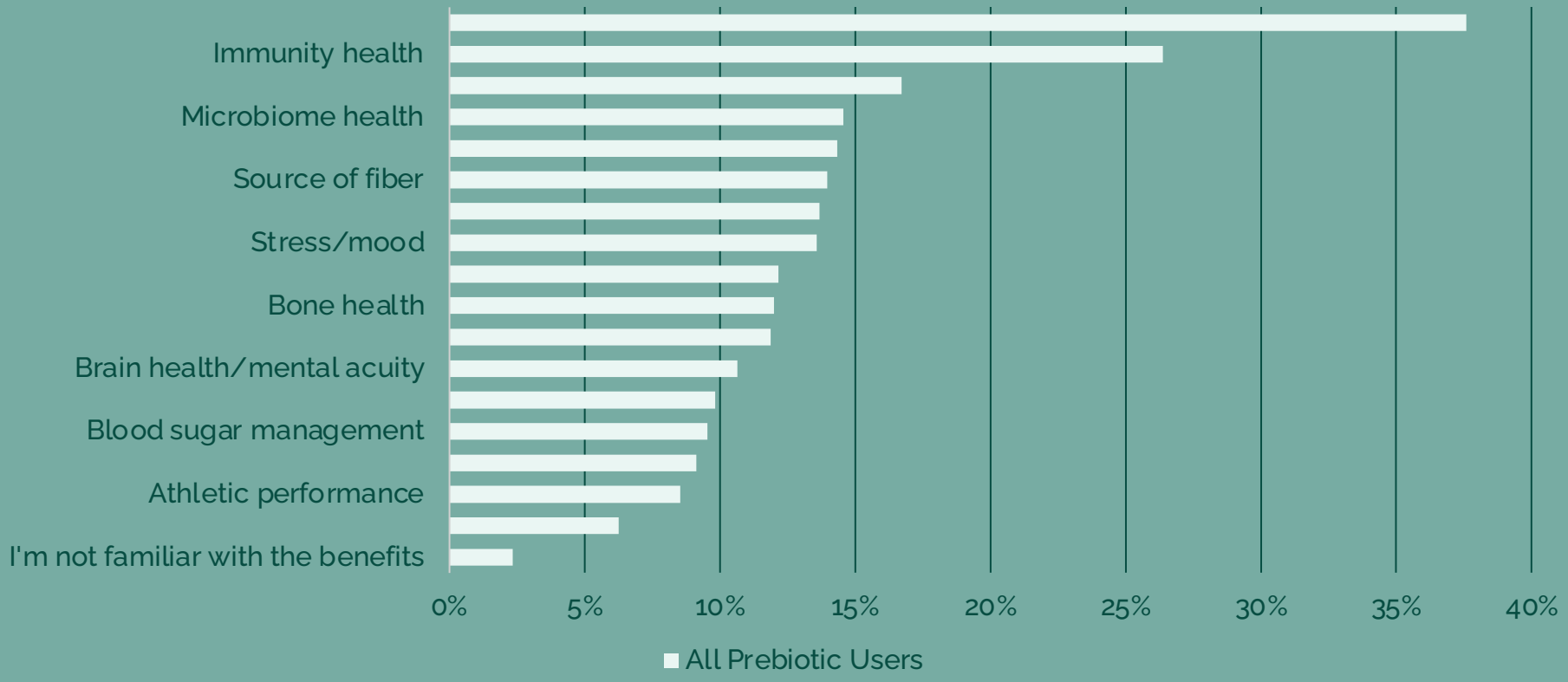
**Key Insights:**

- Prebiotic users generally took prebiotics for gut health and digestion followed by immunity and regularity.




*Note: Prebiotic users n=1711. Question PRE1: "Why do you take a prebiotic supplement?"*

# WHY CONSUMERS TAKE PREBIOTICS (FUNCTIONAL FOOD & BEVERAGE)

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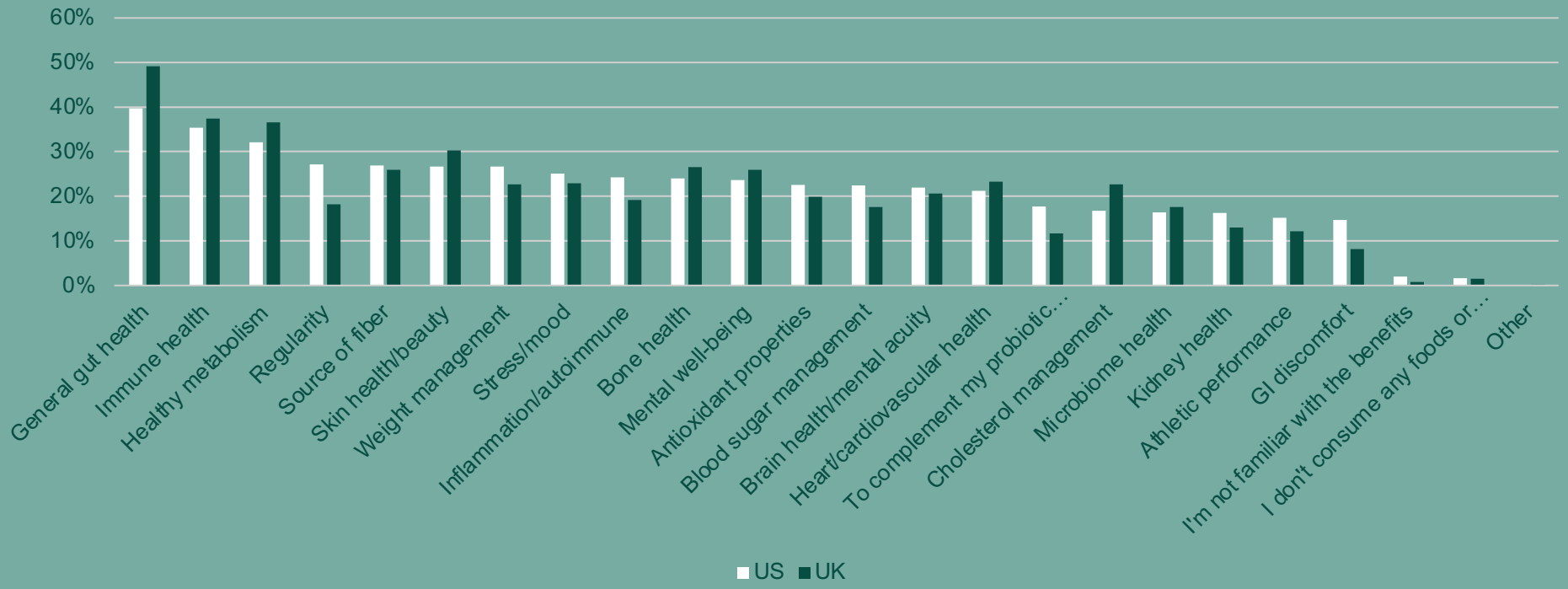
**Key Insights:**

- Both US and UK respondents mark general gut health as the top benefit they are looking for when consuming foods and/or beverages that contain prebiotics.
- It is notable that for the top three responses, US respondents are lower than the UK. This was a multiple response option, so that suggests those in the UK are more likely to seek multiple benefits.
- Regularity over-indexes in the US by a wide amount as does to complement a probiotic.




Note: US n=651, UK n=610. Question: "What benefits are you looking for when you choose to consume foods/beverages that contain prebiotics?"

# Prebiotic Types

*GPA recognizes the below categories as established and/or emerging types of prebiotics. As science evolved, these will be updated.*
*Access detailed information and science on the types here.*

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| Prebiotic Type | Research-Supported Health Benefits | Dosage | Sources | Applications |
|---|---|---|---|---|
| Acacia Fiber | • Modulating the gut microbiome Improving gut conditions Reducing body mass index and body fat percentage<br>• Improving cardiovascular and metabolic syndrome risk factors<br>• Improving biochemical factors related to type 2 diabetes mellitus<br>• Managing malnutrition in children aged 6-59 months<br>• Improving plaque and gingivitis<br>• Exhibiting anti-inflammatory effects in sickle cell anemia Conferring hepatic and renal protective effects | Usually 10 g/day (research uses 5g to 30g) | obtained naturally as a dried gummy exudate from incising the stems and stem branches of the A. senegal and A. seyal trees commonly found in Sudan, Chad, and Nigeria | commonly used as a thickening or emulsifying agent or incorporated into beverages and foods to increase their fiber content |
| Fructooligosaccharides (FOS) | • Stimulating the growth of healthy bacteria<br>• Inhibiting the growth of pathogenic microorganisms<br>• Supporting gastrointestinal health<br>• Improving mineral absorption<br>• Reducing triglycerides Supporting healthy glucose metabolism<br>• Improving immune function<br>• Improving atopic dermatitis | • 400 – 680 mg/100 mL in infant formula<br>• < 500 mg per day as a non-medicinal ingredient in NHPs<br>• 4 g per day for healthy glucose metabolism and reducing triglycerides<br>• 5 – 15 g per day for GI health<br>• 8 – 15 g per day for supporting immune function | Perennial plants such as artichokes, chicory, onions, leeks, garlic, asparagus, and yacon, as well as cereals and honey<br><br>Industrial production using enzymatic synthesis. | FOS is currently being incorporated into various food applications such as formula for infants, baby food, dairy products, meat/fish/poultry products, confectionary/candy, cereal products, beverages, cookies, crackers, bakery products, food supplements, processed foods |

# Prebiotic Types

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| Prebiotic Type | Research-Supported Health Benefits | Dosage | Sources | Applications |
|---|---|---|---|---|
| Galactooligosaccharides (GOS) | • Relief of GI symptoms Positively affecting the aging gut by reducing intestinal permeability and increasing the mucus<br>• Supporting healthy microbiome development in infants<br>• Reducing and alleviating skin conditions<br>• Alleviating neurological diseases through the gut-brain axis<br>• Modulating the immune response and supporting healthy immune function | Oral daily dose of around 5 g typically required to confer a health benefit<br><br>Most studies utilize a daily dose 5 g and 20 g | dairy products, legumes, and root vegetables<br><br>manufacturing methods include natural extraction, polysaccharide hydrolysis, chemical synthesis, and enzymatic synthesis | Prebiotic ingredient in various food and pharmaceutical formulations, either as a standalone ingredient or combined with other prebiotics. In infant nutrition, GOS is one of the preferred prebiotics in supplementing infant formulas |
| Human Milk Oligosaccharides (HMOs) | • Supporting the production of secondary microbial metabolites<br>• Enhancing cognitive, language, and motor skill development in infants<br>• Protecting against atopic dermatitis/eczema in infants<br>• Stimulating the growth of beneficial Bifidobacterium in infants and adults<br>• Maintaining GI health, preventing pathogens, and supporting immunity in infants | 2 – 2.4 g/L of 2'-FL per day for infants<br>24 – 12.0 g/kg of 2'-FL per day for young children<br>2 – 20 g/kg of 2'-FL per day for adults | Natural component in human milk.<br><br>Commercial production using Chemical and enzymatic synthesis along with fermentation | Various food applications such as formula for infants and toddlers, infant and toddler foods, meal replacement beverages, bars, breakfast bars, non-carbonated sports drinks, and flavored waters, etc. |
| Isomaltooligosaccharides (IMOs) | • Modulating the gut microbial profile Improving metabolic disorders<br>• Relieving constipation Demonstrating anticarcinogenic effects in preclinical settings | Commonly used in clinical settings at 10 g/day for 4 weeks | Small quantities in honey, soy sauce, sake, rice miso, and some fermented foods | Used in the food and feed industries |

# Prebiotic Types

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| Prebiotic Type | Research-Supported Health Benefits | Dosage | Sources | Applications |
|---|---|---|---|---|
| Polyphenols | • Microbiome modulation<br>• Neuroprotective benefits for age-related brain atrophy and cognitive performance<br>• Urinary tract prophylactic benefits through antioxidant, anti-bacterial, and anti-inflammatory activities<br>• Cardiometabolic benefits<br>• Anti-adipogenic benefits<br>• Anti-inflammatory, antioxidative, and immunomodulatory benefits in the gut | 0.5 g to 1.5 g per day | Fruits, vegetables, cereals, olives, legumes, cocoa, tea, coffee, wine, beer, and grape pomace | Used in food and beverage, pharmaceutical and nutraceutical, and cosmetic and personal care. |
| Resistant Starch (RS) | • Improves appetite / reduces hunger<br>• Modulates the microbiome<br>• Increases insulin sensitivity and reducing the risk of type 2 diabetes<br>• Improves hemoglobin A1c and other metabolic biomarkers in diabetic and people with metabolic syndrome<br>• Protects against upper GI cancers in high-risk individuals<br>• Reduces triglyceride content in the liver<br>• Reduces inflammation<br>• Improves kidney health<br>• Reduces blood pressure in individuals with hypertension<br>• Strengthens the intestinal gut barrier | 6 g to 30 g, with lower amounts (<6 g/day) used in multi-ingredient prebiotic mixtures | Natural and processed starchy foods in variable quantities, including whole grains and raw starches like green bananas, raw potatoes, legumes, and cooked and cooled starchy foods. | RS is added to dairy products, baked goods, sugar confections, starchy foods, and beverages to increase their total fiber content without affecting taste or texture and is sold as a standalone supplement |

# Prebiotic Types

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| Prebiotic Type | Research-Supported Health Benefits | Dosage | Sources | Applications |
|---|---|---|---|---|
| Xylooligosaccharides (XOS) | • Inducing bifidogenesis (Childs et al., 2014; Finegold et al., 2014; Lin et al., 2016).<br>• Improving plasma sugar and lipid profiles in type 2 diabetes (Sheu et al., 2008; Yan et al., 2022).<br>• Positively altering the gut microbiota during the development of diabetes (Yang et al., 2015).<br>• Modulating immune function markers (Childs et al., 2014; Divyashri et al., 2021).<br>• Relieving constipation in pregnant and non-pregnant young women (Jeon et al., 2015; Tateyama et al., 2005).<br>• Relieving dysbiosis in the feces of ulcerative colitis patients in clinical remission | As low as 1.4g/day<br><br>Most studies use a dose of 4-8 g/day | bamboo shoots, milk, honey, fruits, and vegetables but can also be produced at an industrial scale by the hydrolysis of agro-industrial wastes, commonly known as lignocellulosic materials | Ingredient in various functional foods, including soy milk, soft drinks, tea, cocoa drinks, nutritive preparations, dairy products with milk, milk powder, and yogurt, candies, cakes, baked goods, pudding, jellies, jam, and honey products, either as a food additive or components of a synbiotic formulation |
| Lactulose | • Treating constipation by reducing intestinal transit time (Panesar & Kumari, 2011; EFSA, 2010)<br>• Reducing the degree of hepatic encephalopathy (HE) by decreasing ammonia production (Panesar & Kumari, 2011; Balzano, 2023; Bloom & Tapper, 2023)<br>• Inhibiting pathogenic bacteria, such as Salmonella and Shigella, by lowering the pH of the colon environment (Panesar & Kumari, 2011; Karakan et al., 2021)<br>• Reducing the prevalence of urinary and respiratory tract infections, enhancing immune health, and decreasing the risk of colon cancer through the production of healthy gut microbiota and inhibiting harmful pathogen growth (Panesar & Kumari, 2011; Karakan et al., 2021)<br>• Managing inflammatory bowel disease by eliminating and preventing endotoxemia (Panesar & Kumari, 2011)<br>• Lowering blood glucose levels and reducing pancreatic insulin production through its anti-endotoxin effects (Panesar & Kumari, 2011; Chu et al., 2022)<br>• Improving mineral absorption through the increased production of short-chain fatty acids (SCFAs) such as acetate (Karakan et al., 2021) | Up to 10 g per day (EU)<br><br>Up to 500 mg per day (CA)<br><br>15 to 45 mL, 2 to 4 times daily for the treatment of constipation (oral, US).<br><br>15 to 30 mL, 2 to 4 times daily, for the management of HE oral, US).<br><br>300 mL in 700 mL of water with retention in the colon for 1 hour and repeated every 2 hours until the episode is resolved (rectal, US). | Commercially, lactulose is produced through a process involving the alkaline isomerization of glucose into fructose.<br><br>Lactulose can also be formed in mammalian milk during ultra-high temperature heat processing. | Lactulose is commonly used in many food and pharmaceutical applications. The technical properties of lactulose make it a useful ingredient for food purposes such as a sweetening agent, fermentable carbohydrate, or thickening agent, and it has also been reported to improve the survival of probiotic strains in yogurt (Panesar & Kumari, 2011)<br><br>Lactulose is regulated as a prescription drug in many countries, including the United States (US). |

# Prebiotic Types

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| Prebiotic Type | Research-Supported Health Benefits | Dosage | Sources | Applications |
|---|---|---|---|---|
| Pectin | • slow gastric emptying<br>• improvement of physical bowel function<br>• reduced glucose and cholesterol absorption<br>• increase of fecal mass | • 10 to 20 g daily | Pectin is naturally found in some fruits and vegetables in small amounts. Apples are a fruit that are particularly rich in pectin. | Pectins are often added as a gelling agent in sugar-free jams and jellies. |
| Inulin | • Enhances calcium absorption and whole-body bone mineral content and density<br>• Improves stool consistency | • 8 g mixed with calcium-fortified orange juice<br>• 4 g mixed in a dairy products | Inulins are a group of naturally occurring polysaccharides produced by many types of plants, industrially most often extracted from chicory. The inulins belong to a class of dietary fibers known as fructans. Inulin is used by some plants as a means of storing energy and is typically found in roots or rhizomes | Confectionery, fruit preparations, milk desserts, yogurt and fresh cheese, baked goods, chocolate, ice cream and sauces. |

# Prebiotic Types

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| Prebiotic Type | Research-Supported Health Benefits | Dosage | Sources | Applications |
|---|---|---|---|---|
| Guar Gum | • Inhibits bacterial growth<br>• Manages and prevents stomach ulcers by acting as an acid-neutralizer<br>• Reduces blood sugar and cholesterol levels and improves the blood lipid<br>• Contributes to weight loss and obesity prevention via increasing satiety and delaying stomach emptying<br>• Contributes to gut health by improving bowel movements and stool formation via intestinal microbiota regulation and increasing SCFA<br>• Influences immune function and prevents infections through increased production of immunoglobulin | • Daily dosage of guar gum as 5 g per tablet or granules, three times daily, for lowering postprandial serum glucose values, delaying stomach emptying into the duodenum, reducing glucosuria, improving HBA1 values, leveling blood sugar profile, lowering lipids, and regulating digestion.<br>• Daily intake of 28-36 g of guar gum for therapeutic applications such as wound healing, inflammatory bowel disease treatment, preventing ulcers, managing IBS symptoms, reducing blood sugar and cholesterol levels, helping weight loss, and aiding in regular bowel movements.<br>• Daily dosage of 5-7 g Partially Hydrolyzed Guar Gum (PHGG)<br>• PHGG per day is sufficient to prevent constipation. | They are commonly found in gluten free products, but previously have not typically been purchased on their own in supplemental form. They are now more commonly available alongside gluten free baking flours to be utilized in at-home food preparation. | Guar gum and xanthan gum are often used in processed foods as a thickening and gelling agent. |
| Beta-glucan | • This is the type of soluble fiber that is often associated with the cholesterol-lowering effects promoted by oat - based product companies. | • 100–500 mg for stimulation of the immune system<br>• For a decrease in cholesterol levels, a daily dose of 3 g is recommended. | Beta glucans are found in baker's yeast, oat bran, barley and some mushrooms such as shiitake. | Beta-glucan is found in bacteria, plants, and certain foods, such as baker's yeast, cereal grains, and mushrooms. It is a type of polysaccharide that is made of a string of glucose (sugar) molecules joined together. |

# Prebiotic Types

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| Prebiotic Type | Research-Supported Health Benefits | Dosage | Sources | Applications |
|---|---|---|---|---|
| Agar-agar | • Aids digestion<br>• Relieves constipation<br>• Helps maintain healthy weight | • Approximately 8-10g of agar agar per 600ml of liquid. | Extracted from algae | Often used as a vegetarian gelling agent in vegetarian gelatin and other manufactured foods. You can also find agar-agar in Asian grocery stores as a substitute for gelatin in jelly-like products. |
| Glucomannan | As a supplement on its own, there have been mixed reports regarding its safety, with some studies showing that it causes blockages in people's throats (Henry et al. 1986). This has led to it no longer being available in all countries in pure supplement form. | • 1-13 grams daily | Konjac root, which can be found in some Asian jellies and low-calorie noodles (e.g., shirataki) | It is best to consume glucomannan naturally in the foods mentioned under "Sources". |

# Prebiotic Benefits

Many prebiotics are dietary fibers that are fermented by the bacteria in the gut to produce short chain fatty acids which have a range of beneficial effects on the body. In particular, there is a short-chain fatty acid (SCFA) called butyrate that is known for playing a role in a number of health promoting pathways.

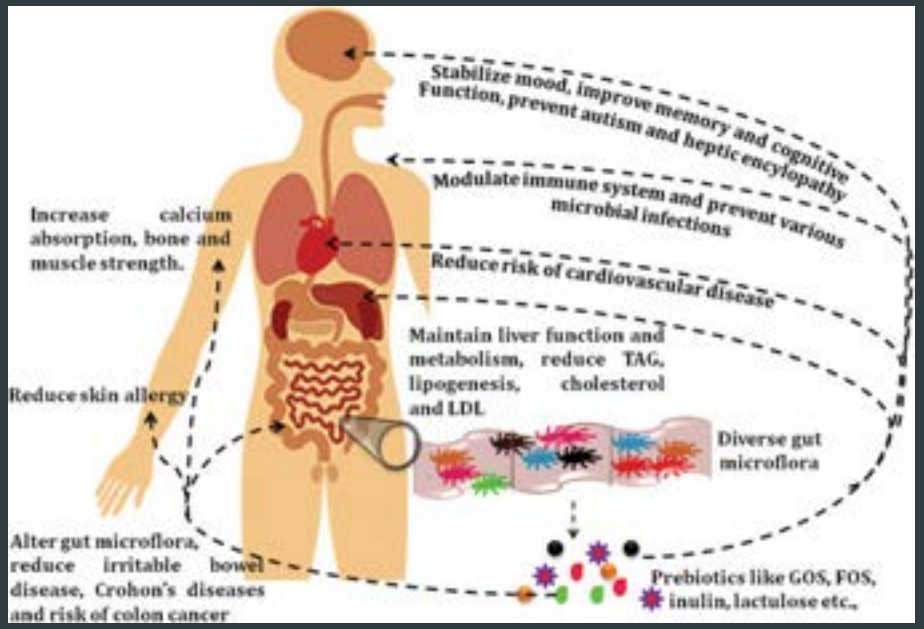
These SCFAs are able to reduce inflammation in the body, as well as play a role in digestive health.

**Main benefit areas include:**

- Improve gut and bowel health in infants
- Improve regularity, i.e., reduces traveler's diarrhea and improves constipation
- Improve immune function in the elderly
- Improve symptoms in IBS sufferers
- Improve absorption of calcium and other nutrients in relation to bone health
- Enhance satiety
- Improve insulin sensitivity and slow glucose absorption, thereby aiding with blood glucose control
- Improve blood lipid profiles by increasing HDL, and reducing LDL and triglycerides

(Gibson G et al. 2017, Cani P and Delzenne N, 2009)

Prebiotics are a powerful nutritional tool with a variety of health benefits.
Read some of the latest research>>



# Prebiotics and Gut Health

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Over the years, researchers have demonstrated the importance of the gut and in particular, the gut microbiome and the metabolites that it produces, and their role in helping to develop and maintain a healthy metabolism, a healthy brain, a healthy immune system as well as overall health. We now also know that prebiotics are instrumental in maintaining a healthy and balanced gut.

This balance begins at birth, when the microbes initially colonize the intestinal tract. This early microbiome helps to shape the development of the immune system. Eating the right types of prebiotic foods which feed the gut microbiome during infancy has been shown to have years-long immune benefits.

Prebiotics also help maintain a balanced microbiome throughout life. They help maintain regularity and proper gut function, help keep the intestinal wall barrier intact and strong, support a healthy immune system and help reduce inflammation. In addition, prebiotics improve the absorption of minerals, i.e., calcium which is important for maintaining healthy bones. When the gut is imbalanced, it's known as "dysbiosis".

**DID YOU KNOW?**

A healthy gut contributes to the gut-brain axis, the gut-liver axis, the gut-skin axis, the gut-kidney axis and more. When the gut is imbalanced, every other system in the body is affected. Health begins in the gut.

# Gut Health and Mood

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Gut health is another extremely important factor that can influence one's mood, nutrient digestive ability, and internal inflammation.

The connection between gut health and immunity has been acknowledged within Chinese medicine for years, however it has only recently started to be supported through evidence-based research, which has lead to it being more widely accepted within Western medical practices *(Cryan & O'Mahony, 2011; Konturek, Brzozowski & Konturek, 2011).*

External to the brain, the gastrointestinal system is the most densely populated area within the body with neurotransmitters and neuropeptides. This may help explain why extreme stress can lead some people to having bowel motion changes.

Research shows internal inflammation is associated with heightened negative moods, therefore it is important to strengthen gut integrity and reduce inflammatory pathways through proper nutrition.

**DID YOU KNOW?**

Poor gut health has been shown to lead to inflammation throughout the body; and inflammation has been shown to be associated with depression and anxiety.

# Dietary Fiber and Mood

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Dietary fiber, which is often classified into one of either soluble or insoluble fiber, plays many roles in the body.

Due to their ability to slow down the absorption of glucose and prevent spikes in blood glucose levels, viscous soluble fiber can be very beneficial
at lowering the glycemic index of a meal that contains some form of carbohydrate. This has a flow on positive effect on a range of mood controlling factors as well as appetite and weight regulation.

A study performed looked at the difference in inflammatory markers following the consumption of a diet rich in fiber (the recommended 30 g a day), coming from either a supplement (psyllium, a soluble fiber), or that coming from a Mediterranean style diet (i.e. fiber coming from fruits, vegetables and grains). It was found that the inflammation was significantly reduced following the high fiber diet, irrespective of the source *(King et al. 2007).*

From this, it may be taken that dietary fiber does play a role in reducing inflammation within the body, and that although ideally your clients will be consuming this in the form of whole-foods, on the occasions that they are unable to obtain adequate amounts this way, supplemental form may be utilized and still have a positive overall effect.

**DID YOU KNOW?**
Serotonin, your mood elevating neurotransmitter, is actually higher in concentration within your gut, than your brain.

# Gut Health and Metabolism

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Gut wellness not only impacts local tissues and gut function, it also impacts wider metabolism through many mechanisms. The microbiota produce metabolites that are absorbed and may be biochemical signals communicating with the brain, kidneys, liver, pancreas, etc.

Metabolites include short-chain fatty acids. Butyrate, one particular short-chain fatty acid, actually turns genes on and off (an histone deacetylase inhibitor). One study reported that prebiotic resistant starch changes the expression of more than 200 genes within the large intestine (Keenan et al, 2012). Another study reported that fructo-oligosaccharides changes the expression of 67 genes, many of which were related to immunomodulation benefits *(Fukasawa JAFC 2007).*

One prebiotic fiber, resistant starch, increases peripheral insulin sensitivity within hours, most likely through changing the expression of the genes that control insulin sensitivity within the gut.

Gene expression has also been registered following prebiotic consumption in muscle tissue, kidneys, pancreas, fat tissue and the brain.

# How are prebiotics regulated?

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Prebiotics lack a consistent global regulatory definition, with most countries not explicitly outlining regulations for them. Fiber, which encompasses some prebiotics, falls under stringent food laws in many regions. However, for dietary supplements or natural health products (such as in Canada), the regulatory approach to prebiotics varies, reflecting a lack of uniformity. Given the generally recognized safety of prebiotics, regulatory agencies have not prioritized extensive oversight.

As research on different prebiotic types expands, Australia and New Zealand have granted approved claims for several prebiotics, while in Canada, inulin boasts its own monograph, and the Global Prebiotic Association (GPA) is in the process of advocating for a prebiotic monograph with Health Canada.

Recognizing the need for clarity in this regulatory landscape, GPA is actively developing a searchable global regulatory map as a valuable resource for its members. This tool will provide links to supporting documents, enhancing understanding and compliance. Despite the diverse regulatory approaches, adherence to Good Manufacturing Practices (GMPs) and Hazard Analysis and Critical Control Points (HACCP) or their equivalents is a common requirement. Safety, manufacturing standards, and permissible ingredients are also regulated, with additional stipulations in certain regions, such as the U.S., that claims must not imply disease treatment, must be substantiated, and should not be misleading.

# Food Sources and Dosage

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## Food Sources

Some of the densest food sources of prebiotic fibers are:

- Chicory root fiber
- Jerusalem artichoke
- Dandelion greens
- Acacia Fiber (found as a supplement)
- Lupini beans and lupin flour
- Tigernuts and tigernut meal
- Isomalto-oligosaccharides (found inside functional high fiber food products)
- Raw onion and garlic
- Asparagus
- Glucomannan found inside konjac noodles

## Daily Recommended Intake

Based on different scientific groups around the globe it is recommended that everyone consumes between 5g-20g of prebiotic fibers per day to ensure they reap the health benefits that they can provide. The differences in quantities required vary based on the type and source of the prebiotic e.g., the oligo-saccharide FOS vs the oligosaccharide XOS.

# Prebiotic Levels in Common Fruits and Vegetables

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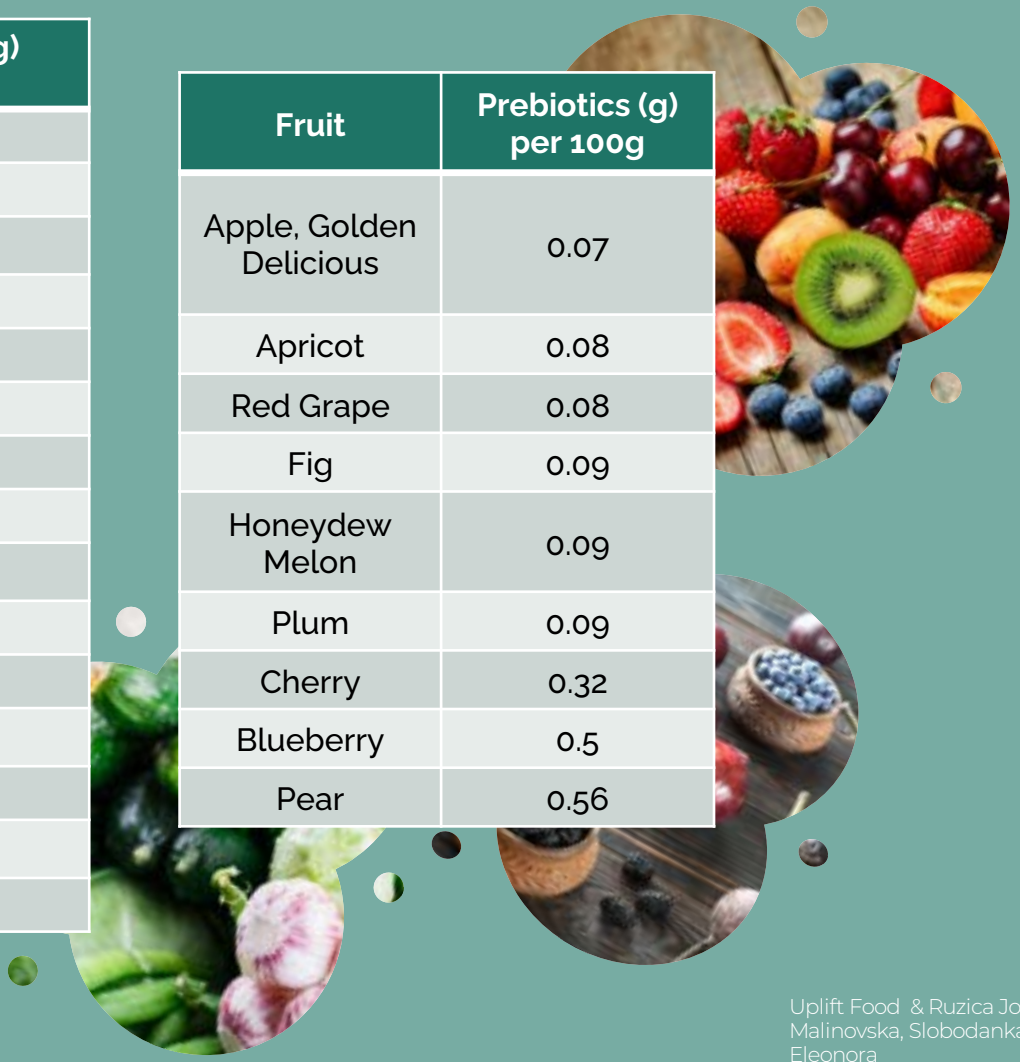
| Vegetable | Prebiotics (g) per 100g |
|---|---|
| Beetroot | 0.48 |
| Broccoli | 0.89 |
| Brussel Sprouts | 0.82 |
| Carrot | 0 |
| Celery | 0 |
| Chard | 0 |
| Eggplant | 0 |
| Kale | 0.51 |
| Lettuce, Green | 0 |
| Peas | 0 |
| Radish | 0 |
| Red Pepper | 0 |
| Tomato | 0 |
| Yellow Beans | 0 |
| Zucchini | 0 |

| Fruit | Prebiotics (g) per 100g |
|---|---|
| Apple, Golden Delicious | 0.07 |
| Apricot | 0.08 |
| Red Grape | 0.08 |
| Fig | 0.09 |
| Honeydew Melon | 0.09 |
| Plum | 0.09 |
| Cherry | 0.32 |
| Blueberry | 0.5 |
| Pear | 0.56 |



Uplift Food & Ruzica Jovanovic-Malinovska, Slobodanka Kuzmanova & Eleonora Winkelhausen (2014) DOI: 10.1080/10942912.2012.680221

# Vegetables Providing the Richest Source of Prebiotics

| Vegetable | Prebiotics (g) per 100g (range) |
|---|---|
| Fennel | 0.79 |
| Scallion | 4.1 |
| Garlic | 1.76 - 6.4 |
| White onion | 1.1 - 7.5 |
| Leek | 1.07 - 8.0 |
| Dandelion Greens | 0.73 - 12.0 |
| Jerusalem Artichoke | 1.62 - 15.0 |
| Chicory Root | 0.52 - 26.2 |

Uplift Food & Ruzica Jovanovic-Malinovska, Slobodanka Kuzmanova & Eleonora Winkelhausen (2014) DOI: 10.1080/10942912.2012.680221

# Prebiotic/Microbiome Terms

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**Dietary Fiber:** Nondigestible carbohydrates and lignin that are intrinsic and intact in plants. (IOM) Dietary fibers can be bulking, viscous, or fermentable

**Short-Chain Fatty Acids (SCFAs):** A subset of fatty acids that are produced by the gut microbiota during the fermentation of partially and nondigestible polysaccharides (NIH)

- **Butyrate:** A four-carbon short-chain fatty acid that is produced through microbial fermentation of dietary fibers in the lower intestinal tract.

**Fermentation:** The process of extracting energy from molecules. In particular, the consumption of dietary fibers by the microbiota within the large intestine, producing short-chain fatty acids and other metabolites

**Gut-Brain Axis:** Signals sent in both directions between the gut and the brain via nerves and hormones.

**Metabolites:** An intermediate or end product of fermentation and other metabolic processes. “Primary” metabolites are directly involved in normal “growth”, development, and reproduction.

**Metabolomics:** The scientific study of chemical processes involving metabolites.

**Postbiotic:** A preparation of inanimate microorganisms and/or their components that confers a health benefit on the host (ISAPP)

**Prebiotic:** A product or ingredient that is utilized in the microbiota producing a health or performance benefit. (GPA)

**Prebiotic Effect:** A health or performance benefit that arises from alteration of the composition and/or activity of the microbiota, as a direct or indirect result of the utilization of a specific and well-defined product or ingredient by microorganisms. (GPA)

**Probiotic:** Live microorganisms that, when administered in adequate amounts, confer a health benefit on the host (ISAPP)

**Gene Expression:** The process of turning on a gene that enables it to produce end products, proteins or non-coding RNA.

# Prebiotic/Microbiome Terms

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**Microbiota:** The microbiota consists of a wide variety of bacteria, viruses, fungi, and other microorganisms present in a singular environment, such as the human digestive tract. The microbiome refers to the entire habitat of the body, including its microorganisms, genomes, and the surrounding environmental conditions.

**Diversity:** A description to characterize the range of microbiota within a healthy human. A diet with plenty of dietary fiber and prebiotics will support diversity in the microbiome.

**Synbiotic:** mixtures of live or inanimate microorganisms with substrate(s) selectively utilized by either the co-administered microorganism or the host's indigenous microorganisms, conferring a health or performance benefit. (GPA)

**Dysbiosis:** a disruption to the microbiome resulting in an imbalance in the microbiota or their metabolic activities

**Modulation:** an intervention with the intent of pushing the gut microbiome toward a desired state. (Cell, March 2018)

**Shotgun Sequencing:** In genetics, shotgun sequencing is a method used for sequencing random DNA strands. It is named by analogy with the rapidly expanding, quasi-random shot grouping of a shotgun.

**16S Sequencing:** Microbial profiling using 16S ribosomal RNA (rRNA) sequencing is a common method for studying bacterial phylogeny and taxonomy. The 16S rRNA gene is the most established genetic marker used for bacterial identification and classification, mainly because it consists of both highly conserved and hypervariable regions.

# Synbiotics

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## What is a synbiotic?

According to the International Scientific Association for Probiotics and Prebiotics (ISAPP), a synbiotic is defined as "a mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit on the host". The concept of a synbiotic emerged from the realization that probiotics and prebiotics while beneficial independently provide optimal benefit when combined. The expert panel was convened in May 2019 in an attempt to clarify what had become a confusing and "wordy" definition.

They went on to specify two subsets of synbiotics, complementary and synergistic. A 'synergistic synbiotic' is a synbiotic in which the substrate is designed to be selectively utilized by the co-administered microorganism(s), these are difficult to test and less commonly used in clinical trials.

A 'complementary synbiotic' is a synbiotic composed of a probiotic combined with a prebiotic, designed to work together to lead to desired health outcomes and that it should be tested together in order to be labelled as a synbiotic. [1]

# Global Prebiotics Week

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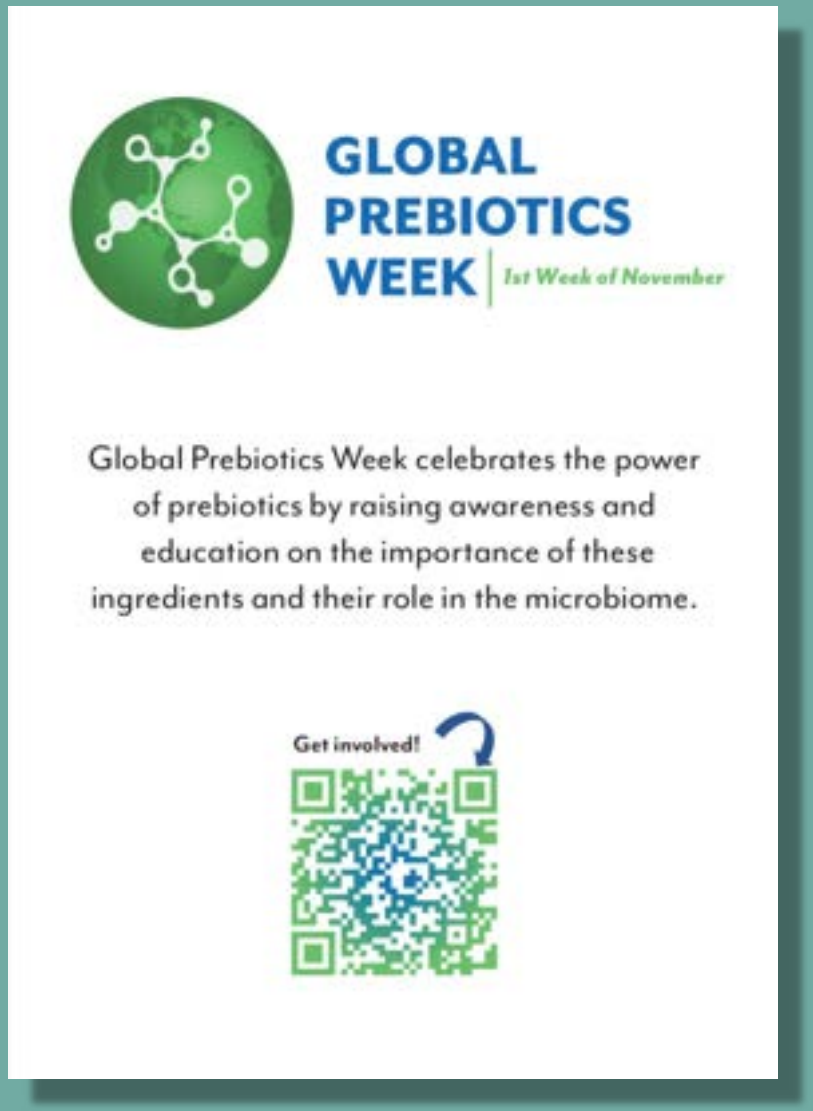
GPA's annual Global Prebiotics Week occurs the first week of November, celebrating the power of prebiotics by raising awareness and education on the importance of these ingredients and their role in the microbiome.

Each year, GPA provides members with a toolkit that includes a custom Global Prebiotics Week logo, curated social media content, banner images, and more for members to use to celebrate throughout the week.



# GPA Young Researcher Awards

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The annual GPA Young Researcher Awards are given to two (2) young scientific researchers (under 40 years old) who were the first authors of research papers that have driven remarkable advancements in the understanding of the science or impact of prebiotics with receive awards in the below categories:

- *GPA Young Researcher Award for Fundamental/Primary Research: $2,000 USD*
- *GPA Young Researcher Award for Applied Research: $2,000 USD*

Topics can cover any aspect of prebiotic research including gut and other microbiomes and must be original research published in a peer-reviewed journal. GPA defines a prebiotic as a product or ingredient that is utilized in the microbiota producing a health or performance benefit. A prebiotic effect is “a health or performance benefit that arises from alteration of the composition and/or activity of the microbiota, as a direct or indirect result of the utilization of a specific and well-defined product or ingredient by microorganisms”.

This award program is open to postdoctoral fellows or Ph.D. students. Applications will be judged by a panel of expert scientists from the prebiotic field, including GPA members and other researchers from around the world.

# NutraStrong Prebiotic Verified Program

GLOBAL PREBIOTIC ASSOCIATION

GPA is proud to present NutraStrongTM Prebiotic Verified, a collaboration with Nutrasource.

Prebiotic Verified seeks to address three industry points by maintaining a level of quality standardization. These points include verification of input, relevant stability testing (based on end use product shelf life & storage), as well as ingredient efficacy provided from either the supplier or internal sources.

The goal of Prebiotic Verified Program is to showcase premium brands and ingredient providers in the marketplace to reduce consumer confusion in the category by ensuring consumers receive adequate dosages of prebiotics in their products and that brands are utilizing ingredients properly.

*Click here* for more information on 'Prebiotic Verified'

## Key Aspects

**Lab Analysis**
- Ensure ingredients meet label claims and specification sheets.
- Ensure relevant testing is begin completed

**Label Review**
- Ensure health claims are backed by solid evidence at dosages present in the finished products.
- Utilize data from the raw material providers.

**Manufacturing Quality**
- Ensure products are manufactured in a GMP or equivalent environment.

**Corporate Values**
- Showcase unique features of brands such as sustainability, accountability, or other core causes.

## Key Program Updates
- Program updated to annual fee structure based on amount of SKU (no per lot review fees)
- Inclusion of regulatory and testing quality sign off to hold brands accountable for ingredient use and frequency of release testing.

# Resources

*Click each topic to access the resource online.*

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- **GPA Infographics:** PDFs that are free to download and use.
- **Prebiotics Types Guides:** Detailed sheets on individual prebiotic types.
- **GPA Webinars on Demand:** Free to access recording and slides.
- **Resource Guide:** List of reputable prebiotic companies and their contact info.
- **Prebiotic Verified Program:** Operated by SGS/Nutrasource.
- **Scientific Papers on Prebiotics:** Monthly research summary *posted here* and please contact GPA with requests for prebiotic research. We have a robust database on Mendeley.
- **Global Prebiotics Week:** celebrated annually the first full week of November. Page contains resources that are free to use.

**Acronyms:**

GPA – Global Prebiotic Association

IPA – International Probiotic Association

ISAPP – International Scientific Association for Probiotics and Prebiotics

ITC – Industry Transparency Center

# SPECIAL THANK YOU TO OUR 101 GUIDE CONTRIBUTORS

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