

PLANT PROTEINS

Quality & Applications

deep dive



PROTEIN QUALITY

THE COMPLETE TRUTH

The Rise of Plant Protein

No one's surprised by the fact that protein is one of the most popular ingredients that consumers want more of in their food. In fact, 25% of consumers would choose protein as the ideal ingredient to fortify their favorite foods, according to Mintel data. Whether motivated by personal health, availability, animal protection or the environment, consumer demand for plant-based alternatives is a trend that's here to stay. Based on a Mattson survey, it is clear that plant-based protein is the winner with almost half (48%) of respondents planning on eating more plant-based foods, almost one third (29%) considering themselves as flexitarian (the fastest growing food tribe), and most (69%) already cutting down on animal-based meat.

As the number of people powering up on plant protein continues to grow, so does interest in understanding their quality. Are they as effective as animal proteins? Do they need to be combined with other protein sources given their "incomplete" amino acid profiles? Here is the complete truth about plant protein quality.

Plant Protein Advantages

Almost half (46%) of Americans agree that plant-based proteins are better for you than animal-based options according to Mintel. While this perception may hold true for whole plant protein sources, many wonder whether the same can be said for concentrated plant protein powders.

Naturally "Free From"

While the dairy industry is innovating alternatives to try and address these challenges, plant proteins are always free from:

- **Saturated fat and cholesterol**
- **Contamination of growth hormones and antibiotics** that may be used on livestock
- **Major allergens** (alternatives to top allergens egg and milk-based proteins like whey)

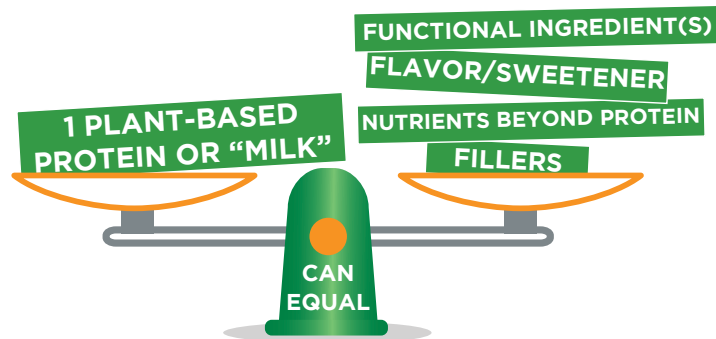
This makes plant proteins even more attractive ingredients when formulating for general wellness, heart health (one of America's top health concerns), and food allergy-friendly. Up to 15 million people have food allergies in the US according

to Food Allergy Research & Education. Additionally, 65% of the human population has issues digesting lactose, a milk sugar naturally found in dairy products and most dairy-based protein concentrates. While some milk-based products are claiming "dairy free" or "lactose free" due to processes, consumers who know the intense pain of dairy issues still won't take the chance as long as any form of "milk" is on the label.

Nutrient-Dense Protein Options

Some plant protein powders provide protein and nothing else, whereas others may retain some beneficial nutrients from its parent material depending on the degree of protein concentration and processing method used. For example, **hemp, pumpkin and sacha inchi protein powders are multi-benefit ingredients** resulting in labels that have nutrient-based claims with shorter ingredient lists for formulators and consumers alike. That's because with only 50-70% protein concentrations, they still **contain a larger range of vitamins, minerals, some fiber and even essential fatty acids like alpha-linolenic acid**. Eighty to 90% protein concentrates such as traditional rice and pea proteins have some iron but little other nutrients, thus are best for fortifying protein content alone in formulations.

Plant-Based Ingredients =
More Nutrient Claims +
Shorter Ingredient Lists + Lower COG

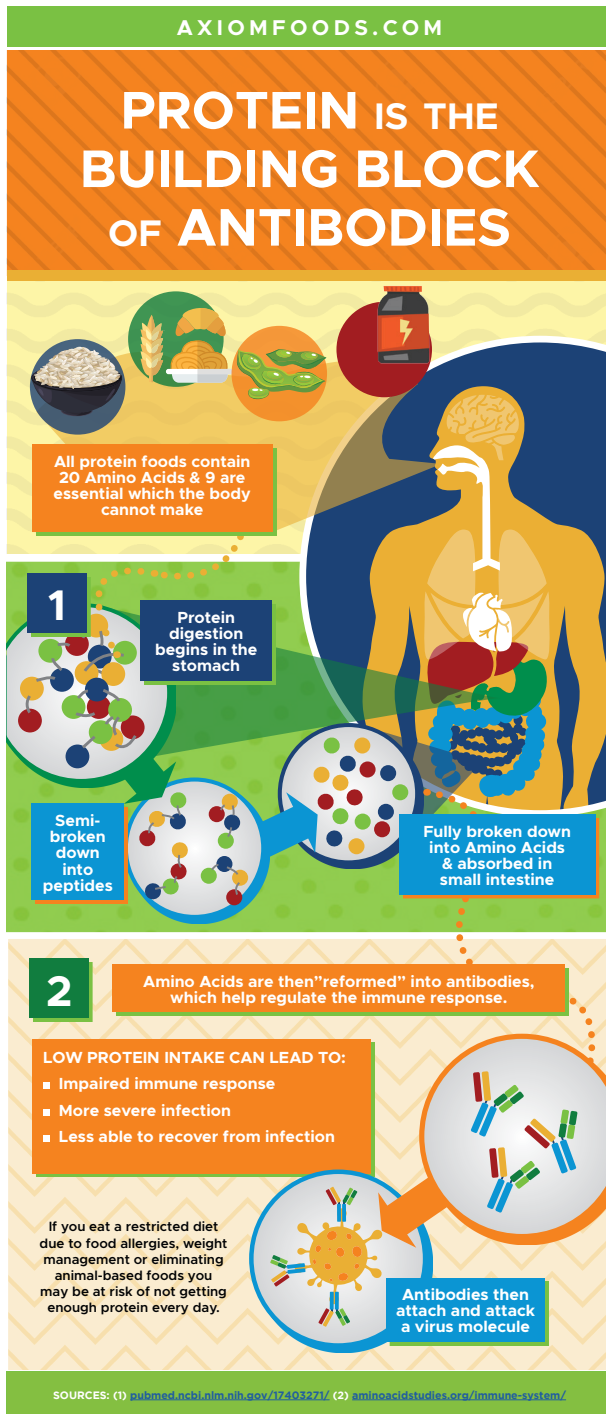


The Role of Amino Acids is Universal

Amino acids are the building blocks of protein. All dietary proteins contain the same 20 amino acids just in different ratios and with different absorption rates depending upon the source. Protein holds multidimensional benefits but among the most recognized is its ability to help **build muscle, support weight loss and provide nourishment for healthy hair, skin, and nails**. When the goal of protein consumption is to become **stronger and healthier**, consumers often seek healthier sources.

Other major functions of protein in the body include:

- **Building valuable enzymes** that regulate daily bodily functions (like digestion and the sleep/wake cycle)
- **Transporting nutrients, oxygen & waste** through the body
- **Building hormones** such as insulin to regulate blood sugar
- **Forming new cells** by reading genetic info stored in DNA
- **Building antibodies** which support the immune system



The Plant Protein Quality Challenge

Protein quality, defined as the ability of a protein to provide the body with amino acids in needed ratios to achieve protein synthesis is currently measured by the Protein Digestibility Corrected Amino Acid Score (PDCAAS). It is determined by comparing a protein's amino acid profile to a standard reference protein (aka a scoring pattern) and then taking into account its *digestibility* — the percent of the ingested protein that is actually absorbed by the body. The resulting value essentially tells us how well a single protein source is able to sustain new tissue growth in humans. But when do humans ever consume a single type of protein all day long? There are very few instances, one of which is during infancy.

Needless to say, therein lies one of the commonly disregarded limitations of the PDCAAS which is important to note when dealing with plant proteins. It is imperative for formulators, clinicians and consumers alike to keep in mind that PDCAAS is purely mathematical and does not provide real world application of protein utilization. Plant proteins are expected to have lower PDCAAS values than animal proteins given their incomplete amino acid profile and subpar digestibilities. **But the reality is that these less than ideal PDCAAS values of individual plant proteins are irrelevant within average adult human diets which are composed of 5 or more protein sources per day. It is a known fact that the human body combines amino acids from multiple protein sources in a 24-hour period in order to activate protein synthesis.**

The Proof is in the (Protein) Pudding

Multiple published studies to date have compared the efficacy of a plant protein to animal-based whey protein when used as a post workout supplement.

Clinical Study Winning the Absorption Race



WHEY
85 minutes

RICE
67 minutes



Leucine, the key amino acid for muscle building, absorbs **almost 30% faster** from rice protein than whey protein.*



CHECK IT OUT For more info

✓ *See study details at:
AxiomFoods.com/Studies

✓ See other infographics explaining protein's role in trending benefits-driven formulations at: AxiomFoods.com/axiom-in-the-news/

In 2013, Joy et al. determined that administration of Axiom's Oryzatein® rice protein post resistance exercise improved body composition and exercise performance, as good as whey protein did, in groups of trained athletes. Specifically, both supplements worked equally well to increase lean body mass, muscle mass, strength and power. There were no significant differences between groups ([Nutrition Journal](#)).

Supplemental pea protein was shown to promote increases in biceps brachia muscle thickness as effectively as whey protein in a 2015 study published in [Journal of the International Society of Sports Nutrition](#). Participants underwent 12 weeks of resistance training and were instructed to consume pea protein, whey protein or placebo twice a day during their training period.

A 2018 study on professional mixed martial artists (MMA) found no benefit of whey protein over rice protein (or vice versa) for building and maintaining muscle mass ([EC Nutrition](#)).

Most recently, researchers at Lindenwood University examined the effects of a lower, 24g daily dose of Oryzatein® rice protein or whey protein. Similarly, they too found that both proteins conferred the same benefit on training adaptations helping to significantly increase muscle mass and athletic performance. In other words, there was no advantage to using whey protein ([Journal of the International Society of Sports Nutrition](#)). These studies help to support the fact that incomplete does not mean obsolete when it comes to plant proteins. In spite of incomplete amino acid profiles and imperfect PDCAAS scores, protein synthesis was still achieved especially when consumed as part of omnivorous diets.

Quality Solutions

Despite criticisms, the PDCAAS method of protein evaluation is currently approved and required for use by the FDA when making a protein claim on a food label. While animal-based proteins like egg, whey and casein have perfect or near perfect PDCAAS scores (i.e. 1.0 or 100%), plant proteins have presented a challenge to formulators given their imperfect scores. Formulating with specialized versions of plant proteins that boast a 1.0 PDCAAS such as Axiom's Vegotein™ TX Texturized Pea Protein (per Table 1) or blending two or more complementary plant proteins (per Table 2) are simple and effective ways to improve the PDCAAS value of protein when making a protein claim.

Blending Plants for a Complete Protein



PICK ONE OF EACH

Blend one grain or seed-based protein with pea protein to **create a complete amino acid profile with an ideal PDCAAS.**

Also, did you know that the human body can make a complete protein just by consuming one of each within a 24-hour period?

PDCAAS by Plant Protein Source (Table 1)

Protein	PDCAAS ⁽¹⁾	PDCAAS ⁽²⁾
Oryzatein® 80 (rice protein 80%)	0.63	0.52
Oryzatein® 90 (rice protein 90%)	0.73	0.60
Oryzatein® SG-B/N (suspension grade rice protein)	0.71	0.59
VegOtein™ P80 (pea protein 80%)	0.96	0.88
VegOtein™ N (neutral pea protein)	0.98	0.90
VegOtein™ P85 (pea protein 85%)	0.87	0.80
VegOtein™ HP80 (hydrolyzed pea protein)	0.91	0.84
VegOtein™ TX80 (texturized pea protein 80%)	1.0	0.82
VegOtein™ TX75 (texturized pea protein 65%)	1.0	0.82
VegOtein™ MA (pea protein for meat analogue)	0.83	0.76
VegOtein™ F80 (pea protein 80%)	1.0	1.0
VegOtein™ F85 (pea protein 85%)	1.0	0.70
Cannatein® Plus (hemp seed protein 65%)	0.83	0.69
Incatein™ (sacha inchi protein)	0.81	0.67
Cucurbotein™ OR55 (raw pumpkin seed protein 55%)	0.83	0.69
Cucurbotein™ OR65 (raw pumpkin seed protein 65%)	0.94	0.78
Cucurbotein™ OT59 (toasted pumpkin seed protein 59%)	0.85	0.71

- (1) Based on 2013 FAO amino acid scoring pattern for older child, adolescent, adult (greater than 3 years).
 (2) Based on 1985 FAO/WHO/UNU amino acid scoring pattern for children age 2-5 years. Compliant with FDA Code of Federal Regulations section 101.9(c)(7): Protein

Improving PDCAAS by Combining Protein Sources (Table 2)

Mixed Protein	PDCAAS ⁽¹⁾	PDCAAS ⁽²⁾
Oryzatein 80 + VegOtein P80 (50:50) Blend	1.0	0.95
Oryzatein 80 + VegOtein P80 (35:65) Blend	1.0	1.0
Oryzatein 80 + VegOtein N (50:50) Blend	1.0	0.91
Oryzatein 80 + VegOtein F80 (40:60) Blend	1.0	0.96
Oryzatein 90 + VegOtein F80 (30:70) Blend	1.0	1.0
Oryzatein 90 + VegOtein P80 (40:60) Blend	1.0	1.0
Oryzatein 90 + VegOtein N (50:50) Blend	1.0	0.90
Oryzatein SG-B/N + VegOtein P80 (40:60) Blend	1.0	1.0
Oryzatein SG-B/N + VegOtein N (55:45) Blend	1.0	0.87
Oryzatein SG/B/N + VegOtein P80 + Cannatein (25:60:15) Blend	1.0	1.0
Oryzatein 80 + VegOtein P80 + Cannatein (40:40:20) Blend	1.0	0.90
VegOtein P80 + Cannatein (60:40) Blend	1.0	1.0
VegOtein N + Cannatein (80:20) Blend	1.0	1.0
VegOtein F85 + Oryzatein 80 (60:40) Blend	1.0	0.96
Incatein + VegOtein 80 (30:70) Blend	1.0	0.93
Incatein + VegOtein 80 + Oryzatein 80 (10:50:40) Blend	1.0	0.94
Cucurbotein OR55 + VegOtein P80 (40:60) Blend	1.0	1.0
Cucurbotein OR65 + VegOtein N (50:50) Blend	1.0	1.0
Cucurbotein OT59 + VegOtein TX80 (30:70) Blend	1.0	1.0

As general rules, grain-based proteins (such as rice) will complement and improve the amino acid profile of a legume-based protein (such as pea) and vice-versa. Seed-based proteins should be evaluated individually, as the limiting amino acid will vary from source to source but they too complement legume-based proteins.

While it is outdated wisdom that plant proteins need to be consumed in the same meal to obtain necessary essential amino acids, labeling laws have yet to catch up to this fact. PDCAAS values should be considered when making protein claims, but they should not be the tell-all for plant proteins whose other merits outstand animal-based proteins for today's health savvy and environmentally conscious consumers.

As plant-based eating continues to trend, more plant proteins will continue to infiltrate the market and more research will help explain the benefits of plant proteins. As such, it is important to understand and evaluate plant protein quality from both a mathematical and nutritional stand point and remember that in light of modern American diets an incomplete protein does not mean an obsolete protein. When it comes to formulating, plant protein quality is easily enhanced by blending with one or more complementary proteins.

Claims-Based Patents



Our **Oryzatein® Brown Rice Protein** features the only patented muscle and sports claims thanks to multiple U.S. and international method of use patents, supported by multiple clinical trials. Only finished products formulating with Oryzatein can include claims including an increase in:

- ✓ Muscle Mass
- ✓ Strength
- ✓ Power
- ✓ Endurance

Axiom customers are protected by the patents, as Axiom actively pursues brands infringing on the patents.



CHECK IT OUT

For more info

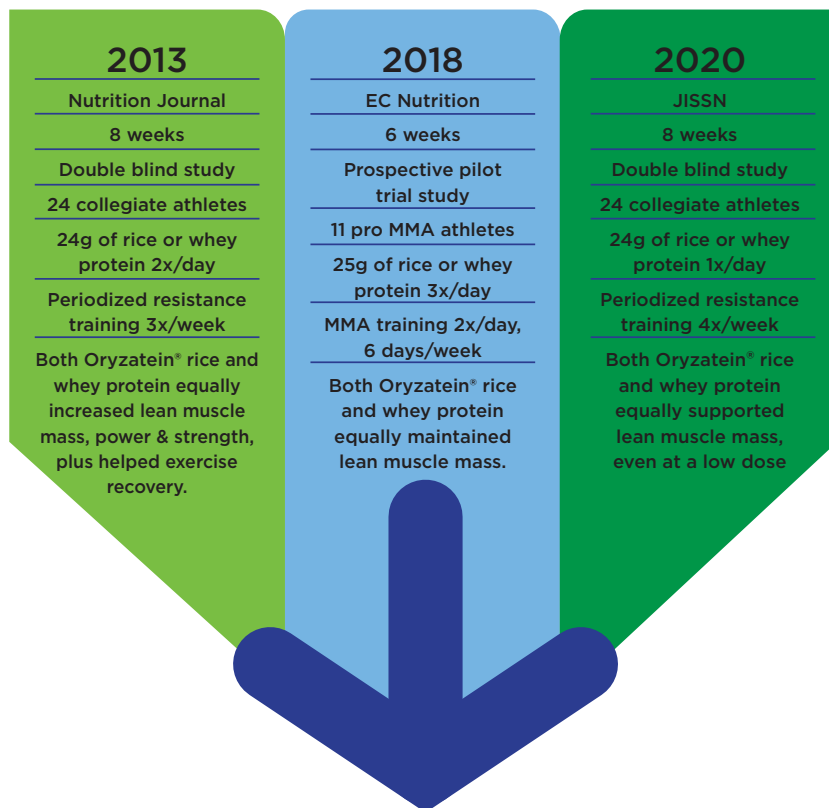
- ✓ Clinical trials at: [AxiomFoods.com/studies](https://www.axiomfoods.com/studies)
- ✓ Webisodes documenting the latest clinical trial, featuring UFC fighters at: [PlantvsAnimal.com](https://www.PlantvsAnimal.com)
- ✓ A list of patented claims

Email info@axiomfoods.com to get a personal representative.

STUDIES & PATENTS AT A GLANCE

Three Published Clinical Studies

One HEAD TURNING Result Helping Even the Playing Field



Oryzatein® is equally as effective as whey protein for increasing and maintaining lean muscle mass

2018 Study at-a-glance



FOR 6 WEEKS, 11 MMA FIGHTERS TOOK PART IN THE 1ST PRO-ATHLETE RICE PROTEIN VS. WHEY PROTEIN CLINICAL TRIAL.



And we filmed it! Now consumers can relate to a scientific study benefiting our plant protein industry. Check it out.

PLANTVSANIMAL.com








Rice vs Whey PROTEIN CHALLENGE

WITH THE COMBAT CLUB

ADVANTAGES OF DIFFERENT PLANT PROTEINS

In General & Specific to Axiom

	 RICE (Ancient Grain)	 PEA (Pulse/Legume)	 HEMP (Seed)	 PUMPKIN (Seed)	 SACHA INCHI (Seed)
<p>Advantages of Axiom Foods</p> <p>Let us tell you why sourcing these products made by Axiom Foods is better than from any other source.</p>	<ul style="list-style-type: none"> • Best tasting • FDA GRAS • Non-GMO Project Verified • Patented sports claims* • Clinically tested as good as whey** • U.S.-made, Suspension-grade • 80-90% concentration • Largest commercial supply • Multiple versions • Will be USP monographed standard • 100% digestible • Authentically organic options*** 	<ul style="list-style-type: none"> • Best tasting including even more neutral options • FDA GRAS • Non-GMO Project Verified • Guaranteed soy and gluten free • Large commercial supply • 80-85% concentration • Multiple functional versions including extruded • TX (Texturized) and F80/85 pea versions = 1.0 PDCAAS • 100% digestible (except F80/85) • Authentically organic options*** 	<ul style="list-style-type: none"> • Virtually neutral taste and color • FDA GRAS • Non-GMO Project Verified • 68% concentration • <20ppm THC • Made from the hemp heart • 18-month shelf life • 100% digestible 	<ul style="list-style-type: none"> • Multiple versions including raw & toasted • Lighter pumpkin seed flavor than typical • 100% digestible 	<ul style="list-style-type: none"> • Self-Affirmed GRAS • Non-GMO Project Verified • Unique • 60% concentration • Good digestibility
<p>Advantages of Each Protein</p> <p>While all of these are allergen-friendly, sustainable and part of a clean label in general, each protein is a good source of other nutrients, has a different flavor profile, etc.</p>	<ul style="list-style-type: none"> • Good BCAAs • Good source of iron • Leucine absorbs faster than whey • Easily digested • Gluten free • Naturally neutral flavor • Most allergen-friendly • Sourced from world's 3rd-largest crop 	<ul style="list-style-type: none"> • Good BCAAs • Good source of iron • Easily digested • High in lysine • Most functional 	<ul style="list-style-type: none"> • Good source Omegas, manganese, phosphorus, potassium and iron • Most multi-nutrient 	<ul style="list-style-type: none"> • Can be a good source of iron, zinc, copper, manganese, magnesium and potassium • Rich in arginine essential amino acid which can help maintain acid/base balance, excretion of nitrogenous waste, making NO (nitric oxide) to support healthy heart and vascular function 	<ul style="list-style-type: none"> • Good source omega 3, vitamins E and A • High in glycine and triptophan amino acids (serotonin) • Nutty flavor • From Peru



CHECK IT OUT For more info



Axiom's complete PDCAAS Statement including digestibility information



A list of patented claims



Amino Acid comparison white paper, breaking out the profile for each plant protein

Email info@axiomfoods.com to get a personal representative.

*Visit AxiomFoods.com/Patents

**Visit AxiomFoods.com/Studies

***Certified organic at factory level, not Axiom Foods, Inc.

Not All Innovators Are Created Equal



Axiom is Making News

Los Angeles Times

“[Axiom] has cornered the \$150-million market for the alternative protein as it shifts from the sports-supplement aisle toward a ubiquitous ingredient of products on nearly every grocery store shelf.”



“Want Muscles? Rice Is the New Meat.”



Axiom Foods' Rice & Pea Proteins featured in "Game Changer: Plant Proteins for Athletes" Nutrition Research Project won by clinical research experts Increneo



WHO WE ARE

The Axiom Foods Difference

Established

Founded in 2005, the first and largest manufacturer of hexane-free, allergen-friendly rice protein, among other plant-based proteins and dairy alts, is headquartered in Los Angeles.

Trifecta

The only company which is innovator, manufacturer AND distributor of multiple sustainable ingredients. Axiom owns its proprietary functional rice and pea protein processes among others.

Innovation

The originator of multiple plant fraction processes, with dozens more in the pipeline.

Setting the Bar

The 1st clinically tested, patented, U.S.-made, FDA GRAS, and Non-GMO Project Verified rice protein.

Worldwide Resources

Sources high quality raw ingredients through key partnerships and distributes internationally through relationships with Brenntag Food & Nutrition among others.

Inventory

The largest commercial inventory available, doubling over and over, with new U.S. factories in development.

Quality Control

Manufactured in GFSI-certified and ISO-certified facilities using HACCP based standards, lab tested at multiple stages, and authentically certified.



Manufactured
in a GFSI SQF
Certified Facility

Team of Experts

From an ever-growing Quality Management team to Food Scientists specializing in everything from functionalities to human nutrition — over 30 people are here in 4 states to serve you.



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