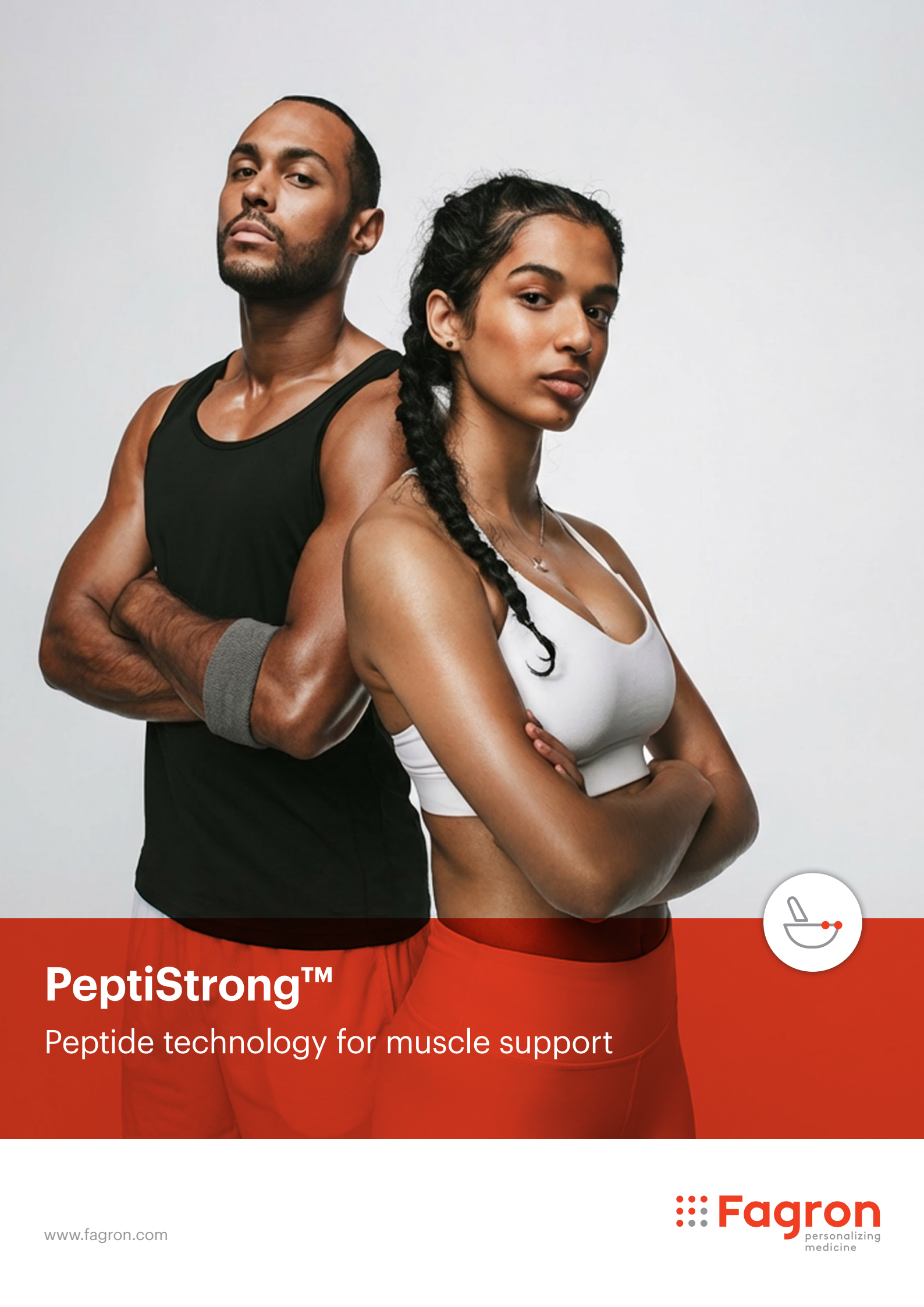

PeptiStrong™

Peptide technology for muscle support

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Summary

Introduction

Skeletal muscle constitutes approximately 40 to 50% of total body mass and is the principal protein reservoir in the body, which makes it central to healthy aging (Figure 1). Lean mass, which largely reflects skeletal muscle tissue, plays a key role in metabolic regulation. Epidemiologic data further show that low lean mass, particularly when combined with excess adiposity, is associated with higher cardiometabolic risk and increased all-cause mortality. Sarcopenia, the age-related loss of muscle mass and strength, accelerates after 75 years, with approximately 3 to 4% muscle loss per year, and contributes significantly to frailty, falls, and functional decline. Globally, population aging is increasing these risks, with an estimated 2 billion people at least 60 years old by 2050. Beyond older adults, muscle health is also relevant for younger and middle-aged individuals and physically active people, where preservation of lean mass supports performance, metabolic function, and day-to-day capacity.[1,2,3,4,5]

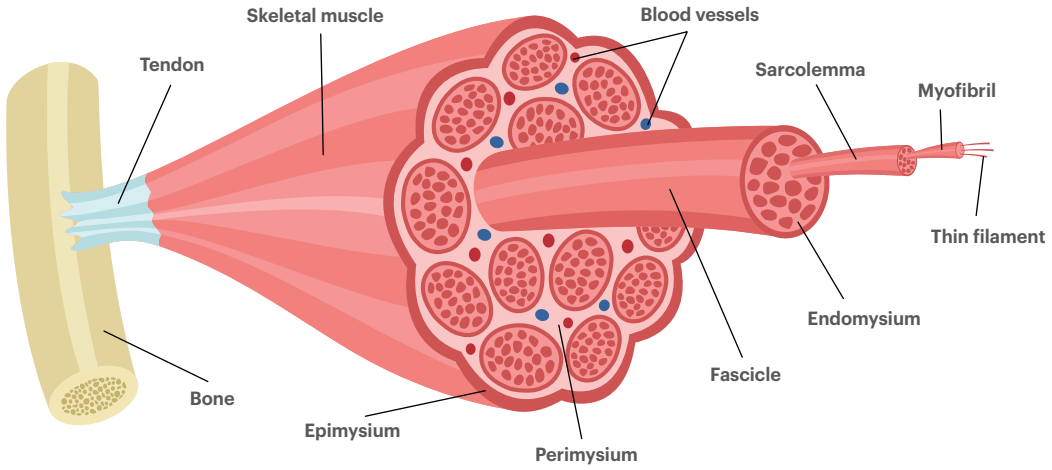


Figure 1. Structure of skeletal muscle.

Traditionally recognized primarily as contractile tissue responsible for movement, skeletal muscle is now considered an endocrine-responsive organ. It responds to hormonal signals and secretes myokines that regulate glucose and lipid homeostasis, modulate inflammatory pathways, and influence systemic metabolic health. Dysregulation of these endocrine functions, driven by physical inactivity, chronic inflammation, or hormonal resistance, contributes to obesity, type 2 diabetes, and cardiovascular disease. In contemporary lifestyles that include sedentary behavior, stress, ultra-processed foods, and poor work-life balance, these muscle-health mechanisms affect not only older adults but also younger and middle-aged people, including recreationally active individuals. Only 1 in 4 adults meets physical-activity guidelines, which underscores the need to preserve lean mass for performance, metabolic health, and day-to-day function.[3,4]

Muscle mass results from the dynamic balance between muscle protein synthesis, that is anabolism, and protein degradation, that is catabolism. When synthesis exceeds degradation, muscle hypertrophy occurs. When degradation predominates, atrophy develops. This balance is closely regulated by intracellular signaling pathways that are sensitive to nutrients, hormones, and mechanical stimuli. Protein intake, particularly essential amino acids, is a potent anabolic stimulus. [6,7,8]

Protein supplementation is widely used to support muscle health, but different sources present distinct strengths and limitations. In general, dairy and other animal proteins are digested more readily and contain higher amounts of essential amino acids, especially leucine, which strongly stimulates muscle protein synthesis. In contrast, many plant proteins have lower digestibility or contain fewer essential amino acids. [9,10]

These limitations can be mitigated by increasing the per-meal dose, combining complementary plant sources, adding limiting amino acids, or mixing plant proteins with dairy proteins. A more recent option is hydrolyzed protein peptides. These provide amino acids and also act as signaling molecules that can shift muscle metabolism toward anabolism and away from catabolism, which may support faster recovery and better muscle preservation. [9,10]

PeptiStrong™ was developed as a patented *Vicia faba*-derived peptide matrix intended to optimize muscle-health outcomes. Its composition supports muscle protein synthesis, recovery, and strength, and represents a suitable strategy for muscle preservation, rehabilitation, and performance.

This brochure reviews the importance of maintaining skeletal muscle for overall health, the main types of protein food supplements and their limitations, and how **PeptiStrong™** stands out as an innovative nutritional food supplement.

1. Skeletal Muscle

Skeletal muscle acts as an endocrine organ. Muscle contraction triggers the release of myokines (cytokines and peptides) that act locally and across distant organs. Among key examples, interleukin-6 (IL-6) helps regulate glucose and lipid metabolism and contributes to the exercise-induced anti-inflammatory response. Interleukin-15 (IL-15) and leukemia inhibitory factor (LIF) support the maintenance and recovery of muscle mass and function (for example, satellite-cell activity). Myostatin is a negative regulator of muscle growth, while decorin, which is upregulated with exercise, can counteract myostatin and aid lean-mass preservation (Figure 2). Additional myokines such as irisin and secreted protein acidic and rich in cysteine (SPARC) have been linked to improved insulin sensitivity, beneficial adipose browning, and protective effects in multiple tissues. Together, these signals illustrate why maintaining and training muscle mass positively influences metabolism, systemic inflammation, and overall health. [11,12,13]

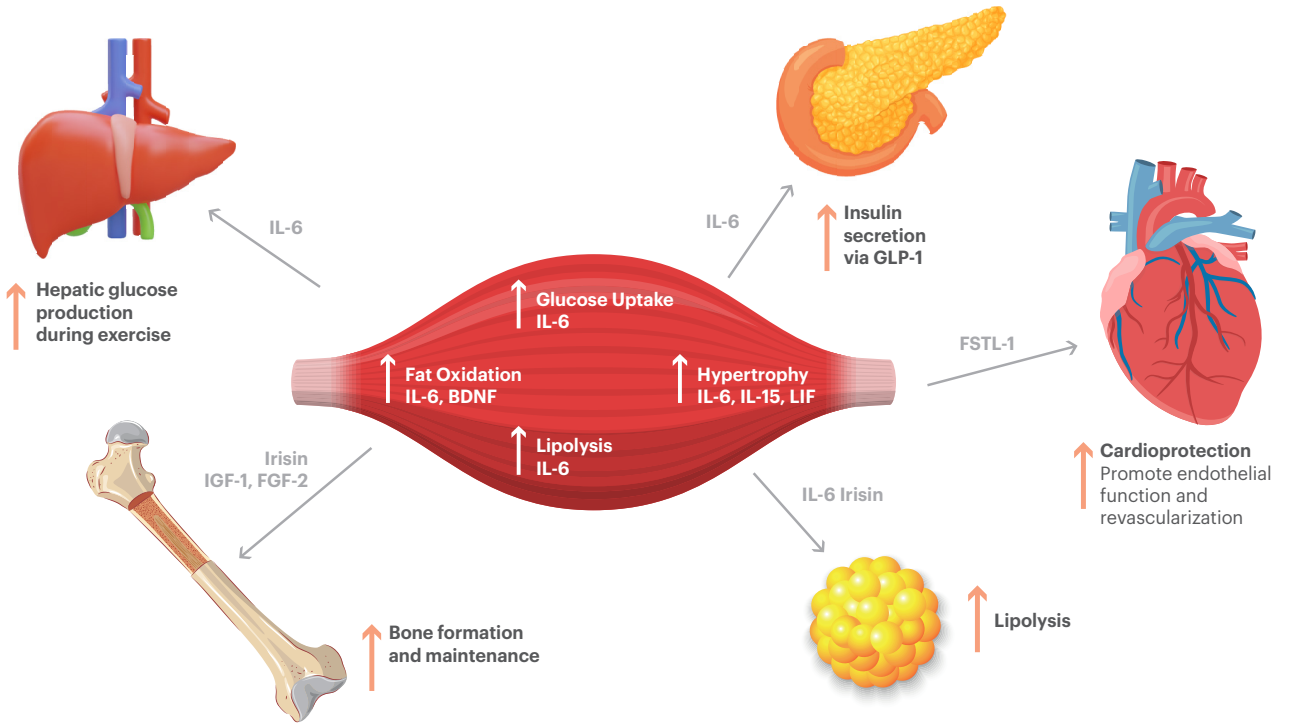


Figure 2. Myokine-mediated muscle-organ crosstalk.[14]

Mechanisms of muscle protein synthesis and degradation

In skeletal muscle, the main driver of growth is the IGF-1/insulin to PI3K to Akt to mTORC1 axis. Activation of mTORC1 stimulates translation and promotes synthesis of contractile and enzymatic proteins. Both resistance exercise and post-exercise nutrient intake act on this pathway to enhance muscle protein accretion. Among nutrients, leucine plays an essential role in muscle protein anabolism. Meals providing sufficient leucine activate mTORC1 signaling and increase muscle protein synthesis (MPS). This effect is particularly important in older adults with anabolic resistance and is further amplified when combined with resistance exercise. Consequently, resistance training together with adequate protein intake, ensuring sufficient leucine per meal, represents the most direct strategy to stimulate muscle anabolism. Muscle mass, however, ultimately reflects the dynamic balance between protein synthesis and proteolytic degradation.[15,16]

At the other end of this balance, the dominant muscle-specific proteolytic pathway is the ubiquitin-proteasome system (UPS), where the E3 ligases atrogin-1/MAFbx and MuRF1 are strongly induced across atrophy states. This catabolic mechanism is largely governed by FoxO (forkhead box O transcription factor). When active and nuclear, FoxO increases atrogene expression and directs proteins toward degradation. In parallel, the autophagy-lysosome system recycles cellular components. If it is chronically upregulated by disuse, disease, or aging, it accelerates muscle loss. Under immobilization, inflammation, or energy deficit, Akt/mTORC1 activity declines and reduces protein synthesis, whereas UPS activity and autophagic flux increase (Figure 3).[16,7]

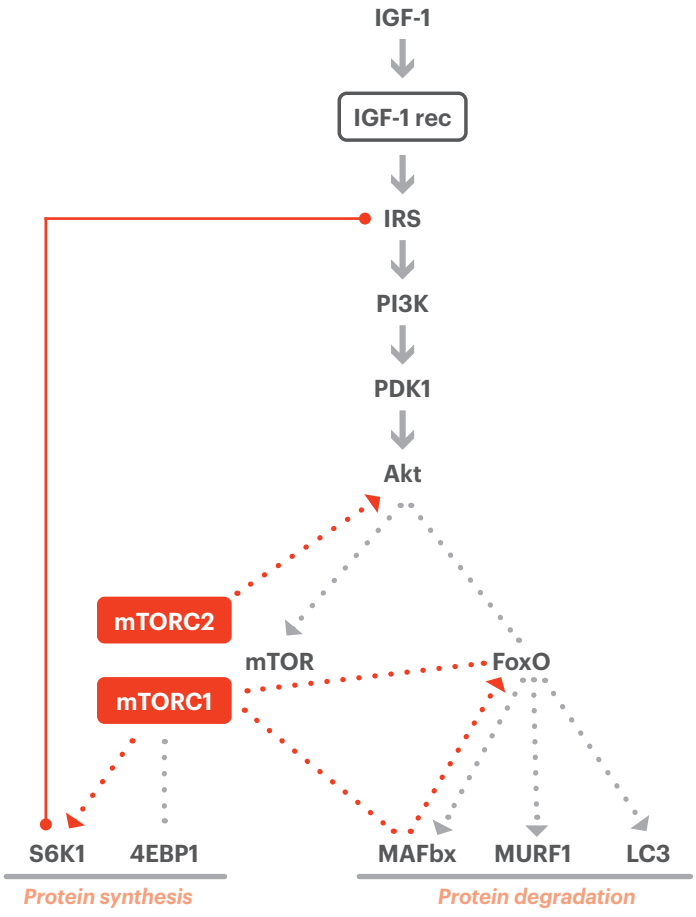


Figure 3. IGF-1/PI3K/Akt/mTOR signaling in muscle protein turnover.[17]

2. Protein Supplements

Habitual dietary intake is frequently insufficient to meet protein requirements, particularly in older adults. This shortfall contributes to progressive declines in muscle mass, strength, and functional capacity, and it is linked to adverse metabolic outcomes. Aging also brings anabolic resistance, a reduced stimulation of muscle protein synthesis after nutrient intake that leaves body protein pools, notably skeletal muscle, unable to compensate for postabsorptive losses. Over time, this net deficit culminates in sarcopenia. Therefore, expert guidance recommends increasing total daily protein intake. When diet alone does not achieve the desired amounts and distribution, protein supplementation provides a practical strategy to bridge the gap, particularly when timed around exercise to optimize the anabolic response. Within this context, the selection of protein source is relevant because different proteins vary in digestibility, essential amino acid profile, and bioactive properties.[16,18,19,20]

Animal-derived proteins such as whey protein and casein are conventional references. They are highly digestible, provide complete essential amino acid profiles, and are rich in leucine, the key amino acid that triggers muscle protein synthesis. Consequently, they reliably stimulate anabolic responses, particularly when consumed after exercise or appropriately distributed across meals.[21,22]

Plant-based proteins present distinct characteristics. Although sources such as soy and pea contain all essential amino acids, they often provide lower leucine content and have slightly reduced digestibility. Consequently, at equal doses, their anabolic response can be less robust than that of animal proteins. However, recent studies show that when consumed in sufficient amounts, combined with complementary sources (for example, pea and rice) or fortified with leucine, plant proteins can support muscle protein synthesis to levels comparable with animal proteins. They are effective alternatives with potential sustainability advantages and suitability for plant-based diets.[18,22]

As a specific example among plant proteins, fava bean (*Vicia faba*) combines high protein content (approximately 25 to 40%) and a favorable amino acid profile (lysine-rich) with moderate to high digestibility. Digestibility can be improved with dehulling and processing. Managing antinutrients (for example, vicine/convicine, phytic acid, tannins) through breeding and processing has broadened its use as a protein ingredient. In humans, ileal amino acid digestibility of properly processed fava bean can approach 90%. In addition, protein hydrolysates derived from fava bean are being explored as sources of bioactive peptides with potential anabolic and anti-catabolic effects.[23,24]

Bioactive Peptides

Food-derived bioactive peptides are short peptide fragments with biological activity beyond their nutritional value. These peptides can modulate pathways involved in muscle anabolism, inflammatory control, and myocellular homeostasis. Their potential has historically been limited in practice because of three challenges: (1) enzymatic degradation during digestion that reduces oral bioavailability; (2) restricted intestinal permeability and systemic absorption; and (3) reliance on empirical, low-specificity discovery methods that slowed clinical translation.[25,26]

Recent advances are beginning to address these limitations. Rational discovery strategies, tailored formulations that protect peptides from proteolysis, and systematic assessment of stability, permeability, and metabolic fate are enabling the development of clinically relevant nutritional peptide interventions.[25,26]

PeptiStrong™ was developed through an artificial-intelligence (AI)-guided, objective-first workflow. Machine-learning models ranked *Vicia faba* peptides for their ability to stimulate muscle protein synthesis and modulate inflammatory pathways. *In vitro* studies confirmed increased protein-synthesis markers and reduced TNF-α. Candidate peptides demonstrated resistance to gastrointestinal digestion, transepithelial transport, and plasma stability, which accelerated the path from concept to a targeted peptide network for muscle health.[27,28]

3. PeptiStrong™

PeptiStrong™ is a plant-based ingredient obtained from *Vicia faba* protein through selective enzymatic hydrolysis that yields a defined network of bioactive peptides. Unlike traditional protein supplementation, which mainly provides intact proteins or free amino acids, **PeptiStrong™** provides peptide fractions selected to engage key pathways of skeletal muscle metabolism, supporting a favorable balance between anabolic and anti-catabolic processes.

This composition translates into benefits beyond amino acid delivery. **PeptiStrong™** has been shown to support muscle strength recovery, help reduce muscle fatigue following periods of damage or stress, and increase muscle protein synthesis during recovery after disuse, which suggests potential to support lean mass restoration. By modulating mechanisms that include myostatin, irisin, and proteolytic markers, **PeptiStrong™** offers an innovative approach to maintaining muscle health across different life stages.

PeptiStrong™ is differentiated within the supplement category. Whereas whey, casein, or plant proteins typically require higher doses to supply amino acids for muscle protein synthesis, **PeptiStrong™** provides a targeted peptide matrix designed to influence specific molecular pathways. This makes it a versatile and efficient option to support performance, strength recovery, and muscle health, which are clinically relevant for preserving functional capacity in aging adults.

3.1. The science behind PeptiStrong™

PeptiStrong™ supports muscle strength, recovery, and protection through complementary mechanisms. In adults engaged in resistance training, daily supplementation with 2.4 g of *Vicia faba* peptide hydrolysate produced greater gains in leg-extension strength and muscular endurance compared with placebo (Figures 4–5).[29] Beyond these training adaptations, intense sessions can trigger exercise-induced muscle damage (EIMD), which leads to delayed onset muscle soreness (DOMS), pain, and reduced function. In this setting, individuals taking **PeptiStrong™** recovered strength significantly faster than placebo over 72 hours, supporting a quicker return to normal function (Figure 6).[28]

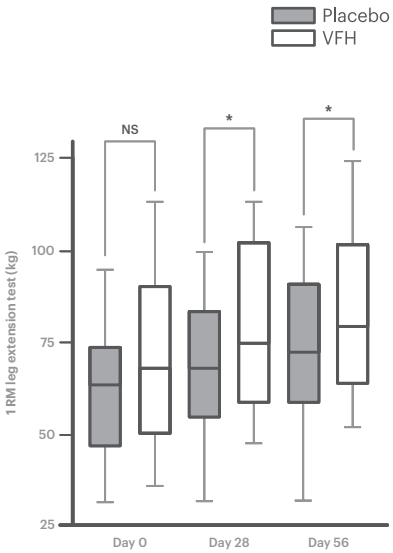


Figure 4. With resistance training, daily supplementation with 2.4 g of *Vicia faba* peptide hydrolysate produced greater gains in bilateral leg-extension 1RM versus placebo. Between-group differences were significant at Day 28 (p = 0.045) and Day 56 (p = 0.050). Acceptance criteria: *p< 0.05.[29]

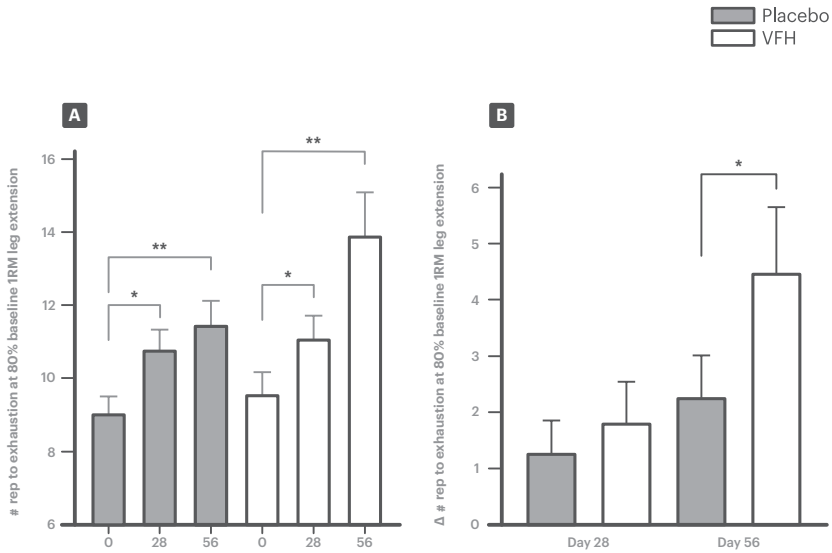


Figure 5. With resistance training, daily supplementation with 2.4 g of *Vicia faba* peptide hydrolysate produced greater gains in bilateral leg-extension 1RM versus placebo. Between-group differences were significant at Day 28 (p = 0.045) and Day 56 (p = 0.050). Acceptance criteria: *p<0.05, **p<0.01.[29]

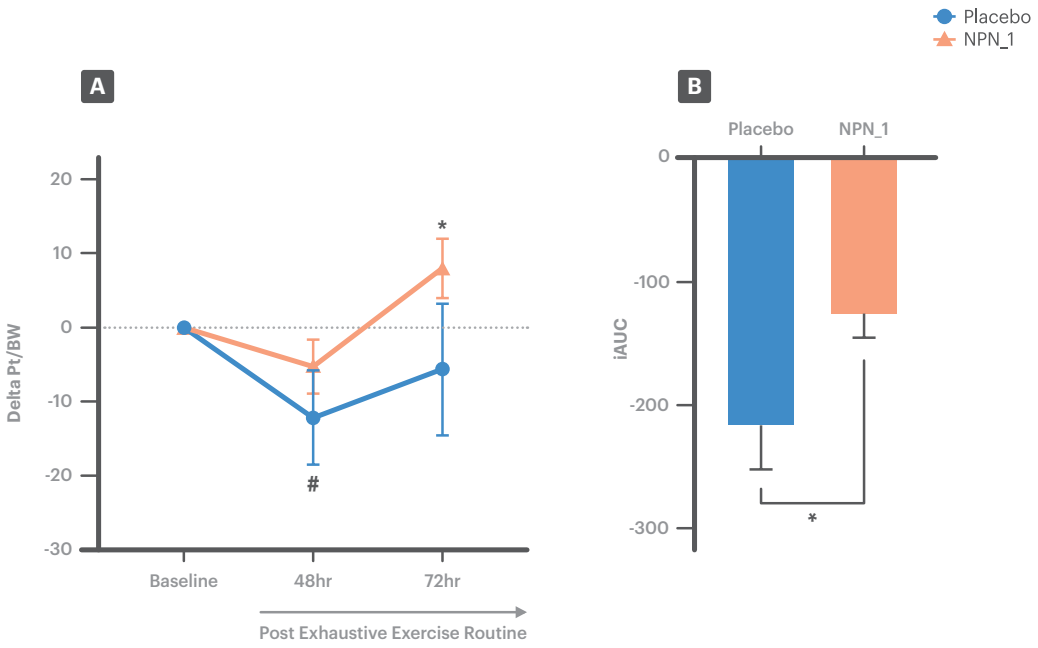


Figure 6. Over 72 hours postexercise, strength recovery was faster with *Vicia faba* peptide hydrolysate versus placebo (iAUC p = 0.020). Panel A shows peak torque normalized to body weight and expressed as percent of baseline at 0, 2, 48, and 72 hours after eccentric EIMD. Panel B summarizes the incremental area under the curve (0–72 hours), indicating a superior overall recovery profile with the peptide group. Acceptance criteria: *p<0.05, #p=0.032 shows a significant difference between the placebo and the baseline strength.[28]

PeptiStrong™ also reduced circulating myostatin, a negative regulator of muscle growth, which indicates a favorable shift in the balance between anabolic and catabolic processes and supports maintenance of muscle mass (Figure 7).[28] At the molecular level, *in vitro* assays showed activation of the mTOR/S6 signaling pathway, consistent with stimulation of the primary anabolic mechanism for muscle growth and repair. In an *in vivo* disuse model, **PeptiStrong™** preserved muscle structure. Immobilized controls showed atrophic, disorganized fibers, whereas treated muscles remained closely packed and uniform, with higher Type I/IIa signals (Figures 8–10).[30]

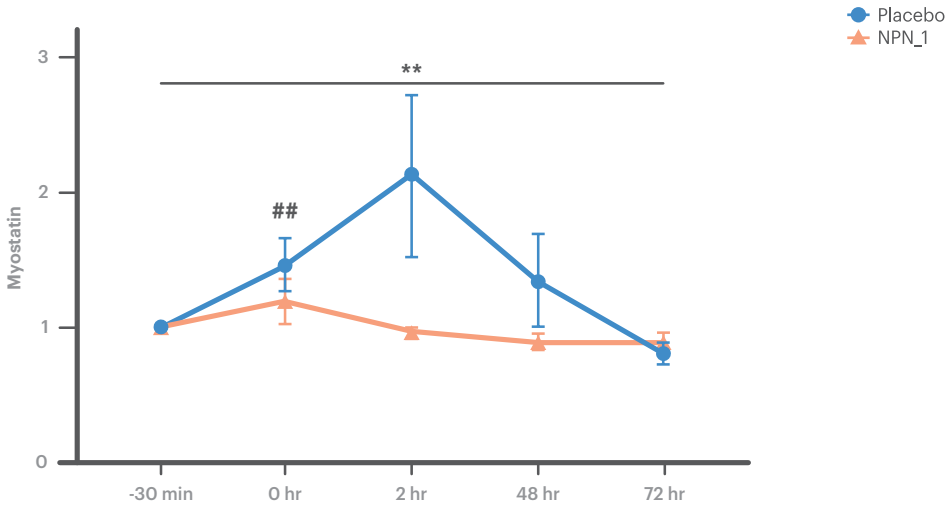


Figure 7. *Vicia faba* peptide hydrolysate significantly reduced plasma myostatin levels compared with placebo. The black line indicates a significant treatment effect. Acceptance criteria: NPN_1: *p < 0.05; **p < 0.01. Placebo: #p < 0.05; ##p < 0.01. NPN_1 blunted the early peak.[28]

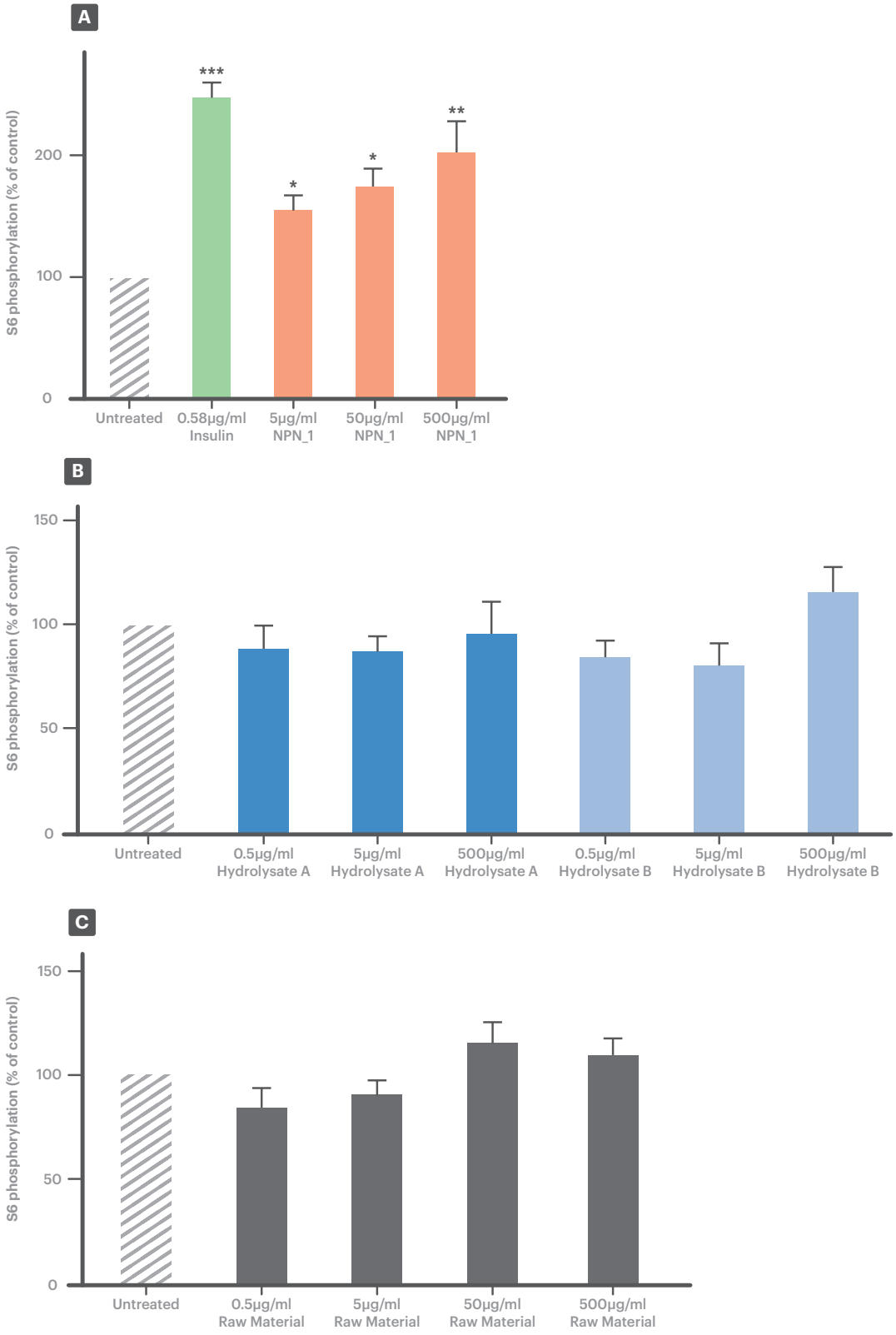


Figure 8. In muscle cells (C2C12), the *Vicia faba* peptide network increased S6 phosphorylation, indicating activation of the mTOR pathway and stimulation of protein synthesis. Generic hydrolysates or raw material did not reproduce the effect. Acceptance criteria: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. [30]

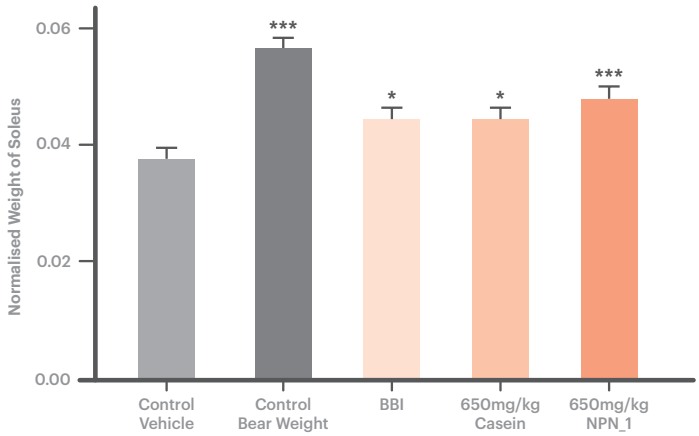


Figure 9. In a murine hindlimb unloading model of muscle disuse, the *Vicia faba* peptide network (NPN_1) attenuated soleus muscle loss versus control, preserving muscle mass. Acceptance criteria: *$p < 0.05$; ***$p < 0.001$.[30]

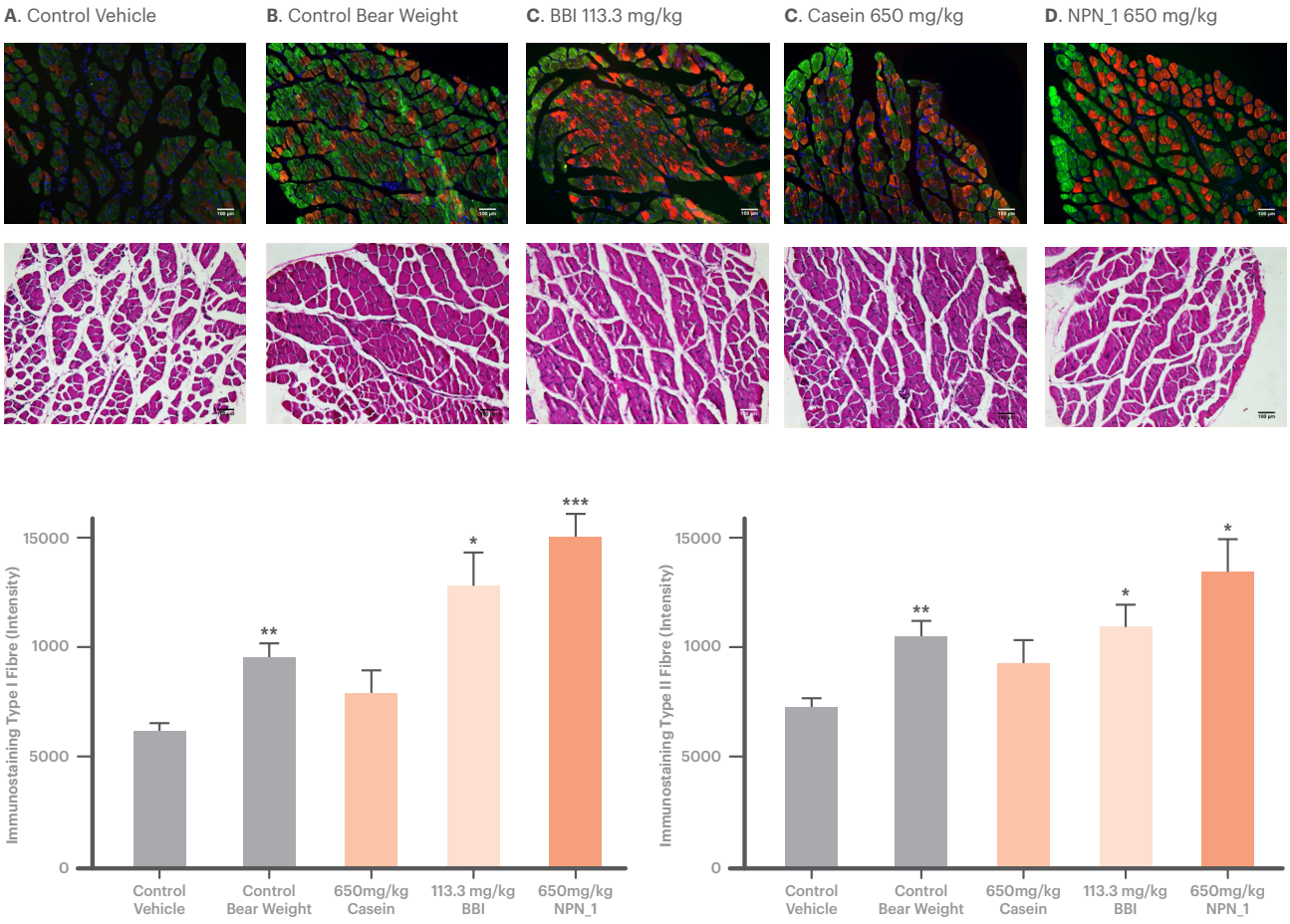


Figure 10. In a model of muscle disuse, the *Vicia faba* peptide network (NPN_1) preserved muscle architecture and enhanced Type I/IIa fiber markers versus control. Acceptance criteria: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ (n = 5).[30]

Taken together, the clinical and mechanistic data point in the same direction. **PeptiStrong™** helps direct muscle biology toward preservation and recovery, complements training, and offsets common stressors. Collectively, these findings indicate stronger anabolic signaling, reduced muscle breakdown, and support for faster strength recovery and long-term muscle health, positioning a practical, plant-based option to sustain muscle function.[29,30]

3.2. Prescribing with PeptiStrong™

PeptiStrong™ is intended for daily use to support adult muscle health across life stages. A clinically used daily dose of 2.4 g is specified by the producer and aligns with human studies; this can be scheduled near resistance-training sessions or during recovery windows, consistent with protocols that demonstrated improvements in strength recovery and related outcomes.

For practical implementation, **PeptiStrong™** is supplied as a powder suitable for multiple delivery systems, including capsules, powders and ready-to-drink shakes, chewable tablets, gels, bars/cereals, with clear beverages and gummies also listed among common applications (Figure 11). These options allow clinicians to tailor format, dose-splitting, and timing to patient preference and adherence needs.

Suggested use (evidence-aligned)

- ***Dose***: 2.4 g per day, consistent with the results from the clinical studies.
- ***Timing***: With or shortly after resistance training, or during defined recovery windows after disuse, reflecting study designs that reported faster strength recovery and favorable biomarker changes.
- ***Format selection***: Capsules, powders/shakes, bars, chewables, gels, and where appropriate clear beverages or gummies, chosen for adherence and patient preference; the mild taste and broad compatibility can facilitate compliance.

Note: Ongoing and recent trials further characterize efficacy in mixed-sex cohorts and sports-nutrition contexts; clinicians may consider emerging data when refining timing and format choices for specific patient populations.

Figure 11. Dosage forms that can be used to deliver **PeptiStrong™** in pharmaceutical and food-supplement products.

3.3. Compouding with PeptiStrong™

PeptiStrong™ is supplied as a free-flowing powder with a density of d = 0.6532 g/mL for food-supplement applications in capsules, powders and ready-to-drink shakes, chewable tablets, gels, bars/cereals, clear beverages, and gummies. It is partially water-soluble and is stable over the pH range of 5-7, which supports straightforward incorporation into both liquid and solid dosage forms. For aqueous preparations, target a final pH close to the stability range of 5-7 and avoid strong acid or alkali; use a mild buffer if needed to maintain palatability and peptide stability.

3.4. Suggested Formulas

PeptiStrong™ Sachets
(Powder for Reconstitution)

Component	Amount
PeptiStrong™	2.4 g
Flavor*	qs
Mannitol	qs 5 g

Directions for patient:
Dissolve one sachet in about 200 mL cold water. Take once daily.

*Flavor is optional. With no flavor, the patient can dissolve the powder in a preferred liquid (for example: water, juice, coconut water, etc).

PeptiStrong™ in Capsules

Component	Amount
PeptiStrong™	600 mg
DiluCap™ Hygro	qs 1 capsule
Capsule HPMC n° 00	1 capsule

Directions for patient:
Take four capsules.
Take once daily.

PeptiStrong™ in Gummies

Component	Amount
PeptiStrong™	1.2 g per gummy
Flavor	qs
Gummy base	qs 8 g (or other, according to the pharmacy's process)

Directions for patient:
Take 2 gummies once daily to provide 2.4 g/day.

Process notes

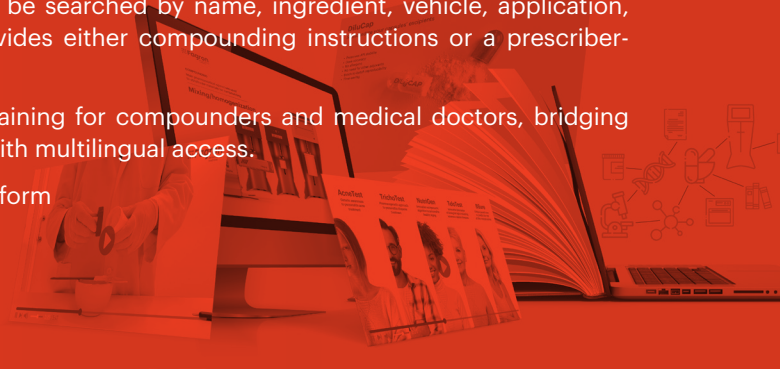
- **Liquids/sachets**: disperse under moderate shear to uniformity; adjust sweetness/flavor; confirm final pH near 6.
- **Capsules/solids**: blend by geometric dilution; verify blend uniformity before fill.
- **Gummies/chewables**: incorporate near final mixing temperature; ensure even distribution.

Resources for clinicians and pharmacists

As part of the **Fagron Academy** initiative, the **Fagron Formulary** is a scientific database for personalized medicine that serves both prescribers and pharmacies. Entries can be searched by name, ingredient, vehicle, application, dosage form, or medical specialty, and each record provides either compounding instructions or a prescriber-oriented version as appropriate.

The **Fagron Academy Video Platform** offers structured training for compounders and medical doctors, bridging prescribing and compounding in personalized medicine, with multilingual access.

Check at Fagron.com/formulary and Fagron.com/videoplatform



4. Quality and Safety of PeptiStrong™

PeptiStrong™ is a plant-based, vegetarian-friendly ingredient consisting of a defined network of bioactive peptides derived from *Vicia faba*. A GRAS (Generally Recognized As Safe) Notice (GRN No. 1166) for the use of the ingredient in food applications was submitted to the U.S. Food and Drug Administration, and the FDA issued a "no questions" letter, indicating that the information provided supports the ingredient's safety under the intended conditions of use. Clinical studies have evaluated daily use and reported efficacy outcomes consistent with improved recovery and performance.

Tolerability and antinutrients. As a fava-bean–derived hydrolysate, **PeptiStrong™** may contain the naturally occurring antinutrients vicine and convicine. Modeled exposure suggests that levels of these compounds in multiple servings remain below those reported in the scientific literature as triggering favism in males with G6PD deficiency. The information regarding vicine and convicine levels in **PeptiStrong™** is based on the manufacturer's analytical data and exposure assessment, as well as levels reported in the scientific literature, submitted as part of the GRAS Notice (GRN No. 1166) to the U.S. FDA. Labeling that clearly identifies the presence of "fava bean protein" is recommended. Clinicians should consider G6PD deficiency when advising patients.

Positioning and use. Within these documented specifications, **PeptiStrong™** can be positioned as a science-based, consumer-friendly food-supplement ingredient for muscle health and recovery. Product formulation, on-pack wording, and claims should follow local legislation. Use should remain consistent with professional guidance and the product's technical documentation.

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