

2021 White Paper

# What on EARTH is Bioavailability?!

A guide to unlocking innovation & nutritional value of natural products



AstraGin<sup>®</sup>



## Introduction

In modern-day diets and nutrition, supplements and nutrient absorption and bioavailability play an increasingly essential role. As a result, the global dietary supplement market has been growing exponentially in recent years. In 2020, the industry's market size was estimated at \$170.4 billion. **By 2027, the global market for dietary supplements is expected to be worth \$298 billion.**

Demand for dietary supplements is expected to increase even further, as witnessed in 2020. This is primarily due to the increased appreciation of the role good health plays in fighting illnesses, made evident by the COVID-19 pandemic. For organizations in the dietary supplement industry, this presents an excellent opportunity to scale in the coming years. However, it's not just about producing dietary supplements, but about developing products that will have the desired impact on consumers' lives.

On matters of nutrients, one of the major challenges people face is absorption and bioavailability. Regardless of how healthy a diet is, it will not benefit the consumer if they cannot access the nutrients. As a dietary nutrient professional, your products must have a high nutrient absorption rate. This guide seeks to assess the underlying challenges in nutrient absorption and outline how AstraGin®, a patented nutrient absorption-enhancing and gut health ingredient, is the ideal solution.

## Nutrient Absorption

The purpose of eating goes well beyond eradicating hunger. It's about unlocking the nutritional value of various products. Once broken down and absorbed into the body, such nutrients play a crucial role, such as acting as catalysts to key body processes and giving people energy for day-to-day activities.

Therefore, consuming a wide variety of nutrients is essential for the body to remain in prime condition. Unfortunately, a healthy diet does not equate to good health. Before nutrients offer nourishing benefits to the body, food must be mechanically and chemically broken down during digestion into macronutrients. For instance, carbohydrates are broken down to glucose for energy or storage, whereas proteins will produce different amino acids.

At this juncture, the macronutrients are absorbed by the small intestines into the bloodstream, where they are transported to different parts of the body. Without a healthy digestive system, nutrient absorption is not optimal, meaning the body does not access the necessary amount of nutrients, regardless of how balanced meals are.

Internal factors that influence the absorption rate of nutrients include thorough chewing of food, levels of good gut bacteria, hydrochloric acid, and cell integrity of the gut. Other factors that may affect nutrient absorption include:

- Medications
- Stress
- Alcohol consumption
- Environmental factors

Essentially, having poor nutrient absorption can be just as bad as not consuming a balanced diet. And, the same issues also affect the effectiveness of dietary supplements. This is why a critical element in developing beneficial supplements is optimizing nutrient absorption. Otherwise, you may be marketing a nutritious product with lacking benefits to consumers.

## Importance of Gut Health in Nutrient Absorption

The gastrointestinal system (gut), better known as the digestive tract, is a group of organs that plays a crucial role in people's health and well-being. The digestive system organs include the mouth, esophagus, stomach, liver, pancreas, gallbladder, small intestines, large intestines, and rectum. While it has many functions, digestion and absorption of food are the primary ones.

Within the gastrointestinal tract are bacteria that facilitate harvesting, digestion, and utilization of nutrients. They help facilitate the synthesis of folate, thymine, biotin, pantothenic, and riboflavin and assist with the synthesis of vitamin B12 in the colon. Additionally, they also contribute half of the body's daily vitamin K requirement. As such, the presence and health of good bacteria in the gut are essential for nutrient absorption.

Nutrients in the foods, once digested, may enter the human body from the gut lumen by passive diffusion and osmosis. But many nutrients, such as amino acids, do require active transporters located on the intestinal epithelial cell membrane to transport them from the gut lumen to circulation, such as SGLT1 for glucose absorption. These active transporters are activated by mRNA.

Furthermore, many nutrients, such as glucose and amino acids, are absorbed through special absorption sites on the intestinal lumen by special transport proteins. Healthy epithelial cells of the villi transport nutrients (amino acids and carbohydrates) and lacteals (lipids) from the lumen of the intestine to the bloodstream. When epithelial barrier integrity is compromised due to inflammation, medications, or other factors, harmful substances get into our body.

Precise mechanisms of this condition are still unknown. Most studies concur that it is associated with hereditary, infectious, environmental, and auto-immune factors. The integrity of the intesti-

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nal epithelial barrier plays a critical role in human health.

Restoration of the epithelial barrier integrity is an important healing response in intestinal disorders. Medications such as non-steroidal anti-inflammatory drugs, steroids, and immunomodulators, are limited in their application because of poor efficacy and adverse effects.

## Absorption of Amino Acids in the Digestive Tract

Some of the critical nutrients that the body requires are amino acids, often referred to as the building blocks of proteins. Their diverse role in the body also includes the synthesis of neurotransmitters and hormones, signifying their importance. For the body to function correctly, it requires 20 different amino acids.

Among these amino acids, some are classified as essential and others nonessential. The latter is produced in the body, whereas essential amino acids are obtained through meals. Some nonessential amino acids may be classified as essential amino acids in some instances, such as sickness. When this happens, they must be supplemented through diet to ensure proper body functioning.

Therefore, nutrient absorption must remain high for the body to access essential amino acids. Data suggests that it is in the intestines that 90-95% of food is absorbed, with the stomach accounting for the remainder. However, absorption for individual amino acids varies significantly based on several factors:

### 1. The Source of the Protein

Proteins come in various forms, such as single amino acids, intact proteins, amino acid mixtures, and hydrated proteins. With each, the absorption rate will vary. A higher rate is common with free-form amino acids. If there is a need to accelerate protein digestion and absorption, ingesting a protein hydrolysate instead of an intact protein will help.

### 2. Transport System

Amino acid absorption relies on multiple transport systems, such as the leucine system. With this transport system, in particular, leucine will be prioritized. As such, in an amino acid mixture containing leucine, absorption of other BCAAs will be inhibited. Alternatively, the absorption of leucine may be affected due to the presence of other amino acids.

### 3. Amount of Amino Acid

Each amino acid relies on a specific transporter for absorption. If the amount of amino acid exceeds the capacity of transporters, absorption will decrease.

## Now For Your Product(s): Choosing the Right Delivery Method

There are different forms you can use to deliver supplements to your consumers. They generally include liquid, gel, powder, tablet, and capsule. The rate of nutrient absorption varies from one form of delivery to the next. Forms such as liquid and powder offer higher absorption rates than capsules.

As you enter production, consider the impact of the form of delivery on your consumers' ability to benefit from the nutritional value. However, this should be balanced out with other factors such as your target market's preference.

## How to Proceed Towards Optimized Nutrient Absorption

As the world becomes more conscious of the need to access crucial nutrients and having a strong immunity, the demand for supplements is poised to increase. Your ability to capitalize on this growing market depends on how beneficial your supplements are to consumers. This then goes down to one simple factor: the absorption rate of your supplements.

At NuLiv Science, we have a team of scientists and innovators dedicated to developing solutions for natural products which include nutraceuticals, dietary supplements, functional foods & beverages, and more. With our plant-based patented solution, AstraGin<sup>®</sup>, you can improve your supplements' absorption uptake to help your customers get the most nutritional value out of the products they enjoy most. Reach out to us today to learn more about AstraGin<sup>®</sup>.

## Product Innovation Opportunities

Support the absorption and bioavailability of natural products containing:

- Amino Acids
- CBD/Cannabis
- Curcumin
- Fatty Acids
- Glucosamine
- Phytonutrients
- Probiotics
- Protein (Plant & Whey)
- Vitamins

As a brand or contract manufacturer, you can enhance the absorption and bioavailability of nutrients in a wide range of product delivery formats and functions:

- Capsules
- Gels
- Liquids
- Capsules
- Powders
- Functional Foods
- Meal/Snack Bars
- RTD (Read to Drink) Beverages

## Helpful Links & Resources

Want to dive in deeper? These resources highlight specific areas of product innovation opportunity as it relates to enhancing nutrient absorption and bioavailability.

### Amino Acids

This guide discusses the absorption of amino acids in the digestive tract and its movement from the digestive tract to systemic circulation.

### Protein (Plant & Whey)

A quick overview on an ingredient solution for delivering more protein to cells in order to promote muscle growth.

### Curcumin

Curcumin is commonly known to have poor uptake in the human body. View this quick overview on an ingredient solution for substantially enhancing absorption of curcumin.

### CBD

Consumers want to get the most out of the CBD they're purchasing. Get a few insights on how you can maximize CBD absorption and bioavailability.

### Gut Health

A critical component of overall good health is indicative of one's gut health status. Learn more about the effects of AstraGin® on gut health as it relates to various nutrients.

### Immune Health

In a more scientific discussion, learn about the potential effects of AstraGin® on immune wellness outcomes as it relates to gut health and nutrient absorption.

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## Next Steps

### Have questions? Need help?

Get in touch with our team and let us know that you received this guide.

We look forward to connecting with you!

Contact Us or Call: (909) 594-3188

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